

**Cultivating and collecting Cardamom (*Amomum* spp.)
and other NTFP's in Muang Long District,
Luang Namtha Province, Lao PDR.**

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1.1. Introduction

Cardamom (*Amomum villosum*) collection and cultivation is important for the local economies in Muang Long area, Luang Namtha Province, but is also an important export product for Lao PDR as a whole. The purpose of this report is to evaluate the collection and cultivation in Muang Long area, and especially in the villages that have received support for planting of "Khouang Tung" cardamom (*A. villosum* var. *xanthoides*). Because some other NTFP's (Non-Timber Forest Products) are very important in Muang Long area, and for some villages more important than cardamom, I have included information about these as well. Some of these could perhaps be promoted to other villages, planted, more sustainably harvested and better marketed. The other main NTFP that are used for income generation are Sugar palm fruit, Bamboo caterpillar, Edible rattan shoots (mainly *Daemonorops jenkinsiana* in N Lao PDR*), Rattan canes (stems) used for furniture and handicrafts, Eaglewood, Broom grass and Kisi resin. There are probably hundreds of other NTFP's that are used for food, medicine, construction, to make household items, colouring clothes etc. Some of them are also sold in local markets and along roads in smaller quantities. This report does not include information about these smaller NTFP, but they could be used as a subject for an ethnobotanical study later.

Travel to Muang Long was made possible by support from Luang Namtha Drug Supply and Demand Reduction Project (LNDPR), facilitated by Norwegian Church Aid (NCA), UNDCP and the Lao PDR Government.

* This species is fairly fire-resistant, and this is probably the reason it is common in fallow areas. It can also tolerate repeated shoot removal well. However, a species in another genus, *Calamus tenuis*, has a large potential for commercial plantation production of Edible rattan shoots (Evans, T. year unknown). (Seedlings of many rattan species can be bought at the Nam Souang Forest Research Centre in Naxaythong District, Vientiane Prefecture.)

Box 1. The most common NTFP in Northern Lao PDR		
Sugar palm fruit, Palm nut	maak tao, nyod tao (shoots=nyod) (ໝາກຕາວ ຍອດຕາວ)	<i>Arenga pinnata</i> (Wumb)Merr. (Syn. <i>A. saccharifera</i> Labill.) (Palmae)
Red cardamom or forest cardamom	maak naeng daeng (ໝາກ ແໜງແດງ) or maak naeng paa (ໝາກ ແໜງປາ)	<i>Amomum villosum</i> Lour. (Zingiberaceae)
Bamboo caterpillar (also called Bamboo borer or Bamboo worm)	mae (ແມ່)	<i>Omphisa fuscidentalis</i> (Insectifera - Moths)
Eaglewood	mai ket, mai ketsana, mai heuang, mai dam (ໄມ້ເກດ, ໄມ້ເກດສະໜາ, ໄມ້ເຫືອງ, ໄມ້ດຳ)	<i>Aquilaria crassna</i> (Thymelaeaceae)
Rattan canes (for furniture etc.)	vai (ຫວາຍ)	<i>Calamus</i> sp. (Palmae)
Edible rattan shoots	mak vai (ໝາກຫວາຍ)	<i>Daemonorops jenkinsiana</i> and <i>Calamus</i> spp. (Palmae)
Broom grass	kok khem (ກກແຂມ)	<i>Thysanolaena maxima</i> (Gramineae)
Kisi resin, Wild wax	kisi (ຂີ້ຊີ)	<i>Shorea</i> spp. <i>Parashorea</i> spp. (Dipterocarpaceae)
Benzoin	yan (ຢານ)	<i>Styrax tonkinensis</i> (Styracaceae)
Sapan	Sapan, Peuak meuak (ເປືອກເມືອກ)	<i>Debregeasia hypoleuca</i> (Urticaceae)

1.2. Cardamom in Lao PDR

The name cardamom is used for species within three genera in the Ginger family (Zingiberaceae). One of these genera is *Amomum*, where the species are mainly found in Asia and Australia. Another, *Aframomum*, is distributed in Africa and Madagascar, and *Elettaria* is distributed from India to W. Malaysia.*

The most common species in Northern Lao PDR are *Amomum villosum* (in Lao called red cardamom) and *A. ovoideum* (green cardamom). Another species, has recently been introduced from China to Phongsaly province (Lamxay et al. 2001), Luang Namtha province (de Koning 2000a), and also to some of the target villages of Luang Namtha Drug Supply and Demand Reduction Project (LNDRP). This is *A. villosum* var. *xanthoides*, known as "Khouang Tung" cardamom in Lao, or "the improved cardamom from China". Seed capsules from this cultivar might give more than 50% better price on the (Chinese?) market (ibid.). However, in the selling season of 2001 they were often offered the same low price. The most commonly cultivated and collected cardamom in the South is probably *A. longigulare*, but there are at least three others (Lamxay unpubl.).

* Probably all cardamom in Lao PDR belong to the genus *Amomum*, but species of *Elettaria* may also grow wild in Lao PDR. (There are no reports on cultivation of *Elettaria*, but most likely this could be done.) For a relatively comprehensive overview of names of Cardamom see Appendix I.

Box 2. The most common cardamom species in Lao PDR		
Green cardamom	maak naeng khiaw (ໝາກ ແໜ່ງຂຽວ)	<i>Amomum ovoideum</i> Pierre
Red cardamom or forest cardamom	maak naeng daeng (ໝາກ ແໜ່ງແດງ) or maak naeng paa (ໝາກ ແໜ່ງປ່າ)	<i>A. villosum</i> Lour.
Kuang tung or domesticated red cardamom	maak naeng khuang tung	<i>A. xanthoides</i> Wall. (syn. <i>A. villosum</i> var. <i>xanthoides</i>)
Red cardamom (In S Lao PDR)	maak naeng daeng (ໝາກ ແໜ່ງແດງ)	<i>A. longigulare</i> T.L.Wu

Cardamom is easy to cultivate in areas with some shade (50% shade) or in forest. The plant needs relatively moist soil in the dry season, and therefore could benefit from being planted along streams and rivers. There are difficulties related to the harvesting of a product often regarded as common property, the drying which takes place in the rainy season, and a recent fall in prices, which used to be high and relatively stable. Cardamom also needs weeding for better yield, protection from grazing animals and sometimes also protection from caterpillars.

1.3. Importance of Cardamom as a Non Timber Forest Product

Cardamom is very often ranked as the most important source of income from NTFP in rural areas, together with e.g. "Kisi" resin, "Bong" bark (*Notaphoebe umbelliflora*), "Eaglewood", rattan canes or shoots or Sugar palm fruits. When villagers ranked various forest products on the Nakai plateau cardamom came out equally important to wildlife in total importance for the households, or as number five after Kisi resin, fish and frogs (grouped together) and Rattan shoots. (Foppes et al. 1997).

Cardamom is regarded as the second most important agricultural export product of Lao PDR, after coffee (de Koning 2000a, Lamxay et al. 2001). In 1996 the total (registered?) export was 461 tonnes (ibid.). Cardamom has been included in many rural development projects to raise

the level of income in the latest years (IFAD 1991, Vientiane Times (March 13, 1999.), Phanvilay et al. (year unknown)).

Another cardamom used for medicinal purposes is Large cardamom (*Amomum subulatum* Roxb.), grown in India, Nepal and Bhutan. In Sikkim, India, it is one of the most important sources of income for the rural population (Sharma et al. 1998, Lata et al. 1999).

1.4. Importance of Cardamom and other NTFP in Muang Long, Luang Namtha Province

(See Appendix IV.)

For the 19 target villages of *Luang Nam Tha Drug Supply and Demand reduction Project* in Muang Long, fruits of Sugar palm was the most important NTFP in terms of income in the last Village Survey 2000-2001, when grouping all the villages together. The average income was of more than 140.000 Kip/household or approximately 300.000 for each collecting household (306 out of 642). Some of the villages are almost exclusively collecting Sugar palm fruits (Mouangkhan and Somphanmai).

Cardamom came second, for all the villages (this will probably not be the case this year, see section 4.3.), with approximately 60.000 Kip/household or 130.000 Kip for each collecting household (313 out of 642). For five of the villages, Houaythoumai, Jamai, Langphakao, Jakhamtan and Langphamai cardamom is the most important NTFP.

Income from Eaglewood came third with approximately 50.000 Kip/household or 375.000 Kip per collecting household (86 out of 642). In two of the villages Eaglewood extraction was the most important source of income from NTFP (Tasoummai and Pakha).

Bamboo caterpillars is also relatively important, 158 families collected this, and got on average 96.000 Kip)

The income from NTFP varies considerably from village to village, both in terms of relative income for different NTFP and total income from all products for each village. The variation in total income is also large when taking into account the amount of households in each village. See appendix IV. This may reflect differences in the quality of the vegetation in the areas used by each village for collection, as well as differences in traditions and knowledge.

(Source: raw data from Village Profiles 2000-2001, Luang Nam Tha Drug Supply and Demand reduction Project).

2.1. The Uses of Cardamom

In general *Aframomum* is used as a spice, *Elettaria* both as a spice and as medicine (and a masticatory), and *Amomum* used as an ingredient in several traditional medicines in China (TCM), India, Korea and Vietnam. Species in the genus *Amomum* is also used in India.

Cardamom (*Amomum villosum*, and other species, varieties and cultivars) is used in TCM to treat stomachaches, constipation and other digestion problems, and also in treatment of dysentery (Lamxay unpubl., Lamxay et al. 2001). However, "Tsaoko" cardamom (*Amomum tsao-ko* Crevost & Lemarie) is cultivated in Yunnan (China) both for medicinal purposes and as a spice (Su Yongge 2000). Cardamom is also widely used in Korea, Thailand and Vietnam.

