TAPPING OF OLEO-RESIN FROM *DIPTEROCARPUS KERRII*

Ibrahirn Jantan, Abu Said Ahmad & Abdul Rashih Ahmad

Forest Research Institute Malaysia, Kepong, 52109 Kuala Lumpur, Malaysia

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IBRAHIM JANTAN, ABU SAID AHMAD & ABDUL RASHIH AHMAD. 1991. Tapping of oleo-resin from *Dipterocarpus herrii.* A survey was conducted on the tapping *of Dipterocarpus kerrii* for its oleo-resin by the Orang Asli (aborigines) of Tasek Bera and Buloh Nipis. The method of tapping currently employed leads to the destruction of some wood and the production of low yield and poor quality oleo-resin. The tapping technique was improved by applying the bark-chipped method with aqueous sulphuric acid solution as a stimulant. The optimum concentration of the aqueous acid used to stimulate maximum oleo-resin flow was determined. This method proved to be advantageous and economical since minimal concentration of aqueous sulfuric acid solution could be used to produce optimum yield and better quality oleo-resin with less damage inflicted on the tree.

Key words: *Dipterocarpus kerrii* - oleo-resin - tapping - aborigines - bark-chipped method

Introduction

The tapping of oleo-resin from *Dipterocarpus kerrii* has long been done as a sideline by the Orang Asli (aborigines) of Tasek Bera and Buloh Nipis in Pahang and various parts of Peninsular Malaysia to supplement their subsistence from agriculture, fishing, hunting and other forest products trade. Unfortunately, this source of income is being diminished as logging rapidly destroys the natural stands of the trees. The oleo-resin has traditionally been used by the Orang Asli for caulking boats, for torches and for medicinal and other minor purposes (Burkill 1935). Essential oils from the oleo-resin, locally known as "minyak keruing", have recently been used as fixatives in perfumes by essential oils manufacturers in Singapore (Gianno & Kochummen 1981, Gianno 1986). However, the resinous fraction of the oleo-resin has not been exploited commercially. There has been a significant increase in the price of the oil. By virtue of these, the prospects for developing oleo-resin collection as a big industry in Malaysia look bright and the possible cultivation of these trees partly for tapping purposes should be seriously considered.

The method of tapping has not changed since Buckley's account more than fifty years ago (Burkill 1935). Foxworthy (1922) and Burkill (1935) criticized the technique used as crude which resulted in the destruction of some wood. Moir (1981) supported this view and suggested that the traditional procedure of chopping a hole in the trunk where the oleo-resin will accumulate and the use of firing to stimulate further oleo-resin flow could be improved. However, Foston (1935), on the basis of having examined two *D.*

kerrii, concluded that the tapping may not be as damaging as originally thought. A hole of about 18 *cm* deep into the wood and the burnt wood around the tapped area would certainly affect the growth of the tree. The collection, handling and purification of the oleo-resin were poor. Foreign materials and rain water were found in the collected oleo-resin.

The separation of the essential oils from the resinous fraction using gunny and flour sacks as filtering mediums was slow and inefficient especially when compared to other widely used filtering techniques. The open air operation and uncovered containers might lead to loss of the oil due to evaporation. The damage caused by this manner of tapping becomes a matter of serious concern as the demand for keruing timber increases. Moreover, the destructive and wasteful tapping method leads to low production and poor quality oleo-resin.

Various methods have been used in attempts to increase oleo-resin yield from pine trees while reducing stem damage and making the tapped trees saleable for other wood products (Prasad & Joshi 1974, Verma *et al.* 1976, Ordinario & Tongacan 1979, Clements 1960). The use of chemical stimulants by bark-chipped method to increase oleo-resin production has now been used on a large scale in many countries. Among the chemicals, aqueous sulphuric acid is the most commonly used.

This study employed the bark-chipped method using aqueous sulphuric acid to determine the proper extraction procedures of tapping *D. kerrii* for a profitable production of high quality oleo-resin.

