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Persoon, G.A.

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Agarwood is the infected wood of the *Aquilaria* tree. Called 'the wood of the Gods', its uses range from incense for religious ceremonies, perfume for the Arabic world, medicinal wine in Korea and ornamental functions in China. As a healthy tree the *Aquilaria* is worth next to nothing, but wounded its defence mechanisms produce agarwood and the tree becomes a valuable commodity. Gerard Persoon goes in search of the natural and social life of a wounded tree.

Agarwood: the life of a wounded tree

GERARD A. PERSOON

Buddhist monks, Arabic perfumers, Japanese incense producers and Papuan collectors were just some of the cast of the 2nd International Agarwood Conference (March 2007, Bangkok). Participants came from more than thirty countries. The 'world of science' was represented by wood pathologists, anthropologists, foresters, economists and laboratory analysts each with their specific research interests. Alongside the scientists were entrepreneurs from Australia, Malaysia and the United States, potential investors in the opportunities that *Aquilaria* plantations offer. Finally there were nature conservationists concerned with the survival of the tree species. In total more than 120 people, (covering the full agarwood spectrum from production to consumption), came together to discuss the future life of the infected wood of a wounded tree.

Agarwood: its history and its use

Agarwood is the heartwood produced by a number of *Aquilaria* species in Southeast Asia, with Indonesia, Malaysia, Vietnam, Cambodia, Thailand, Laos and Papua New Guinea as the main producing countries and Singapore being the main trade centre. The resin-impregnated heartwood is fragrant and, as a result, highly valuable. This resin is produced as a result of pathological or wounding processes. It is also thought that resin production is a response to fungal infection. Interestingly however, not all *Aquilaria* trees produce resin and it is extremely difficult (or even impossible) to judge from the outside of a tree whether or not it is infected. Cutting the tree is the only way to find out whether the tree contains the resin.

Use of agarwood has been reported in many ancient cultures, even though the history of agarwood use is still to be written. The Egyptians are believed to have used agarwood incense as part of their death rituals more than 3,000 years ago. It is also suggested that incense trade was in fact the first international trade route that existed in history. In Japan, agarwood is said to have arrived with Buddhism. In Vietnam ancient texts also refer to the use of agarwood in relation to travelling Buddhist monks.

Today the range of agarwood products and their uses is seemingly endless. Solid pieces of agarwood are highly appreciated as 'natural art' in Japan, Korea and Taiwan. Craftsmen carve raw pieces of agarwood into beautiful wooden sculptures. Agarwood is also turned into beads and bracelets. Most of the wood, however, is processed and either turned into oil which is used in perfumes and other cosmetic products, or the agarwood chips are ground into powder which is used as the raw material for incense making (and sometimes also for special cigarettes).



The oil is also used in the production of traditional Chinese and Korean medicine, in the preparation of (medicinal) wine and various other products.

The oil is mainly used in the Arab world where it is in high demand. It is by far the most precious essential oil with prices reaching as much as ten times that of sandalwood oil. The largest market for top class incense is Japan with its long tradition in incense making. Both the Arab countries and Japan are interested in high quality agarwood and manufacturers in these countries prefer to process the raw material themselves. This also avoids the mixing of high grade agarwood with wood of lower quality.

The oil is extracted from the agarwood through distillation. This delicate process determines both the amount and quality of oil produced. With the exception of large solid pieces of agarwood which are traded as individual pieces, most of the

wood is ground into very small pieces or powder, which are immersed in water and left to ferment over time. Then the material is transferred to distillation kettles and steamed. After heating, the condensed water and oil are captured in a container where the oil floats on top of the water. The water is removed and the oil is tapped. The price of high quality oil can be as much as US\$50,000 to US\$80,000 per litre. This process can be repeated once or twice depending on the quality of the water and the costs of the distillation process. The powder which remains after distillation can be used for low grade incense making. It is estimated that for the production of one litre of oil 100 to 150 kilos of agarwood is necessary.

Wild and cultivated agarwood

In the past most agarwood has been harvested from the wild. Because it is extremely difficult, if not impossible, to see whether a tree contains agarwood or not most of the *Aquilaria* trees are chopped

down indiscriminately. High quality agarwood can fetch as much as US\$1000 per kilo. Throughout history there has been an ever-moving frontier of agarwood exploitation across Asia as traders, continuously search for untouched forests containing *Aquilaria* trees (Barden et al. 2000). The trees were fetching high prices and as a result, the news about agarwood harvesting spread like 'gold fever'. Large sums of money and all kinds of luxury items were offered to the forest dwelling communities, the traditional producers of agarwood. Usually this 'fever' was temporary. Once the largest trees were cut, new harvesting expeditions became less successful and just as in the case of gold, the collecting of small quantities of agarwood became a less rewarding activity.