In India large cardamom (*A. subulatum* Roxb.) is more broadly (than in TCM?) used to treat infections in teeth and gums, to prevent and treat throat troubles, congestion of the lungs and pulmonary tuberculosis, inflammation of eyelids and also digestive disorders. It is also reported as used as an antidote for both snake and scorpion venom (Lata et al. 1999).

Elettaria species is used as a spice in meat dishes, such as hamburgers, but also in medicine and as a masticatory (i.e. it is smoked) (Mabberley 1996).

2.2. Collection and Cultivation of Cardamom in SE Asia

Cardamom is growing wild in all provinces of Lao PDR as an understorey rhizomatous herb. It is found in evergreen and in mixed deciduous forest in areas with moist soil. It is often found in fallow or disturbed forest areas.

Under natural conditions the density of plants are relatively low, and people have to walk long distances to find the fruits. The density can be increased by propagating young rhizomes (vegetatively), whereby young rhizomes are uprooted, cut, and replanted. Also, other understorey plants must be weeded to achieve good growth and survival. (When such enrichment measures are performed, cardamom can be looked upon as a half-domesticated plant, or belonging to an intermediate system between gathering and agroforestry or agriculture.)

When cultivating cardamom, the most common method is propagation by saplings originating from roots (rhizomes) of other plants. Cardamom can also be propagated by seeds or seedlings, but this is not common. However, there has been performed relatively successful planting tests in Luang Namtha using seedlings from China and Paxon on the Bolaven plateau in 1999 (de Koning 2000a).

There are records on cardamom planting in Champasack Province more than 40 years ago, but more intensive planting began between 1975 and 1980 (Lamxay, unpubl.) Cultivation is widespread in the districts of Bachieng, Pak Xong and Laongam in Southern Lao PDR (Foppes & Ketphanh 2000). In general cardamom is more often grown in "forest gardens" in the Southern parts of Lao PDR and in the North more often just collected from the forest or fallow. In those areas wild cardamom is mostly regarded as owned by the village, and cultivated regarded as owned by a family (Ketphanh & Soydara 1998).

Amomum cardamom is cultivated intensely in many areas in Yunnan (China), and is also cultivated in Vietnam and Thailand. In Thailand it is often referred to as Kravan (the use of this name might include more species than *Amomum krervanh* Pierre).

2.3. Special Problems Related to Cultivation

"Khouang Tung" cardamom has been promoted by a number of development projects the latest years. The enhanced cultivar give better yield, and the fruits and seeds are 10-30% larger than for red cardamom. The price is also reported to be up to 50% better than wild cardamom (de Koning 2000a). This was, however, not the case when we visited Tonglee Import-Export Co. in Xieng Kok in mid September 2001, where both wild and cultivated was bought for only 8.000 Kip/kg.

There are four main problems associated with cultivation of cardamom.

- 1.) The areas are often not prepared and weeded when the seedlings are to be planted. This will make the seedlings weaker, since it will take longer time before they are planted. It might also give weaker growth and more losses in the beginning of the growth period and could make weeding later more labourous.
- 2.) The areas are not suitable for cardamom. Very dense forest will make the plants grow too slowly, and too sunny and dry areas will make them grow slowly in the dry season, or kill the whole plant or some of the leafy stems.
- 3.) No fencing or guarding has been performed or planned before planting. Buffaloes, cows and presumably also goats like to eat the leaves and shoots of the plants. This often gives big losses of seedlings and new shoots. In most cases the plants seem to be able to recover after losing most of their leaves, but the growth might be strongly reduced by animal grazing. Some areas show no sign of destruction even without fencing, but this might be caused by

few animals nearby, just by chance, or that people have time to guard the animals. Steep slopes will probably prevent buffaloes and cows from grazing.

4.) People have not enough time to perform weeding or do not understand the importance of weeding. Weeding has to be performed at least two or three times the first years of growth. Since it will take 4-5 years before the first harvest, it is understandable that some of the farmers could feel unmotivated to perform sufficient weeding. The present low price on cardamom will also probably make people even less motivated. People are also used to a low yield per plant for wild cardamom, and might not be aware of the larger yield possible with cultivated or Khouang Thung cardamom.

2.4. Cardamom Cultivation and Biodiversity

Cultivation of cardamom is reportedly causing loss of biodiversity in Yunnan (China) and in Vietnam. In Yunnan extensive cardamom cultivation might cause the disappearance of nationally protected species of plants from nature reserves (Wang Baorong et al. 1997), reduce the quality of these severely, and also be a factor in reducing the size of the areas (Su Yongge 2000). Large-scale cultivation has also caused problems like reduced drinking water quality due to erosion (ibid.).

In Hoang Lien Son-Sa Pa Nature Reserve in Vietnam cardamom cultivation is mentioned as one of the most important factors for forest deterioration. However, here the long-term effects are regarded as less severe as some canopy cover remains, and nutrients are not lost through erosion (Birdlife International 2001).

It seems that large-scale cultivation is not unproblematic in the perspective of biodiversity conservation and soil protection. However, cardamom cultivation might also be an incentive for people to take care of the forest, since it provides the best yield in the shade under a canopy.

If cardamom cultivation should develop to be one of the main activities and sources of income in an area (or the goal is that), an assessment of consequences for rare species of local flora should be performed. The possibility that introduction of species from China or other areas will have negative impact on (genetic diversity of) local species in certain areas also has to be considered.

2.5. Cultivation of Amomom Cardamom in Other Areas

Sharma et al. (1998) gives credit to the Lepcha tribe in Sikkim (India) for domesticating large cardamom (*Amomum subulatum* Roxb.). This species is now also cultivated in Darjeeling (India), Bhutan, and eastern Nepal. Five wild relatives, *A. linguiforme* Benth. & Hook. f., *A. kingii* Baker, *A. aromaticum* Roxb., *A. corynostachyum* Wall., and *A. dealbatum* Roxb., are also still found in Sikkim (ibid.). Large cardamom is one of the main cash crops, together with mandarin oranges, ginger, and potatoes (ibid.).

2.6. The Best Localities for Cultivation

Cardamom generally produces more fruits if grown in forest or in semi-shaded conditions. If the plant is exposed to much sunlight it will produce more leaf bearing stems (culms), and less inflorescences and fruits (Lamxay unpubl.). It also needs moist places to be able to survive through the dry season. As a suggestion it should be planted in wetter areas of fallow after upland rice cultivation, in forest areas with moist soil, or in gardens with some shade trees, or where young fast growing trees are planted for wood and other uses.

Particularly good places might be on slopes close to streams and rivers, because the air will be relatively more humid, even in the driest part of the year. Chen Jin et al. (2000) stresses the importance of sufficient air humidity in the period of blooming in April, when there are no rain and high temperatures. This should be critical for the pollination of the cardamom flowers.

The optimum shade conditions are probably 50% shade (Ruth Dutton p.c.), but this is also dependent on other factors like moist. If the soil is quite moist also in the dry season, or the area is close to a river or permanent stream, the plants may grow faster under more sunny conditions. On the other side, if cardamom is grown in forest with more shade than 50%, the area will need to be weeded less often. If cardamom is grown in relatively steep slopes (20% or more), the side shoots tend to grow longer away from the mother plant and grow downwards, in this way the plants are able to spread and self-propagate over a larger area faster than on relatively flat areas.

Chen Jin et al. (2000) describes the best soil condition for cardamom cultivation briefly. In their field study in Phongsaly province they found that the soil types were generally good for cardamom cultivation (ibid.). The most important factor is probably the moisture of the soil in the dry season, and the ability of the soil to keep water is important. This is positively correlated with the amount of clay particles (and as a general rule soil that stick together and stick to your fingers, have more clay particles).

2.7. Propagation by Rhizome Cutting

Cardamom planting can take place in between May and June. The recommended distance between plants vary from 2-3 m x 2-3 m (Lamxay et al. 2001) to 1m x 1m (de Koning 2000a). Higher density would allow higher cover in the third year when the first production of fruit will take place (ibid.). In Muang Long the plants were some places planted between 1.5 m x 1.5 m (Pakha, Langphakao and some places in Somphankao), and some places more dense (Somphanmai and Somphankao).

Propagation is best done by selecting young rhizomes with (10-) 20 to 40 (-50) cm high leaf bearing stems (culms) with 1-2 leaves (Lamxay et al. 2001). These are uprooted carefully, and parts of the rhizome are cut in lengths of about 20 cm, keeping two stems on each part. The leaves and shoots of these stems are cut away, and the piece of rhizome is planted approximately 3 cm deep in the soil. It is very important to keep the rhizomes from drying in the sun when replanting. Too deep planting will give reduced growth and might also kill the saplings.

3.1. Harvesting

Cardamom fruits (loculicidal capsules) are borne on leafless floral shoots arising from the rhizome. In the Northern parts of Lao PDR the fruits are harvested from August to September, and in the Southern parts about one month later.

The fruits should be harvested when the capsule has dark red to brown colour on the inside, and the colour of the seeds is from deep purple to bluish black. Completely black seeds are over-mature. Too early harvesting is especially a problem when cardamom is growing on common land. Harvesting of un mature capsules give smaller seeds, and the capsules and seeds are more prone to moulding before and under the drying process (Lamxay et al. 2001). In southern Lao PDR this could more easily be avoided, because the most of the cultivated cardamom is grown in "forest gardens" owned by a family (Foppes & Ketphanh 2000b). The harvesting should be sustainable if the capsules are cut carefully with a knife instead of pulling most of the plant from the soil (Foppes & Ketphanh 1997).

A problem, especially with wild cardamom, is that people have to walk long distances to find enough fruits. And the fruits on a given plant, as well on different plants in an area, will be on different stages in development, some too young, some already too old, and some in good condition for harvesting. In most cases it will be too much work to come back after some days to collect from the same plant again and people will instead collect all fruits regardless if some of them are too young or too old.

The old ones will give fruits and capsules of reduced quality (totally black when dried), and the young ones will also give reduced quality, including more mould, and the capsules will be difficult to open to get out the seeds (clusters of seeds), if that is desired (for the Korean market).