Materials and methods

Survey of tapping method, collection and handling of the oleo-resin

The method of tapping oleo-resin from *D. kerrii* by the Orang Asli at Tasek Bera and Buloh Nipis in Pahang showed heavy damage on the trees (Figure 1). An axe called 'beliong' was used to cut a rectangular shaped hole into the tree trunk. The hole was about 24 x 7 X 18 cm in size and had a floor that sloped downward away from the mouth, thereby forming a deep container that could collect the oleo-resin that exuded from the walls of the hole. The injury stimulated a slow flow of oleo-resin. A fire was set in the hole and it spread through the hole as the already accumulated oleo-resin began to burn. The firing which took about 5 *min* stimulated more oleo-resin flow. The hole was left for about a week, a span of time believed to allow for the maximum amount of oleo-resin to collect in the hole. The oleo-resin was collected by ladling it into a metallic container.

The hole was burnt again to supply another week's collection of oleo-resin. The firing was repeated until the hole could not yield anymore oleo-resin. Then a new hole would be made on another part of the tree trunk.

The separation of the essential oils fraction of the oleo-resin from the resinous fraction was done in a small tent using gunny and flour sacks successively as filtering mediums . These sacks were hanged firmly by the rim

from wooden frames. The essential oils fraction dripped slowly through the sacks leaving the resinous fraction as residue.

Figure 1. Effect of traditional method of tapping on the *Dipterocarpus kerrii* tree

Tapping of D. kerrii at Forest Research Institute Malaysia

A stand of *D. kerrii* in field 12E of the Forest Research Institute Malaysia, designated as E55, planted in 1935, was chosen for this study. Four trees (I, II, III & IV) were tapped following the bark-chipped method using sulphuric acid solution spray. Tapping was conducted according to the following sequence:

1) The tapping area was marked at about 50 *cm* above the ground. The diameter of the tree at this height ranged from 100 to 120 *cm*. The outer rough bark with deep and shallow cracks was removed using a parang to get a somewhat smooth tapping surface.
2) An inner bark streak approximately 2.5 *cm* wide was removed to expose the wood surface using a tapping knife. The width of the tapping face was approximately equal to the diameter of the tree measured at 100 *cm* from the ground. The streak was directed upwards at an angle of about 30" to the horizontal.
3) Half inch nails were used to attach an apron and a spiral gutter to the bark, just below the tapped area. Any gaps present between the gutter and the bark were closed by pounding the inner edge of the gutter into the bark. A 1-quart cup was used as the collector. It was supported by two large nails which held the cup snugly against the tree. The completed installation is shown in Figure 2.

Figure 2. Tapping of oleo-resin from *Dipterocarpus kerrii* using the bark-chipped method with aqueous sulphuric acid solution as stimulant

4) Sulphuric acid solutions of different strength (2.5,5,10,15, 25 and 50%) were sprayed on the exposed wood surface using a one pint capacity plastic sprayer. For each strength of acid, the experiment was done in triplicates. A control experiment was done by following the similar tapping method but without chemical stimulant.
5) A plastic sheet was attached to the top of the tapping area to minimise contamination of the exuded resin by rain water and foreign materials. Including control, there were 21 treatments on each tree. The acid was sprayed on the freshly cut surface. The oleo-resin was collected at the end of each day for six days and the amount was recorded.

Separation and purification of the essential oil

The essential oil was separated from the resinous fraction by extraction with petroleum ether followed by centrifugation and purified by hydro-distillation.

Results and discussions

The removal of bark to expose the wood surface did not stimulate oleo-resin secretion but merely prepared the area for acid treatment (Table 1). The results indicate that acid treatment stimulated oleo-resin secretion from *D. kerrii.* According to Riyanto (1980), the stimulation might be due to:

- the hydrolysation of the sap channel and substantial drop in the wall pressure, resulting in a sap secretion above normal;
- the hydrolysation of the parenchymal cells, resulting in the secretion of cell fluids which will be absorbed by the sap; the quantity of watery sap

increases more and more and is secreted above normal;

- the buffering effect of the acids, preventing the sap to form its cyclic chain, thus maintaining its form as an aldehyde; so the sap continues to be watery and is secreted continuously above normal.

