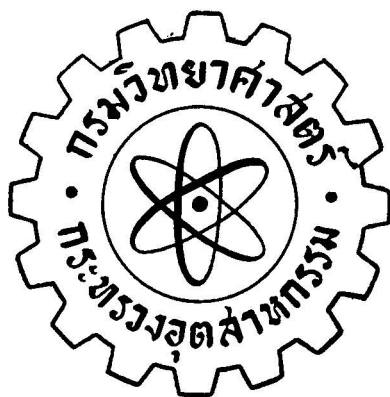


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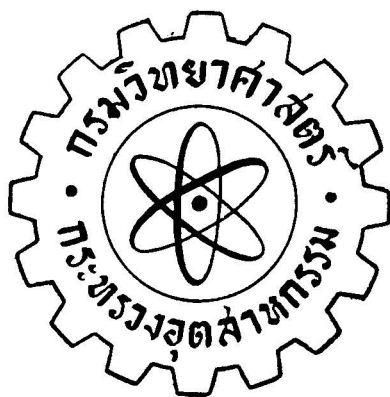
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CONTENTS

	Page
Kapok-Seed Oil . . . . .	1
<i>Nidnoi Sucharitkul</i>	
Coconut Oil From Fresh Meat. . . . .	5
<i>Sompule Suyasinto</i>	

**ABSTRACTS**

Research on Amoebiasis . . . . .	14
Hatching of the Eggs of Giant Gourami . . . . .	15
I 131 Therapy of Hyperthyroidism . . . . .	15
Ascarides in the Biliary Passages . . . . .	16
Variation in the Origin of the Trapezius . . . . .	17
Fungus Isolation from "Kong Kao Kieu" . . . . .	18
The Serologic Identification of <i>Vibrio Cholerae</i> . . . . .	18
Jaundice due to Opisthorchiasis . . . . .	19
Report of the Results of Experiment on Teak Regeneration	19
The Use of Gibberellic Acid for Stimulating the Growth of Orchid Seedlings . . . . .	20
Using Pineapple Leaf for Budding Rubber Trees . . . . .	20
The Impregnation of Wooden Sleepers . . . . .	21

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DEPARTMENT OF SCIENCE  
Ministry of Industry, Bangkok, Thailand  
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# KAPOK-SEED OIL

Mrs. Nidnoi Sucharitakul, B. Sc. (C.U.)

Department of Science

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## Summary

*This paper reports some of the results of a study of kapok-seed oil.*

## Introduction

Kapok seed contain about 20-30% by weight of edible oil, which is in some respects superior to cotton-seed oil. They also contain about 24% of protein, and, unlike those of cotton seed, their cake and meal contain no poisonous gossypol. Because of their various uses, they are exported in an increasing amount, currently bringing in over 10 million bahts a year. Realizing their increasing importance, the Division of Research of the Department of Science initiated an investigation into the treatments, the properties and the uses of kapok-seed products. In this paper are given some of the preliminary results of the study of kapok-seed oil.

Two varieties of kapok (*Ceiba pentandra*) are commonly grown in Thailand, the native and the hybrid between the native and Togoland varieties. Usually a native kapok pod is smaller than one of the hybrid but contains more seed, i. e. about 30% by weight or higher compared with about 20% in a pod of the hybrid.

## Experimental

### *Oil Extraction*

Various methods of extracting the oil in kapok seed were tried. It was found that the best method consisted of grinding the seed complete with hulls, expressing the oil by means of a

hydraulic press and then extracting the remaining oil in the meal with a solvent. If the hulls were first removed, the meal tended to form lumps owing to the high content of gluten in it, thus preventing easy flow of the oil; moreover, the removal of hulls was tedious and wasteful. Toasting of the seed before grinding also facilitated oil flow but the oil was discoloured; besides, the moisture content of 12-13% in the raw seed was the optimum amount for oil expression. The pressing should last about 45 minutes to an hour, during which about 8-10% of oil could be removed. Most of the oil remaining could be removed in subsequent extractions with a solvent.

### *Free Fatty Acid Content in Kapok-seed Oil*

Free fatty acid (FFA) content in various samples of oil ranges from 0.65% to 1.2% for oil from native kapok, and from 1.7% to 3.2% for oil from hybrid one. FFA content was found also to be dependent on the state of maturity. Thus when the pod was still green, the seed being already black, FFA content of the oil was 4.7%; but when the pod was left to ripen on the tree and picked after the pod had turned brown, FFA content of the oil was only 3.2%.

### *Oil Refining*

Kapok-seed oil could be refined by a method similar to that of the American Oil Chemists' Society for cotton-seed oil. For oil with FFA content less than 1.2% alkali refining was found to be unnecessary; steam distillation under reduced pressure was enough to remove the free fatty acid as well as the unpleasant odour, resulting in an oil of a quality suitable for culinary purposes. In Table I are shown characteristics of a typical sample of refined kapok-seed oil.