3.2. Yield

Measures from Champasak have shown that using densities from 12.000 to 25.000 stems/ha would yield from 80 to 200 kg fresh weight of fruit (Lamxay et al. 2001.). This is equivalent to 14 - 40 kg of dried fruit (ibid.). From India (India, Coorg - Web) it was found that cardamom can yield around 100 Kg per acre (This number is slightly larger than 200/ha.). The best yields are obtained from plants 4-5 year old, but cardamom stands can yield sustainably for up to 50 years or more (Lamxay et al. 2001).

3.3. Drying (Curing) of Cardamom

Cardamom is traditionally dried using direct sunlight if there is a clear sky, or over open fire under the house. From Muang Long it was reported that direct sun-drying was not efficient enough (visit to Sompankao village). There are three main problems regarding drying of cardamom, over-heating and charring because it is difficult to keep even temperature, unwanted taste and smell of smoke and moulding because the drying is inefficient. Soydara (1998) suggest quality improvement using an improved wood-fueled oven, very similar to the traditional "Bhatti"- oven used in India (Lata et al 1999).

Over-heating will reduce the oil content and quality of the seeds, and some capsules might even be totally destroyed if the drying process is not guarded well etc. It is also impossible to avoid some smell and taste of smoke, especially if the wood is not dry, and since the drying takes place in the rainy season it is difficult to find dry wood. The third problem is too slow and insufficient drying, this will make the capsules mould, and this problem tend to be larger if they have been harvested too young. The capsules should not be opened before drying, as this will lower the price of the seeds. Much of the taste will disappear during the drying process from opened fruits (However, this seems to be preferred for export to Korea).

Even if you manage to improve the quality of dried cardamom capsules, the price of the product might not be higher, if the traders are not aware of quality differences, or are not able to make good judgements. One way to establish a relationship between price and quality could be to organise the selling better through selling-groups and to implement a standardised system for grading and quality analysis (performed at a central chemical or pharmaceutical laboratory).

A general recommendation is that grains and seeds should be dried at relatively low temperatures. Scanlin (1997, citing NTIS 1982) recommends 45°C as a maximum for grains and seeds. If the seeds are kept inside the capsules (required for the Chinese market), they can be dried at somewhat higher temperature in the beginning, since evaporation of water from the capsules will keep the inside of them and the seeds cooler than the temperature of the incoming air flow. In India there are information on cardamom drying at 55°C in drying rooms (India, Coorg - Web).

In a wood-fired oven the consumption of wood is between 0.8 and 2.3 kg per kg fresh (large) cardamom (Wood Energy News 1999). In Lao PDR tobacco and cardamom production used about 56,430 tons of woodfuel combined in 1992. This can be compared to 9,040 for coffee production in 1994 (Hemmavanh 1999).

3.4. "Updraft" Gas-Drying

An alternative to wood-drying could be an "Updraft Gasifier" system, that has been developed by a project called "Indo-Swiss Project Sikkim (ISPS)" at Tata Energy Research Institute (TERI) in India. Wood is converted to a gas, which is burned in the bottom of an oven of the same shape and size as a traditional wood oven. Studies have shown that it is possible to retain more of the oils (up to 35%), achieve a product with little taste and smell of smoke, and use less wood than before. Also, the product will dry in shorter time, and it is easier to control the heat, thereby avoiding accidental burning of the product (TERI - Web). However, you might expect that some volatile tar and other unwanted compounds will be burned together with the gas (the adverse effect might be minimal compared to wood drying). See Wood Energy News (1999), and Lata et al. (1999).

3.5. Solar-Drying

According to de Koning (p.c.), two of the villages on the border to Nam Hu NBCA (Ban Hadjong and Ban Si Udom on the road to Muang Nalae) have used solar dryers for the curing of cardamom, and they should function well. I have so far not much information on the design of these dryers, but they should be made from plastic sheet and bamboo materials according to a Thai model of design. During the rainy season there are mostly some hours with sun, and this might be enough to dry the capsules. Solar dryers made from metal could be provided with a backup system using a gas burner.

One small solar dryer that could be used is presented in Homepower (Scanlin 1997, Scanlin et al. 1999). One of these would cost about ½ million LAK in material costs in Vientiane (Walch p.c).

Solar drying could have the potential of drying cardamom capsules seeds of very high quality compared to wood-drying or even gas drying. Especially the content and quality of the oil will be improved, and this might give a better price on the capsules and seeds.

It is not the typically "Lao way" to preserve food for consumption later (except for rice), food should preferably be made from fresh ingredients. But solar dryers could also be used to dry other food products for sale all year round (e.g. "mak pao", see "Visit to Langphakao village"). Solar dryers could be owned individually by families, or collectively by cardamom selling groups etc.

3.6. Grading and Improvement of Quality

There exist no written system for grading of cardamom inside Lao PDR as far as I know. However grading is performed on the basis of size of fruits or clusters of seeds, amount of unripe fruits, amount of overripe (black) seeds, amount of moulding, amount of dirt and unwanted plant material. The smell of smoke coming from the drying process is unwanted, however this seems to have no critical effect on the price level.

Thai traders accept up to 3% of the fruits moulded (Ruth Dutton p.c.) Moulding will show as grey surface on dried fruits and seeds. If the amount of unripe and overripe fruits or seeds and dirt is high the product will give lower prices, or perhaps cannot be sold before the collector clean his product.

In general it seems that the traders and middlemen are aware of the relation between price and quality, and the collectors not so much.

Since the collection of wild cardamom means a lot of walking for the collectors, they will collect all the fruits from the plants, also if most of them or many are too young. It also means that they will miss a lot of fruits, because they are already too old when they approach them. Collecting from cardamom plantations means that the plants are in a much smaller area, and this gives the possibility for collecting only mature fruits, without wasting a lot of walking time.

4.1. Marketing of Cardamom

The cardamom harvested in Luang Namtha is either sold through Tonglee Import-Export Co. or Friend of the Upland Farmer Co (FUF). But Chinese companies also buy cardamom directly from the farmers through Lao middlemen. In Phongsaly some farmers sell their cardamom in China through relatives living in China, I do not know if they were able to get a better price than those that sold their products through middlemen inside Lao PDR.

Tonglee Imp.-Exp. Co. also has a branch in Xieng Kok, and the company has a joint venture with another company in Xieng Kok as well as one in Bokeo. Except for the Chinese companies and FUF, there seems to be almost a monopoly situation for the traders.

The farmers that sell cardamom are in a weak position, they are not organised, and they are in September-October in strong need of money before the main rice harvest.

4.2. Demand

According to an article in Vientiane Times, the demand in China is of 2000 tonnes per year. The production is hardly than 1000 tonnes/year. The factories in Shanghai or Canton complete their supply with wild cardamom from Laos and Burma, which is of less value (US\$ 3-4 per kg against US\$ 7 per kg) (Vientiane Times, March 13, 1999).

4.3. Low Prices for Cardamom in 2000 and 2001

The prices of cardamom fell significantly in 2000 and this continued in 2001.

The local price of cardamom was USD 4.80/kg in 1996, in 1999 the price had increased almost 20% (Lamxay et al. 2001). Using the current USD/Kip rate 8.000 Kip/kg (dry weight) this gives less than one USD (September 2001). Some farmers got as much as 15.500 Kip/kg early in the selling season 2001.

Cardamom has been reported as the crop that gives the best returns, i.e. better than coffee, cocoa and oranges (India, Coorg - Web). Vientiane Times reported that cardamom could give farmers a good income, from US\$ 50 to 750 per year, according to the planted surfaces (0.1 to 1.5 ha) (March 13, 1999). Now, if a farmer manages to get 100 kg fresh fruit from his field this would give approximately 20-25 kg dry weight and only a little bit more than 160.000 Kip.

One of the explanations for the fall in prices is said to be that the Chinese does not want to buy the cardamom, due to surplus production last year (Tonglee Yiaxeing p.c.). This surplus was more than 60 metric tonnes (Ruth Dutton p.c.). It is claimed that increased production in Burma is the reason, but it would be likely to think that increased production inside China, Korea, etc. could be a strong contributing factor as well, powered by the high prices over the last years.

The price given to the collectors of wild cardamom two years ago was as high as 24.000 Kip/kg, and used to be higher in the end of the selling season (from August to October-November), than in the beginning. This year the price in the beginning varied from 13.000 to 8.000 (Friend of the Upland Farmer gave up to 15.500), but in mid September the price for the best quality is no more than 8.000-9.000 Kip, and lower qualities are unsellable or gives perhaps up to 5.000 Kip/kg. TongleeYiaxeing (p.c.) say that the Chinese does not want to buy cardamom from his company for 10.000 Kip, however he tries to sell to Vietnamese companies for 13.000 Kip/kg. Friend of the Upland Farmer tries to sell to Korean companies directly to avoid middlemen (Ruth Dutton p.c.), but it is uncertain if this will give significantly better prices.

Nothing is known about any connection with markets of medicinal cardamom in India, Nepal etc. Naturally, a key question would be if the Chinese TCM factories also buy cardamom from these markets. Evans, G. (2000) writes about the tendency for Chinese traders (in Oudomxay) to dominate markets through manipulation of ethnically based regional trade networks, but does not explain this any further. Better organising among the farmers, and a central or standardised quality control might give better prices through the stronger position you get as a seller when you have better knowledge about your product. This could also provide incentives for quality improvement. A constraint for this is probably that the farmers sell their cardamom at a time of the year with rice-shortage, when they really need all the money they can get.

5.1. Visits to Villages, Companies Trading in Cardamom, and an Eaglewood Factory

Interpretator and guide for most of the interviews have been Mr. Khamsing, and Mr. Bounbang have been following most of the visits to the villages in Muang Long explaining issues related to the cultivation of cardamom. Mr. Phongsamouth was interpretator on the visit to Tonglee Imp.-Exp. Co. in Luang Namtha on September 11.