The high prices for agarwood and the local depletion of resources in the wild have led to a variety of efforts to stimulate the growth of agarwood. The most common is the deliberate wounding of trees with large knives or the hammering of nails into tree trunks. In general such efforts do not yield very productive results. The agarwood produced is of inferior quality and can only be used for home consumption. Moreover, high quality agarwood takes many years to develop. It is only during the last few decades that a more scientific approach has been adopted to cultivation. Experiments were set up in several countries including China, Thailand and Indonesia. However, one of the most successful efforts to date has been a project initiated in Vietnam. In addition to laboratory analysis, field experiments were developed by a non-governmental organisation based in Ho Chi Min City. The project, called The Rainforest Project (TRP), is in the Seven Mountains area of South Vietnam close to the border with Cambodia. The experiments were undertaken with local farmers and Buddhist monks who had gained considerable experience in the cultivation of *Aquilaria* trees. Building on their knowledge, experimental plots were developed to stimulate the production of agarwood. The process and experiments were supervised by a wood pathologist from the University of Minnesota, Prof. Robert Blanchette and the Director of TRP, Henry Heuveling van Beek. The main principle of the process was the drilling of holes in the tree trunk and keeping the wound open by putting a small piece of plastic pipe in the hole. A chemical treatment was added to the wound to encourage the trees defence mechanism which stimulates the production of the resin. After years of experimenting with the numbers of holes, the age of the tree, the amount of chemicals and other variables, the first trees were recently harvested and the production of incense made from the cultivated agarwood has begun. The success of the experiment implies that it will not be long before the method spreads to other areas where *Aquilaria* trees are being grown. TRP is also the leading organisation behind the two inter-

national agarwood conferences that have been held so far.

In Thailand a similar process of agarwood cultivation was started by a private company. In the past Thailand has been a traditional producer and consumer of relatively large amounts of agarwood. Over the years trade in a wide variety of agarwood products has developed in Bangkok. Large amounts of agarwood products, not only from the country itself but also from neighbouring Cambodia and Laos, are channelled through the city to markets in East Asia and the Arab world.

The declining supply has led Thai scientists, in partnership with the private sector, to set up relatively large scale plantations. One of these plantations is run by a company called Krissana Panasin in Chantaburi, Southeast Thailand. Over the years it has established a substantial plantation of several hundred hectares, including nurseries, processing and distillation units. The research department of the company has been experimenting with all kinds of techniques to obtain the optimal quality. Moreover, it provides seedlings to interested farmers who can produce agarwood trees on their own farms. The technology to wound the trees in order to start agarwood production is also provided to the small holders by the company. The mature trees are eventually being sold for processing to the company as the farmers usually lack the connections and skills to organise the transport to other buyers. Aside from the cultivation of agarwood, Krissana Panasin also produces a wide range of end products. The company established an extensive public relations department to market these products and reach wholesale traders in consumer countries directly. In this way it tries to bypass the intermediate traders, at least within Thailand but also in places like Singapore and Hong Kong, which mainly serve as import and re-export sites.

A much smaller project to cultivate agarwood is being undertaken by the Catholic Church in Marauke, Papua (Indonesia). Here too harvesting from the wild came to an end within a relatively short period after the agarwood frontier reached the area in 1996. People still try to dig up roots of *Aquilaria* trees that might contain some agarwood, but it is clear that the big harvest is over. The project currently being implemented aims to integrate agarwood trees into the local agroforestry system. This is based on the idea that in the future agarwood may become an additional source of income for the farmers. Methods that are being used are largely based on local trial and error efforts in wounding and treating trees, including inoculation. Processing units are still absent and the farmers are fully dependent on outside traders for market opportunities. As yet the farmers and the church organisation lack the capacity to process the agarwood to add value to



the raw material. But, based on the high prices of agarwood earned in the past the hopes for the future are high.

New areas

The high value of agarwood has attracted the attention of potential investors from a number of countries. Inspired by the success of the plantations that are already established in Vietnam, Thailand and India, new investors are willing to take up

this challenge. New on the scene are the business people from Australia, Hawaii and Malaysia. Having gained substantial experience in the production of sandalwood in Western Australia, some companies are now ready to turn their efforts to *Aquilaria* plantations which could yield even higher prices per production unit. In the meantime, and as is the case with many other expensive products, there is an influx of fake agarwood products onto the

market. These products go by the name of Black Magic Wood (BMW), and in fact are made from non-infected *Aquilaria* wood which has been impregnated with cheap oil. It requires a trained eye and nose to differentiate real agarwood from these fake products.

There are of course a number of questions to be asked in relation to the large scale domesticated production of agarwood: Can the high prices currently commanded by agarwood be sustained if production is substantially be increased? What will the quality of the cultivated product be? There are also concerns about the consequences of large-scale cultivation for the traditional producers of agarwood, the collectors inside the forested areas. It is generally assumed that the natural top quality agarwood will become rare but remain in demand, particularly in Japan. This 'top end' of the market cannot easily be replaced by cultivated agarwood. At the lower end of the supply quality, it is predicted that there will be an increase in supply from both the traditional producers as well as the new ones. A gradual reduction in price is expected as a result of this increased cultivation. Finally it is assumed that the production, and therefore the value, will gradually move from the original rainforest areas to plantations located in other areas. Similar developments have also taken place in the case of other non-timber forest products such as orchids, rattan and crocodile skins.

Protection

A number of measures to protect the *Aquilaria* trees from excessive logging, and thus ensure the survival of the species, are under discussion. However, some repre-

sentatives of conservation organisations point to an apparent lexical confusion as one of the main obstacles in this area. For some years the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has listed all *Aquilaria* species in its Appendix II. This implies the need to monitor the trade (both import and export). However, because agarwood is known across the world by many different names (such as eaglewood, aloeswood, jinko, gaharu, and oudh), and because it is used or even disguised in so many different products (such as oil, perfumes, incense, wine, wood dust and chips), tracking agarwood products requires highly sophisticated detection procedures which are not yet in place. This is one of the reasons why the illegal trade in agarwood cannot easily be stopped. One of the challenges ahead will be the differentiation between wild and cultivated agarwood. Without doubt some of these issues will be discussed during the next agarwood conference which will take place in a few years time. ■

Gerard A. Persoon

Institute of Environmental Sciences,
Leiden University
Email address: persoon@cml.leidenuniv.nl

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