Table 1. Oleoresin yield per tapping (%)

Tree	Arid concentration (%)	Replication I	II	III	Mean ± S.F.
I	0	6.3	2.3	1.3	3.3 ± 2.7
	2.5	114.1	100.9	108.7	107.9 ± 6.7
	5	206.5	222.7	228.9	219.4 + 11.6
	10	252.1	310.2	266.3	276.2 ± 30.3
	15	181.8	218.3	192.3	197.4 ± 18.8
	25	166.6	176.0	170.0	170.9 + 4.8
	50	172.3	166.2	160.8	166.4 ± 5.7
II	0	1.2	1.0	2.5	1.6± 0.8
	2.5	101.2	84.4	113.1	99.5 ± 14.4
	5	199.2	185.1	209.1	197.8 ± 12.1
	10	356.4	285.5	316.4	319.4 ± 35.5
	15	190.5	203.3	211.9	201.9 ± 10.8
	25	162.5	181.4	175.2	173.1 ± 9.6
	50	288.6	315.3	307.6	303.8 ± 13.7
III	0	0.5	1.5	0.7	0.9+ 0.5
	2.5	35.2	41.0	52.4	42.9 ± 8.7
	5	91.7	61.2	85.5	79.5 ± 16.1
	10	181.2	188.5	175.3	181.7 ± 6.7
	15	114.3	130.6	123.2	122.7 ± 8.1
	25	183.6	162.6	170.8	172.3 ± 10.6
	50	211.4	191.2	180.3	194.3 ± 15.8
IV	0	0	0	0	0
	2.5	10.3	15.1	25.2	16.8 ± 7.6
	5	35.1	41.3	23.7	33.4+. 9.0
	10	74.2	74.0	85.2	77.8 ± 6.4
	15	57.5	46.4	50.5	51.5± 5.6
	25	27.7	54.7	39.9	40.8 +. 13.5
	50	52.2	87.9	71.1	70.4 ± 17.9

However, other researchers believe that ethylene produced endogenously by plant tissues in response to injury (acid treatment) plays a dominant role in the formation of exudates (Abeles 1973, Hillis 1975).

Application of sulphuric acid solutions of different strength gave various yields of oleo-resin. Without the stimulant, the secretion of oleo-resin was negligible. Although there were variations in the amount of oleo-resin secreted by different trees, the graphs show that the relationships between resin yield and concentration of aqueous sulphuric acid solution for all trees follow a similar pattern (Figure 3). The oleo-resin yield increased sharply as the concentration of acid was increased up to 10% concentration at which point the yield reached its maximum level. The oleo-resin yield started to decrease at acid concentration greater than 10% and reached the minimum at 15 or 25% acid concentration. At 15 to 50% acid concentration, the amount of oleo-resin collected was irregular.