September 5, 2001. Visit to Somphanmai (ສົມປານໃໝ່) village,

Ak'ha village approximately 3-4 km W Muang Long on the way to Xieng Kok on right hand side. The village has a trial garden area with cardamom and fruit trees, maintained by one person in the village. An area of ca 12 x 15 m had been densely planted two years ago using Khouang Thung cardamom (the improved cultivar from China) saplings bought through Tonglee Imp.Exp. Co. The plants where in good condition, with stems from 80 -100 cm in length. The shade in the area was less than 20% and the planted area was on a small hilltop just below the village. Possibly the area would have been too dry if there had been no possibility for watering the plants, which there were. Also, that much sun will probably produce too many leaves and fewer fruits than in more shade. However, a sunny plantation with possibility for watering might be an effective way of producing new saplings for distribution to other areas and villages.

Comment: According to Village Survey 2000-2001, raw data, cardamom collecting is the second largest NTFP in terms of income in this village and contributes to approximately 12%. However, sugar palm fruit is considerably larger with 88%.

September 5, 2001. Visit to Pakha (ປ່າຄຳ) village,

Lanten (Lao Houay) village approximately 2 1/2 km from Muang Long on the way to Xieng Kok on the right side. Small area planted four years ago approximately 250 m E of the village in an area with some trees about 10-12 years old (40 - 60% shade, and 5-15 % slope). The plants where not in too good condition because the area had not been weeded, and it had also partly been grazed upon by animals. The cardamom plants where tall, 2-3 m long leafy stems,

and had given a small yield this year.

September 6, 2001, **Visit to Sompankao (ສົມປານເກົ້າ) village,**

Close to Sompanmai village, but on the other side of the main road. We visited an area planted with 2.000 (only 1.700) saplings in June, and owned by Head of the Households, Mr. Piea Yea (Pho Yae?) and his family. The area is situated above a small permanent or semi-permanent stream, and the slope is steep, approximately 40% (and difficult to walk in). The area had been weeded recently, and according to the owner it should be weeded three times per year. The shade in the area varies rather much, from 20 % to 60%, and the plants in the more sunny areas are considerably larger (80-100 cm) than those in the most shaded areas (40-60 cm). Most of the plants are already producing 1-2 side shoots downwards on the slope, and they are often as long as 20-25 cm long. According to Mr. Bounbang, the practice of planting on steep slopes is used to make the plant self-propagate over a larger area faster (in China).

The family of the owner collected this year 2-3 kg of wild cardamom, which has been dried one night over fire. He said drying using the sun only would be too unefficient. This years cardamom has not been sold yet, but last year he got 16.000 Kip/kg. He told us that he would get better price if the cardamom was well dried. He has been selling to Tonglee, but also to Chinese traders in Muang Sing.

His family is collecting Sugar palm fruits (Palm nut), which is harvested from the beginning of November. Last year his family sold 4.000 kg to Tonglee in Xieng Kok at a price between 9.5 and 10 Baht/kg ("Mekong price")(approx. 1.900 Kip).

There is a lot of Broom grass (kok khem - ກົກແຂມ) in the village area, and the price is about the same as for sugar palm fruits, but according to the owner is a lot of work to collect this. His family also collected 13 kg of both red and black "mak kha" last year. This was sold to a Lao company for 2.500 - 3.000 Kip/kg. According to him there are no production of handcrafts for sale in his village.

Comment: According to Village Survey 2000-2001, raw data, cardamom collecting is the second largest NTFP in terms of income in this village, contributing almost 15 %. The largest product is Sugar palm fruit with 78%. The third is Bamboo worms, with 6 % of the total income from NTFP.

September 6, 2001, **Visit to Pakha (ປ່າຄ່າ) village,**

An area ca 400 m SW village, planted this year and owned by Mr. Laoternoi (Laotle Noy?). The area is approximately 25 x 30 m and was planted with 2000 saplings, using a distance of 1.5 m in right angles. Most of the shoots where in good condition, with lengths mostly between 40 and 80 cm, but approximately 30 % of the shoots where grazed upon by buffaloes, and the area had not been weeded. The owner explained that his family had had no time for this since they where busy with the rice fields, but they would have some time for this soon. The trees in the area where of similar age or older than in the other area in Pakha (10 -15 m tall and 12-20 years old), and the shade was approximately 50%. The slope was from mainly from 0 to 3% degrees, a small area a little bit more.

The owner explained that his family did not collect any wild cardamom, because of too little time, but in his village there were 4-5 families collecting wild cardamom (according to the Village Survey 2000-2001 raw data there where 7 families collecting together 17 kg cardamom at a total value of 279.000 Kip in Pakha village).

His family get additional income from Palm nut (*Arenga pinnata*), called mak tao locally (ໝາກເຕົາວ). Last year they sold 10 kg, they also sell some pomelo which is priced 1.000 Kip for a large and 500 Kip for a small. The family have lack of rice for 4 months.

Comment: Cardamom collection is very small NTFP in terms of income for this village. (approximately 3% of total income from NTFP). According to Village Survey 2000-2001, the most important NTFP is eaglewood and sugar palm fruit. 13 families, out of 33, were collecting on average 63 kg Eaglewood and got 512.000 Kip, and the total income for the whole village was 6.662.000 Kip (almost 74% of total income from NTFP). 23 families collected on average 60 kg sugar palm fruit and got 91.500 Kp, total for the whole village 2.105.000 Kip (23%). Fast depletion of eaglewood stands, most probably occurring, would mean much more work to find trees and considerably reduced income for this village.

September 10, 2001, **Visit to Langphakao (ຫຼັງຜາເກົ້າ) village,**

We visited a cardamom plantation ca 100 m from the road going to the village on the right hand side and ca 150 m before the village. The forest is approximately 10 years old with 50% - 70% shade and has almost no slope. It is not close to any river or stream. 3.000 saplings had been planted in June this year. The area had been well weeded, and the plants were in good condition. The plants are common property in the village, according to two of the villagers showing us the area. One of the men told us that his family was collecting about 5 kg of wild cardamom from the forest this year, and they got a price of 12.000 Kip/kg. They are also collecting bamboo caterpillar, which gives them 12.000 Kip/kg, fibers from Nang mai (ໜັງໄມ້, skin tree (perhaps the same as Po sa, ບໍ່ສາ, *Broussonetia papyrifera*), which gives 2.000 Kip/kg and "mak pao" sold for 2.700 Kip/kg (explained as a ball coming from the ground, which is sliced and dried). Also collected is mak kha (also in Samphankao).



Comment: Cardamom collection is according to Village Survey 2000-2001, raw data the most important NTFP of this village, followed by bamboo worms. 18 families, out of 22, were collecting on average 7.7 kg cardamom and got 155.000 Kip, and the total income for the whole village was 2.783.500 Kip (almost 63% of total income from NTFP). 15 families

collected on average 9.6 kg bamboo worms and got 111.000 Kp, total for the whole village 1.669.400 Kip (37%).

September 11, 2001, Visit to Tonglee Import Export Co., in Luang Namtha.

Interview with Mr. Tonglee Xiaxeing. (Telephone: +856-86-312330)

According to Tonglee the Chinese do not want to buy the cardamom from his company even for as low price as 10.000 Kip/kg, however he is trying to sell the cardamom to Vietnamese companies for 13.000 Kip/kg. Last year the price was between 17.000 and 24.000 Kip/kg. There exist no written grading system in his company. When looking at the cardamom it seemed to be of very different quality, although he said it all belonged to a lower grade. All the cardamom in his storage had the carpel (skin of the fruit) peeled off before drying, this is according to other sources not what the Chinese want, but suitable for the Korean market.

September 15, 2001. Trading Cardamom on the road,

We met an middleman trading cardamom on the way from Muang Long to Xieng Kok. He was buying cardamom for a Chinese company from Ak'ha women for 8.000 Kip/kg. He was buying the cardamom and it was intended to be stored in someones place in the nearby willage until a Chinese truck would come to collect the bag(s).



September 15, 2001, Visit to Tonglee Imp.-Exp. Co., branch in Xieng Kok.

According to the manager the main products sold are cardamom (32 tonnes/year) and sugar palm fruit (240 tonnes/year). Previous years 50% of the cardamom was sold to Thailand, now the vietnamese markets are more important. They also export to Korea and China. The manager told that the low prices on cardamom was caused by a strong increase in export from

Burma (Myanmar). According to the manager, Tonglee Imp. Exp. Co has a joint venture with another company in Xieng Kok, as well as a company from Bokeo (there exist probably no real competition in Xieng Kok except for some Chinese companies).

An increasingly important product for Tonglee in Xieng Kok is rattan stems (stems from spiny and liana-like palms from several different species) sold to Thailand. There exist three main types in this area according to the manager in Xieng Kok, one thick and yellow in colour which are much looked after and probably very rare inside Thailand. The other two types are thinner (presumably have less valued colour) and break more easily.

Comment: Rattan extraction is likely to be very unsustainable, it has been overharvested in most tropical areas - hence it needs harvesting management. The price on rattan is high, especially for the best quality and colour. The Nam Souang Forest Research Centre (under National Agriculture and Forest Research Institute), are producing seedlings of different rattan species, and has also performed plantation experiments, especially with Edible rattan (*Calamus tenuis* has been most successful (Evans, T. year unknown). Cultivation of rattan shoots can be done in an unforested area, but cultivation of canes has to be done in a forested area since rattan is climbing plant. Rattan canes can grow up to 3-4 m/year, but the normal growth is probably less than half of this.

Thonglee has also plans of investigating possibilities for Rubber tree production in Muang Long district. According to the manager they need an expert from China to evaluate the possibilities, because there exist no expert in Lao PDR.