Table I

Refractive index (27°C)	1.4707
Iodine value	92
Saponification value	191.4
Free fatty acid (calculated as oleic acid)	below 0.05

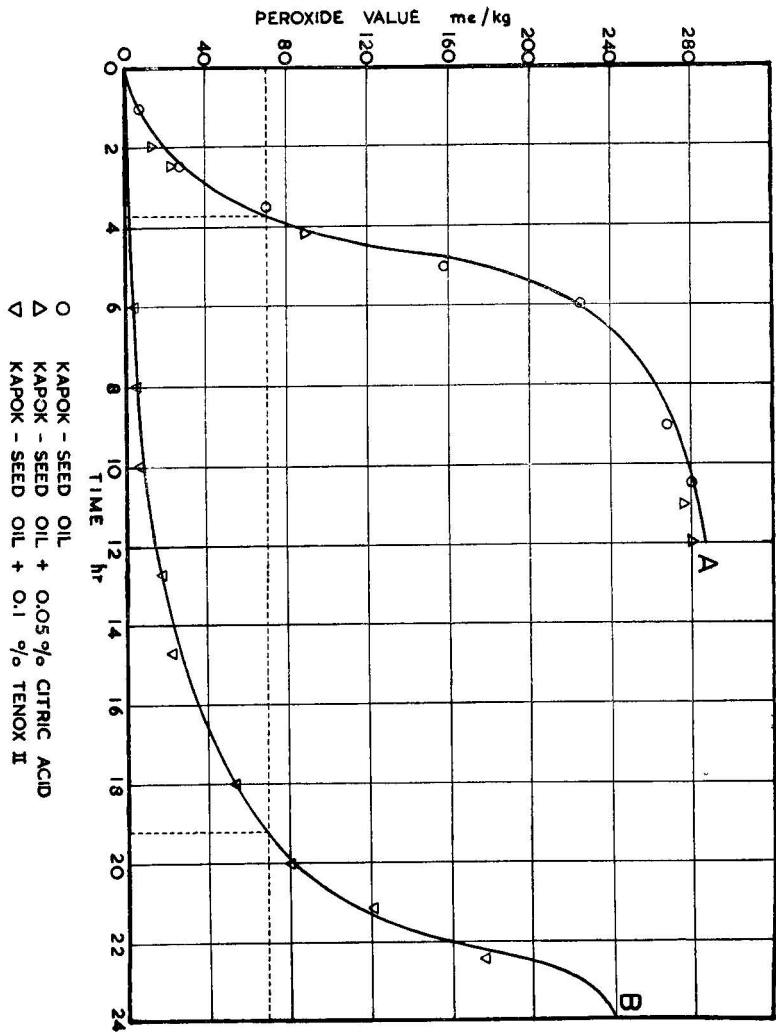


FIGURE I

### *Colour of the Oil*

The colour of the oil was determined by means of a Lovibond tintometer, using a four-inch cell. In Table II are shown the effects of alkali treatments as well as the combined effects of alkali and bleaching treatments.

Table II

Sample number	Description	Colour			
		Un-bleached sample		Bleached sample	
		Y	R	Y	R
1	Crude oil from hydraulic press	28	6.5		
2	Refined oil (from Sample 1) using 12°Be lye 80% max.	17	2.6	5	1.0
3	Crude oil from solvent extraction	too dark			
4	Refined oil (from Sample 3) using 12°Be lye 80% max.	17	3.8	10	2.0
5	Refined oil (from Sample 3) using 16°Be lye 80% max.	17	4.7	8	1.7
6	Refined oil (from Sample 3) using 16°Be lye max.	17	5.2	10	2.2

### *Keeping Quality of the Oil*

The keeping quality of the oil was estimated by means of the active oxygen method (AOM). This is one of the most commonly used methods which can be carried out within a reasonable time in the laboratory. It depends on an acceleration of the rate of oxidation by means of continuous aeration of the sample kept at a high temperature; the peroxide value (PV) being determined, by titration, initially and at intervals until the oil turns rancid.



In Figure I, A shows the stability curve, i.e. peroxide value vs. time, of a sample of refined kapok-seed oil; the conditions of the experiment were: aeration rate = 2.53 cc/sec, temperature =  $208 \pm 0.5^\circ\text{F}$ . Usually a vegetable oil with a PV of 70 me/kg and an animal oil of a PV of 20 me/kg are considered rancid. Thus Figure I A shows that the sample of kapok-seed oil had a stability of 3 hours 45 minutes. This was comparatively low as can be seen from Table III, which shows the stability values for various oils determined by the AOM.