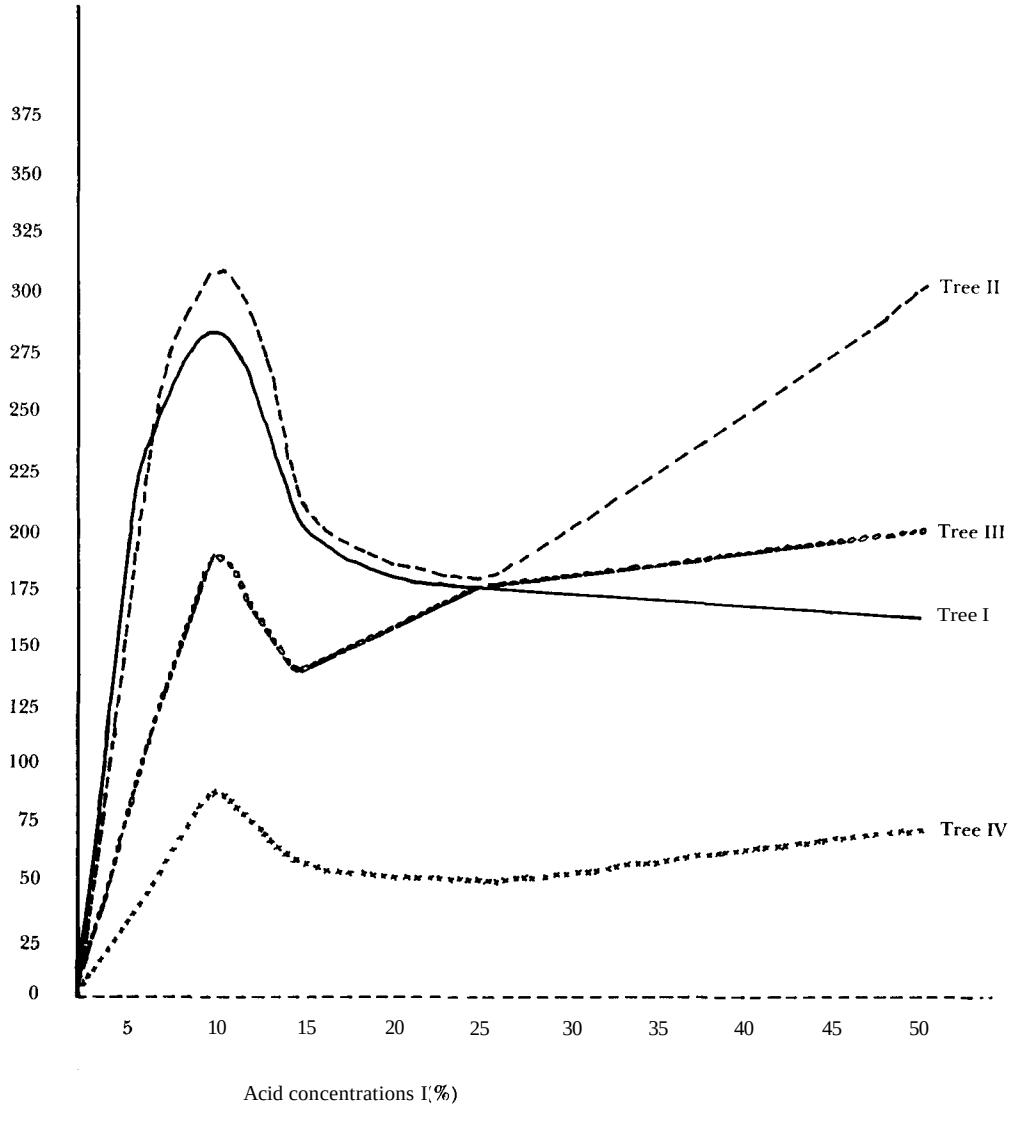

Figure 3. Relationship between average resin yield *(g)* and different levels of sulphuric acid

The average oleo-resin yield obtained using the bark-chipped method with sulphuric acid as stimulant was comparable to that obtained using the traditional method practised by the Orang Asli. The average amount of oleo-resin collected per tree per tapping using the latter method ranged from 100 to 230 *g.* However, greater oleo-resin yields were obtained when a 10% acid concentration was used. The results might indicate that the use of 10% concentration was the best since it was the minimal concentration of the acid that produced the maximum yield. Moreover, the lower the acid concentration that could be used the better it is for the tree since less damage would be inflicted.

Proper extraction and purification processes produced essential oils of higher quality. The colour of the oils was clear yellow and the odour was pleasantly balsamic. The essential oils obtained by the traditional method of the Orang Asli were dark brown in colour and the odour was less pleasant.

Conclusion

The results suggest that treatment with sulphuric acid solution of appropriate concentration coupled with a proper tapping technique will ensure profitable extraction of the oleo-resin from *D. kerrii* with little damage to the tree. This investigation will serve as an impetus for further research in the extraction of oleo-resin from *Dipterocarpus* spp. Some other aspects of the studies which should be looked into are:

- the influence of diameter size of tree on oleo-resin yield;
- the use of other chemical stimulants such as hydrochloric acid, ethrel and paraquat;
- the use of acid paste as stimulant as it is claimed that the paste form has a longer stimulating effect than the liquid form;
- the influence of weather on oleo-resin yield;
- the use of mineral fertilisers in the soil to increase oleo-resin production;
- the influence of age and site on oleo-resin yield.

A properly developed tapping system will contribute to the development of the Orang Asli resin technology and will also provide useful information for a resin industry in Malaysia, if plantation of resinous trees partly for resin production becomes a reality.

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