Comment: Rubber tree (*Hevea brasiliensis*) is planted in many areas in Sip Song Panna (Xishuangbanna), in Yunnan, on slopes at lower altitudes (yield is reduced if planted above 800 m.a.s.l.) Extraction of rubber tree latex, is labourous (some say only suitable for hard working Chinese), the latex has to be collected every day from each tree, it also takes minimum 7 years from planting to first harvest. In Yunnan, where it has been extensively planted, planting has destroyed much of the hill forest that has been sacred or too difficult to cultivate for other purposes (or in some cases just destroy for the sake of reporting "progress"). I.e. it has taken very much of the little natural forest that was left after the enormous destruction of forests in Yunnan following the Cultural Revolution (Su Yongge 2000.)

September 15, 2001. **Visit to a factory producing scented oil from eaglewood (*Aquilaria crassna*).**

The factory is located on the left side of the road, close to the road and approximately 1/2-1 km after Muang Long on the way to Xieng Kok. The Manager or owner was not present, but two of the workers in the factory. The product was referred to as sandalwood* in English, but the use of this name is not correct, although sandalwood also is scented wood. The name in Lao was, however correct, mai ket or mai ketsana.

According to the workers the oil they produced was not the best grade (the lowest?), but the price given was 1.000 Baht for 10 cc. The collectors get 5.000 Kip/kg (possibly only 3.000) for fresh wood having the black resin. In the factory the wood is cut into small pieces (approx 70 x 30 mm) and sun-dried on large plastic sheets. Thereafter it is grinded to small pieces (approx 7x 2 mm) and distilled at low temperature using water-bath. This process take three days. Fuelwood is used for heating. The condenser is simple, and cooled by water. It is possible that sun-drying of the wood gives reduced quality, since the most volatile fraction of the oil probably evaporate to the air.

Comment: People generally need to cut down and destroy five trees before they find one having the dark resin, and new trees need at least 15 years before they can give yield. The present and natural stands of trees are probably quickly depleted, since it is reported that people need to go longer distances to find them. There probably exist a monopoly situation

for sale of the oil. Because of that it might be difficult to open a new factory, try to sell through other channels, or organise the selling of wood to try to achieve better prices.

* The name of true sandalwood refers to several species in the legum family (Leguminosae) and these are probably called mai tjan in Lao (ໄມ້ຈັ້ນ).

September 20, 2001. **Visit to Friend of the Upland Famer Co., Luang Namtha.**

Interview with Mrs. Ruth Dutton. (Telephone: +856-86-211155)

Friend of the Upland Famer Co is working together with 22 villages in three districts, to promote and support the production of mainly cardamom, maize and soyabean. According to Ruth Dutton the low price for cardamom this year is probably mainly caused by an overproduction last year of 60 tonnes. Their company is now trying to sell directly to Korea to avoid middemen, and to get better conditions in Thailand. Their company bought cardamom for 15.500 Kip/kg in the beginning of the season, now the price for a good grade has fallen to 9.000 - 8.000 Kip, and the lowest grade is bough for only 5.000 Kip or rejected. (Previous years the price has been lower in the beginning of the selling season then in the end.)

Their company have no written system for grading of cardamom, but grading is performed on the basis of amount of moulded fruits or seeds, amount of unmatute (small fruit that is difficult to open) or overmatute (black seeds) fruits and seeds. The Chinese market wants unopened fruits, the Korean market want the cluster of seeds without the fruit capsule (if the seeds fall apart from each other they can be used sometimes, but at a lower price). Important is also the amount of dirt and unwantede plant material. The taste and smell of smoke is unwanted with the buyers (however, it is not clear if it affects the price considerably).

According to Ruth Dutton the seeds, of wild cardamom or Khouang Thung cardamom, if properly dried inside unopened capsules will get a strong taste reminiscent of the green cardamom or "true" cardamom (*Elettaria cardamomum*) from India.

Comment: Tasting seeds from wild cardamom in perfect condition, sold by Ak`ha women on the road between Muang Long and Xieng Kok on September 15, and comparing the taste with samples of *E. cardamomum* from Ruth Dutton it can be confirmed that the taste is very similar, and much stronger than for seeds dried without the capsule. (The taste remind of both Mentha and Eucalyptus).

It seems, because of the high quality of taste possible to obtain from wild ones, that it could be possible to sell this as a substitute for *E. cardamomum*.

6.1. Summary

Collection of wild cardamom is an important source of income most of villages in Muang Long and Luang Namtha Province. The low price achieved this year and last year is explained by surplus production in Burma (Myanmar). However, taking into account the high prices the previous years it, as well as promotion of cultivation in Lao PDR and Thailand (likely also other countries and China), this could be caused by an increased production in the whole region. Under any circumstances, it would be too early to decide not too promote cardamom, and the current price is perhaps not too low for the farmers if they would be able to produce more of the cultivated variety more efficiently.

From the few visits to the villages that have started with cultivation of cardamom it seems, that there are problems, and perhaps more in the village where cardamom has not been an important NTFP (Pakha village).

The main problems are insufficient (or no?) weeding and grazing upon the plants by domestic animals. It seems that most of the plants have sufficient shade from trees, but this could perhaps be improved. More emphasis could also perhaps be made to find areas near streams to plant the cardamom, since this could improve growth (more moist) and possibly give more fruits (more moist air is believed to give more pollinating insects).

People are rarely using direct sun-drying of cardamom, since it is not sufficient, and most of it is dried above wood fired ovens. Some of the cardamom, when dried inside the capsules had in spite of this very good quality. There are, however, quality problems with cardamom, and most of this is caused by either too early or too late harvested fruits, or insufficient drying. Cultivation of cardamom would, most likely, remove most of the problems with too early or too old fruits, since the plants are growing close to the village.

Other NTFP are also important in Muang Long area, Sugar palm fruits gives more income than cardamom for about half of the target villages, and is also more important when grouping all the villages together. Quality improvement and organizing if selling groups for this product might be easier to facilitate than for cardamom. Partly because cardamom is sold in September - October, when the villages suffer worst from rice shortage, while Sugar palm fruit is harvested from the beginning of November.

Eaglewood is also an important NTFP (especially for Tasoummai, Pakha and Mounkhan village), emphasis should be made on sustainable harvest of this product. Other products that most likely are unsustainably harvested are Rattan canes (for furniture and handicrafts), especially the most valuable type (yellow and thick), and most likely some of the wild animals.

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Appendix I. Common Names for Cardamom

The name Cardamom applies to all or most *Elettaria* species (e.g. the widely cultivated *Elettaria cardamomum* Maton). According to Mabberley (1996) the name is loosely applied to *Amomum* species as well as *Aframomum* species. Amomum cardamom may also be called "medicinal cardamom" or "Chinese cardamom" among many others. When referring to Cardamom outside Lao PDR, e.g. India, Bhutan, Nepal, Sri Lanka and Guatemala, it is often difficult to know whether they refer to *Elettaria* or *Amomum* or both.

Common name	Scientific name	Reference	Remark(s)
Bastard cardamom	<i>Amomum</i> species		
Bengal cardamom	<i>Amomum aromaticum</i> Roxb.	(Mabberley 1996)	
Camphor seed	<i>Amomum</i> species		
Cardamom	<i>Aframomum</i> species	(Mabberley 1996)	Loosely applied.
Cardamom	<i>Amomum</i> species	(Mabberley 1996)	Loosely applied.
Cardamom	<i>Amomum aromaticum</i> Roxb.	(Mabberley 1996)	Loosely applied.
Cardamom	<i>Elettaria cardamomum</i> Maton	(Mabberley 1996)	"True" cardamom.
Chinese cardamom	<i>Amomum villosum</i> Lour.	(China, Yunnan)	Might include other species.
Green cardamom	<i>Elettaria cardamomum</i> Maton	(Lata, K. et. al. 1999)	
Green cardamom	<i>Amomum ovoideum</i> Pierre	(Lamxay et. al. 2001)	ໝາກ ແໜ່ງຂຽວ (maak naeng khiaw)
Guinea grains, grains of paradise, alligator, malagueta or melagueta pepper	<i>Aframomum melegueta</i> Scumann	(Mabberley 1996)	The best (as spice?) according to the author.
Java cardamom	<i>Amomum maximum</i> Roxb.	(Mabberley 1996)	
Kravan	<i>Amomum krervanh</i> Pierre	(Thailand, Kanchanaburi province, Srisawat district)	Might include other <i>Amomum</i> sp.
Kuang thung or domesticated red cardamom	<i>A xanthoides</i> Wall	(Lamxay unpubl., de Koning 2000a)	Synonym <i>A. villosum</i> var <i>xanthoides</i>
Large cardamom	<i>Amomum subulatum</i> Roxb.	(Lata, Kusum et. al. 1999)	
Madagascar cardamom	<i>Aframomum angustifolium</i> (Sonn.) Scumann	(Mabberley 1996)	
Medicinal cardamom	<i>Amomum villosum</i> Lour.	(Vientiane Times, March 13, 1999)	Might be other species
Red cardamom	<i>Amomum villosum</i> Lour.	(Lamxay et. al. 2001)	ໝາກ ແໜ່ງແດງ (maak naeng daeng)
Red cardamom	<i>Amomum longigulare</i> T.L.Wu	(Lamxay unpubl.)	ໝາກ ແໜ່ງແດງ (maak naeng daeng) (In S Lao PDR)

Round cardamom	<i>Amomum compactum</i> Sol. ex Maton	(Mabberley 1996)	(Java)
Siame cardamon	<i>Amomum</i> species		
Small cardamom	<i>E. cardamomum</i> Maton	(Lata, K. et. al. 1999)	
Thai cardamom	<i>Amomum krervanh</i> Pierre	(Lamxay et. al. 2001)	
Tsaoko cardamom	<i>Amomum tsao-ko</i> Crevost & Lemarie	(Su Yongge 2000)	Yunnan, Used both as a spice and as medicine.
White cardamom	<i>Amomum villosum</i> Lour.	(China, Yunnan)	Might be other species.
White cardamom	<i>Amomum</i> sp. ?	(India, Nepal)	Exported to Scandinavia especially

Appendix II. Other important plants as NTFP's

Name	Scientific name	Reference	Uses & Export
Bamboo caterpillars (bamboo worms, bamboo larvae or bamboo borer) (ແມ່ຫລີດ້ວງ)	<i>Omphisa fuscidentalis</i>	Bangkok Post, September 24, 2001	Fried for food (snack), Thailand
<p>Sold to Thailand or in local markets. The worms are also found in N Thailand. In Muang Long you very often came across relatively thick (70-100 mm) and young bamboo cut down for searching for the worms (in mid September 2001). Many people were also selling them. Further South in Luang Namtha bamboo worms seemed to be less harvested than in Muang Long, but you saw this sometimes.</p> <p>The caterpillars originates from a moth, laying eggs in August. The eggs hatch and the caterpillars start to forage upon bamboo in the beginning of September, and this is also the time to collect the caterpillars. The season might last until May. The worms make one or two holes moving from segment to segment in the bamboo. The people cut down the young bamboo and cut open every stem segment (if it has holes in the bottom) looking for the worms. The price in Thailand for fresh caterpillars is 200-300 Baht/kg, in Muang Long the prices varied between 15-18.000 Kip/kg.</p> <p>The caterpillars are mostly (almost?) stir-fried in Thailand. An evaluation of possibilities for canning them should be performed. Canning is a cheap and efficient way of preserving food, but will they keep their taste and crispness? Most likely canning is done in Thailand already if this is feasible.</p> <p>In Thailand experiments with breeding the caterpillars using hormones is being performed.</p>			
"Bong" bark (pheuak bong)(ເປືອກ ບົງ)	<i>Notaphoebe umbelliflora</i>	Foppes & Ketphanh (1997)	Joss sticks & incense. Thailand
Broom grass (kok khem)(ກົກແຂມ)	<i>Thysanolaena maxima</i>	Foppes & Kethphanh (1997)	
Eaglewood (mai heuang)(ໄມ້ເຫືອງ), (mai ketsana) (Some places called sandalwood, but this is not correct)	<i>Aquilaria crassna</i>	Foppes & Ketphanh (1997), de Koning (2000b)	Resin distilled from scented wood. Arab countries, China & Japan
<p>Price for distilled oil of lowest grade were reported to be 1.000 Baht for 10 cc (in a factory in Muang Long). People get 5.000 Kip/kg (possibly only 3.000) for fresh wood having the black resin. The wood is cut into small pieces (approx 70 x 30 mm) and sun-dried. Thereafter it is grinded to small pieces (approx 7x 2 mm) and distilled, using fuelwood as heat. It is possible that sun-drying of the wood gives reduced quality, since the most volatile oils could evaporate to the air.</p> <p>People generally need to cut down and destroy five trees before they find one having the dark resin, and new trees need at least 15 years before they can give yield. The present and natural stands of trees are probably quickly depleted, since it is reported that people need to go longer distances to find trees. There probably exist a monopoly situation for sale of the oil. Because of that it might be difficult to try to sell through other channels, or organise the selling of wood to try to achieve better prices.</p>			
Sugar palm (maak tao, nyod tao) (ໝາກຕາວ, ຍອດຕາວ)	<i>Arenga pinnata</i>	de Koning (2000b), Foppes & Ketphanh (1997)	Export of fruit (Thailand?) and local

Name	Scientific name	Reference	Uses & Export
"Jewel" orchid	<i>Aoetochilis roxburghii</i>	de Koning (2000b)	Export (China?)
"Kisi" resin(kisi)(ຂີ້ຂີ້)	<i>Shorea</i> or <i>Parashorea</i> spp.	Foppes & Ketphanh (1997)	Siccative in paint and varnish. Mainly Thailand
Paper mulberry (po saa)(ປໍ່ ສາ)	<i>Broussonetia papyrifera</i>	Foppes & Ketphanh (1997), Vientiane Times, July 13-16, 2001	Paper (leaves for fodder?) Thailand & Korea
Rattan for furniture etc.	<i>Calamus</i> spp.	Evans, T. (year unknown)	From Muang Long area most of the export probably goes to Thailand
Rattan fruit	<i>Calamus</i> spp, <i>Daemonorops</i> spp.	de Koning (2000b), Evans, T. (year unknown)	Export (Thailand?)

In N Lao PDR the most common species harvested for Edible fruits are *D. jenkinsiana*. For commercial plantation it seems that *C. tenuis* has a large potential, but I do not know if this is suitable for Muang Long district.



Bamboo worms

Appendix III. Web-sites with special NTFP (or NWFP) coverage

NWFP-Digest-L., a free e-mail journal that covers all aspects of non-wood forest products. -

Back Issues: - <http://www.fao.org/forestry/FOP/FOPW/NWFP/Digest/digest-e.stm>

Archive: - <http://www.undp.org.vn/forums1/forums.htm>

Non-Wood Forest Products Programme, Forestry Department, FAO -

<http://www.fao.org/forestry/FOP/FOPW/NWFP/nwfp-e.stm>

Appendix IV. Charts

Chart 1. Percentage of income from NTFP for each village. Relative importance for each village as source of income. (Date palm = Sugar palm fruit, Wild wax = Kisi resin, Precious wood = Eaglewood, Mae = Bamboo caterpillar). Source: Raw data from Village Profiles 2000-2001, Luang Nam Tha Drug Supply and Demand Reduction Project.

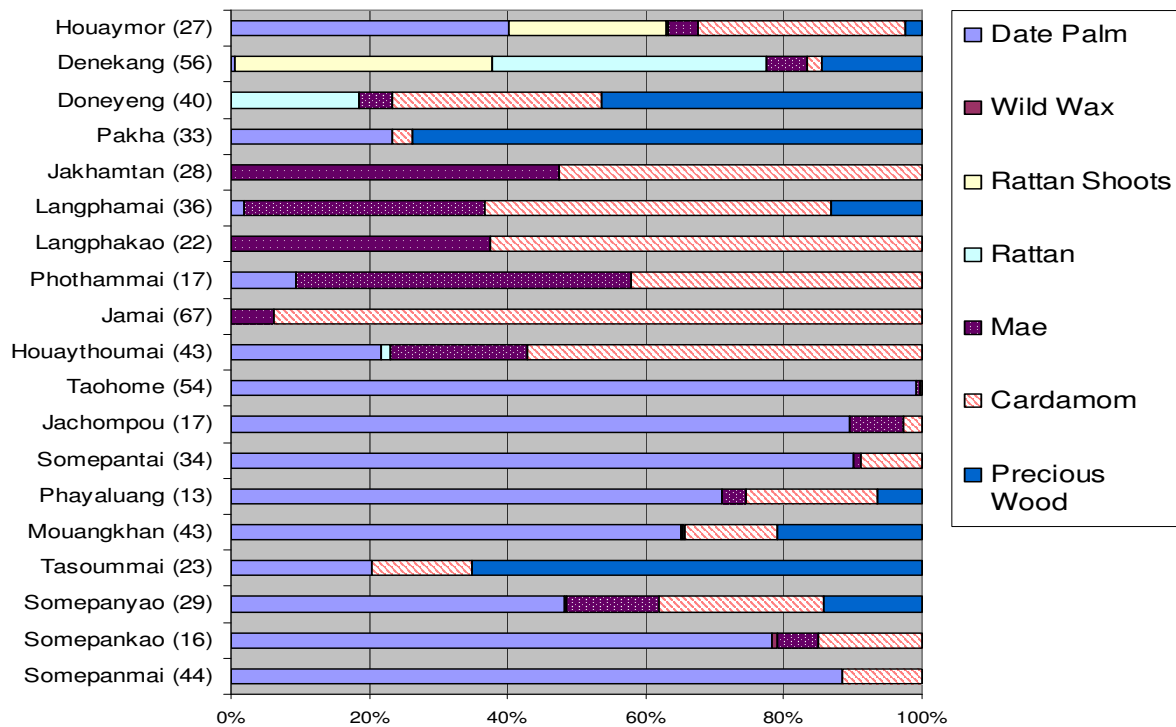


Chart 2. Value of NTFP for each village in Kip

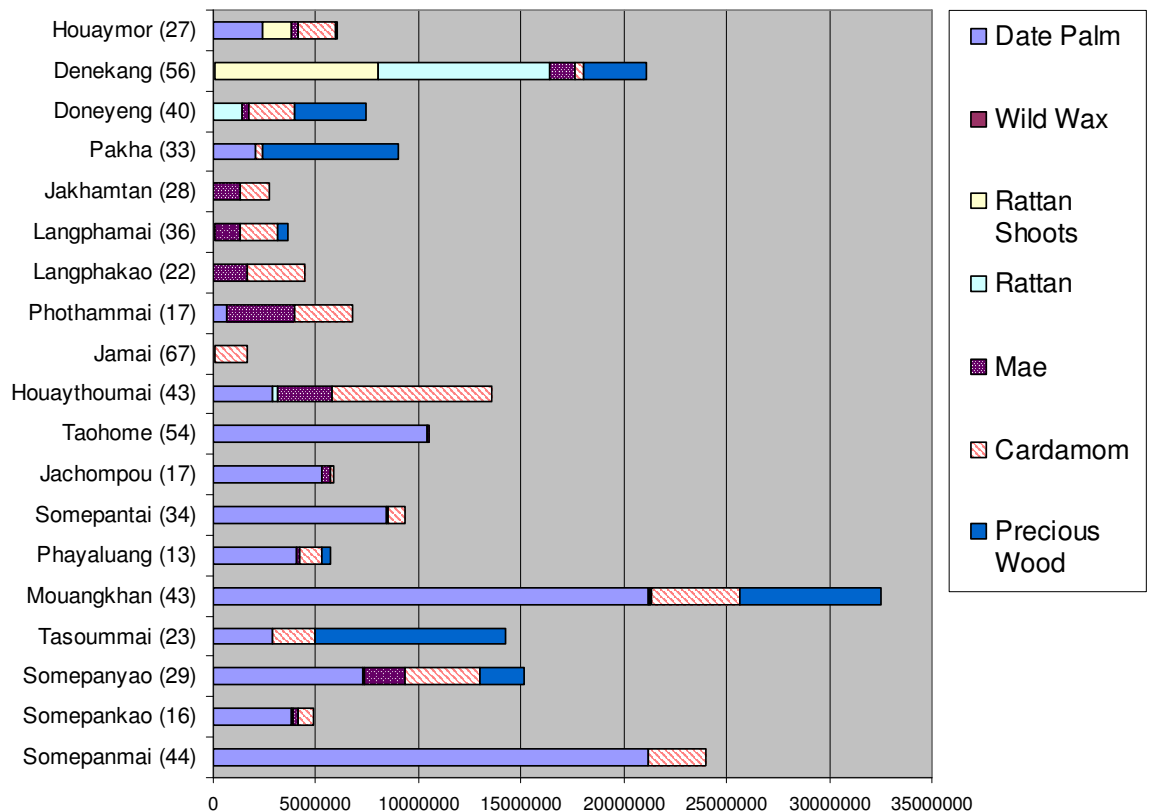


Chart 3. Sugar palm fruits (date palm) collected for each village (kg)

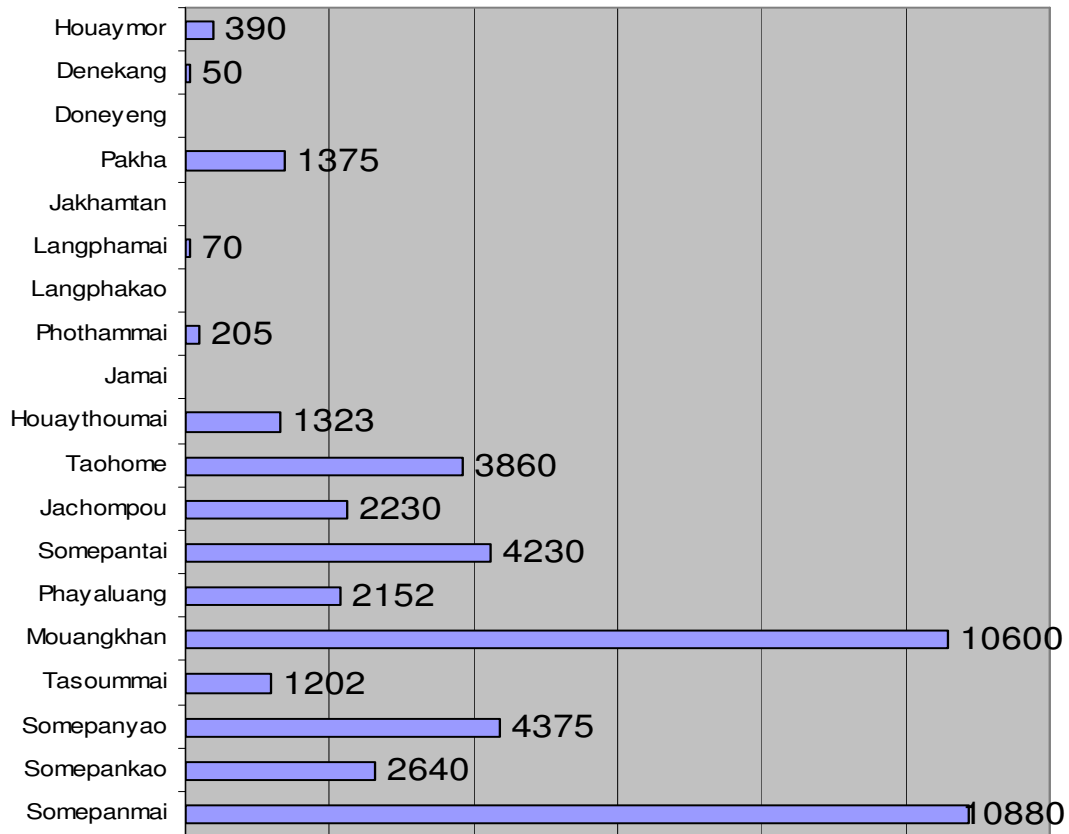


Chart 4. Rattan shoots collected for each village (kg)

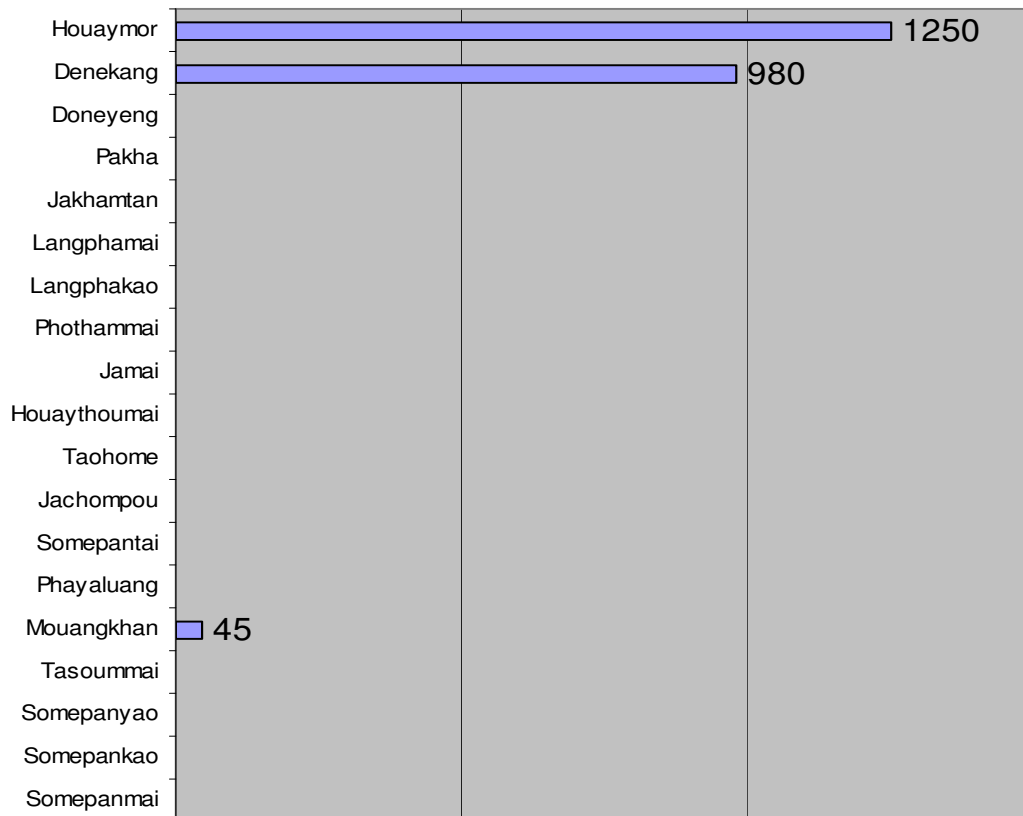


Chart 5. Rattan canes (for furniture and handicraft) collected for each village (kg)

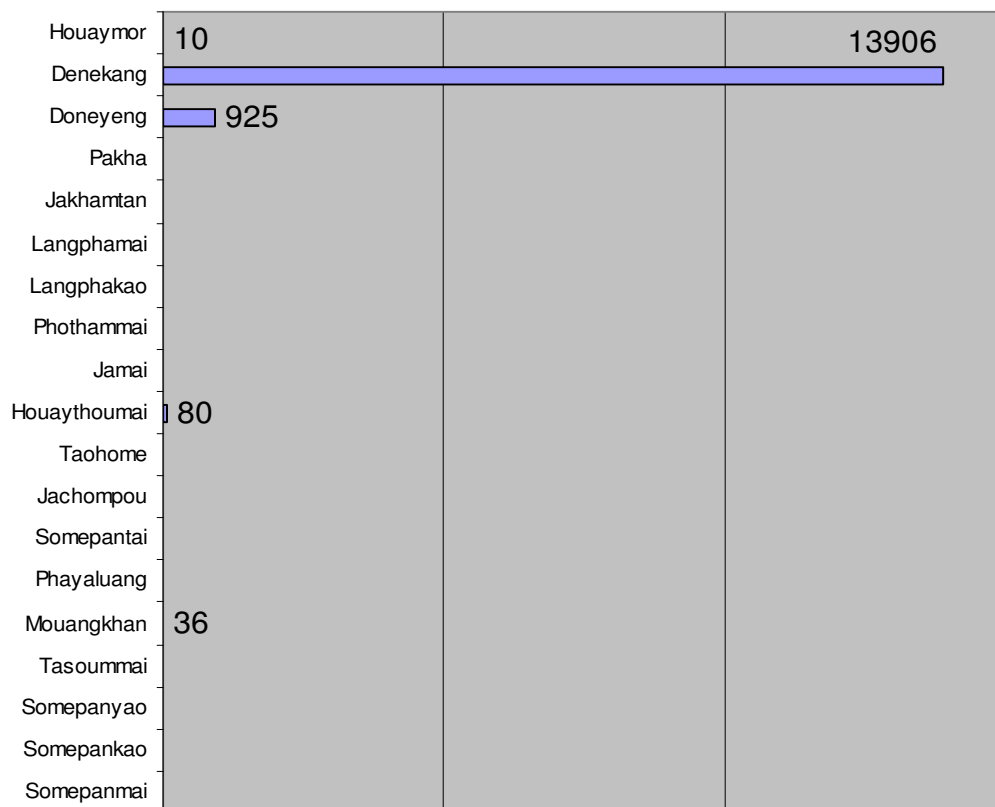


Chart 6. Kisi resin (Wild Wax) collected for each village (kg)

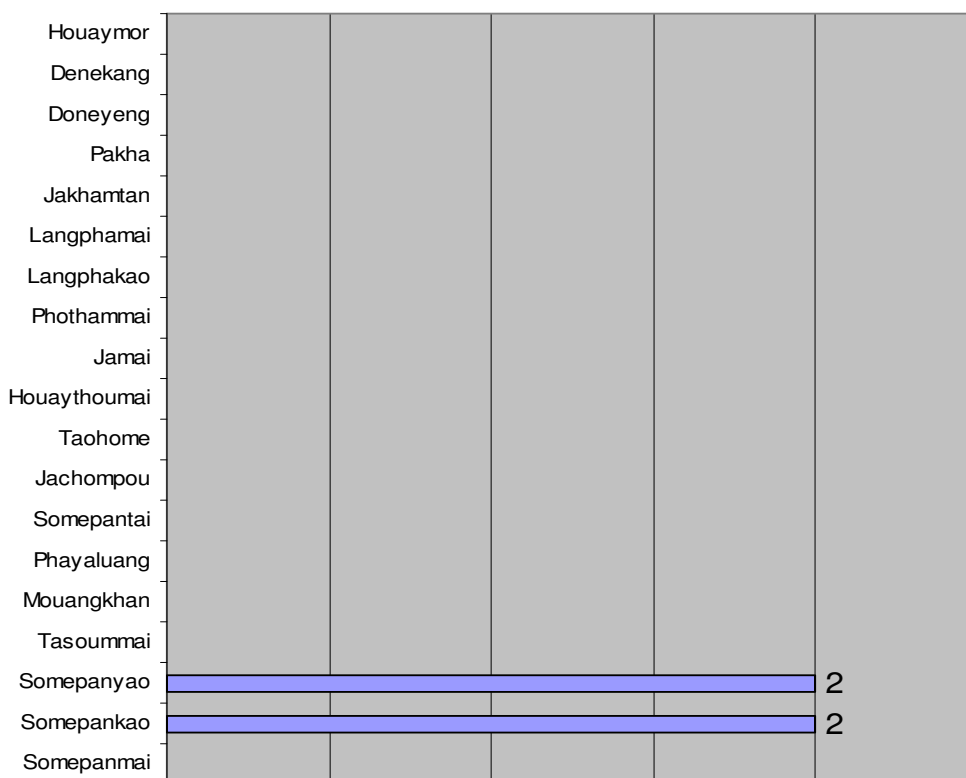


Chart 7. Bamboo caterpillar (Mae) collected for each village (kg)

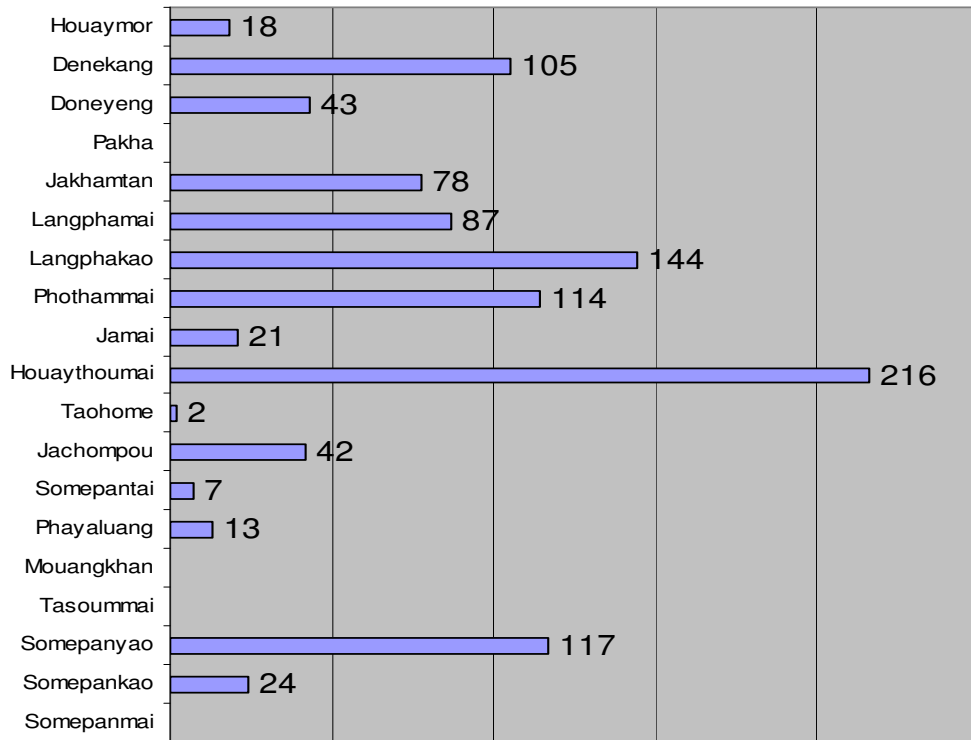


Chart 8. Cardamom collected for each village (kg)

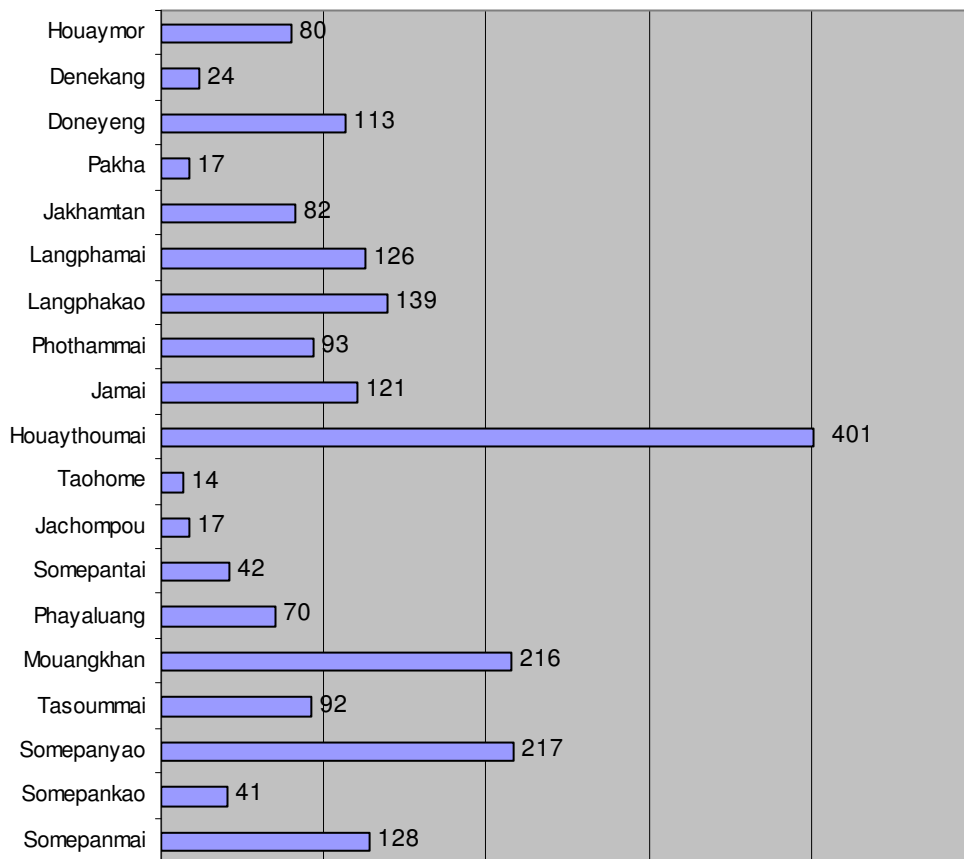


Chart 9. Eaglewood (Precious wood) collected for each village (kg)

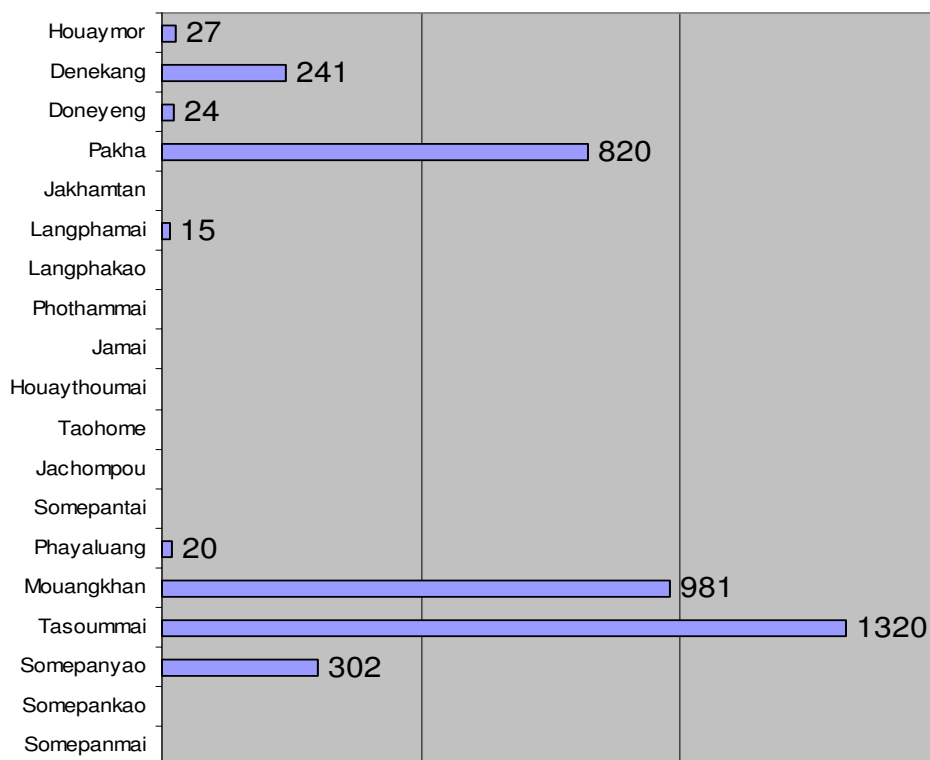


Chart 10. Estimated Opium production for each village (kg). Source: Muang Long Opium Survey 2001, Luang Nam Tha Drug Supply and Demand Reduction Project.