Table III

Oil	Stability
Kapok-seed oil	3 hours 45 minutes
Rendered leaf lard	8 hours
Rendered lard of the back	12 hours
Peanut oil	13 hours
Sesame oil	24 hours
Coconut oil	68 hours

Direct measurement of the shelf life of an oil is difficult, because it takes a long time and depends on factors such as temperature, light intensity and moisture content, which accelerate rancidity; of these factors, light intensity are the most effective. After 16 months, a sample of refined kapok-seed oil, stability 3 hours 45 minutes, kept in a dark stoppered bottle was found to have a PV of 0.03 me/kg with no perceptible odour.

Referring back to Figure I, the effects of additives are also shown. It can be seen that 0.05% of citric acid make little, if any, difference in the keeping quality of the oil; 0.1% of Tennox (an anti-oxidant of the following composition: butylated hydroxy anisole 20%, propyl gallate 6%, anhydrous citric acid 4%, in 70% propylene glycol), on the other hand, considerably increased the oil stability.

# COCONUT OIL FROM FRESH MEAT

Sompule Suyasinto  
Department of Science

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## Summary

*The paper describes a method of extraction coconut oil from fresh coconut meat. The oil obtained was clear, and low in free fatty acid content, and had no rancid odour and taste. The yield, however, was still unsatisfactory.*

## Introduction

Crude coconut oil from copra is not suitable for consumption. It needs refining before use for edible purpose. To eliminate the refining process the oil was extracted from fresh coconut meat, in order to obtain a better quality oil and to minimize the high loss in the copra process.

In the preparation of coconut oil from copra, the meat of the fresh coconut is dried either in the sunlight or in crude copra driers. The drying takes place from two to several days until it has lost most of its water content. During the sun-drying process, bacteria, molds and the cellular enzymes of the coconut itself exert a combined action to damage the coconut meat and oxidize the oil, so that upon extraction the latter is coloured, high in acidity, and has rancid odour. Moreover during transportation and storage, copra is further damaged by the said bacteria, copra bugs and other organisms, resulting in bad quality oil as well as low yield.

In an effort to improve the quality of coconut oil, several processes basing on the wet or cocouut milk process have been tried. In these processes, the milk expressed from fresh coconut is subjected to various treatments, taking from several hours to

several days to complete. During this time katabolic and oxidase enzymes as well as bacteria react unfavorably on the milk substances. Coconut milk is a good bacterial media for the growth of microorganisms, which secrete enzymes causing changes and adversely affecting the quality of the resulting oil. It is a biochemical fact that the action of the katabolic enzymes, after the metabolism of the organism ceases, brings about deterioration and eventual disintegration of the component of the organism. As soon as the coconut is plucked from the palm, its metabolic activities begin slowing down and eventually stop. But the katabolic enzymes keep on with their destructive activities. Upon opening the nut and exposing it to the air, the oxidase enzymes start functioning, and add their deleterious effect upon the meat of the nut.

### **Experimental**

The preparation of coconut oil from fresh meat was made in 2 steps:—

- 1) Pressing of the fresh meat to obtain coconut milk.
- 2) Separation of the oil from the coconut milk.

#### **Pressing of the fresh meat to obtain coconut milk**

The meat to be pressed was shredded by a shredding machine available in the market. It is composed of rotary wood cylinder upon whose surface iron needles are nailed.

The pressing machine is a Laboratory Carver hydraulic press with a steel cylindrical cage of 3.5 inches in diameter and 7.5 inches high. The capacity of the cage is about 900 g of shredded coconut meat.

In the experiment, the conditions were varied as follows:—

- 1) First pressing using raw meat and without an addition of water.
- 2) First pressing using raw meat and with an addition of water.
- 3) First pressing using steamed meat and without an addition of water.

- 4) First pressing using steamed meat and with an addition of water.

In the second and third pressings cold water and sometimes hot water were added.

Table I The pressing of raw coconut meat without an addition of water to the raw meat

		Fresh meat	1st cake	2nd cake	3rd cake	4th cake	5th cake
Fresh meat	g	900	—	—	—	—	—
Wt. of cake	g	—	400	370	316	276	256
Cake	%	—	44.5	41.2	35.2	30.6	29.4
Moisture	%	52.2	—	48.1	46.9	43.7	46.8
Oil content	%	31.6	—	29.6	28.2	29.6	26.3
Wt. of oil	g	284	—	110	89	82	62
Oil expressed	g	—	—	174	195	202	222
„ „	%	—	—	61.3	68.7	71.1	78.3

First pressing without an addition of water. For each successive pressings, 450 g of water was added to the cake.

Table II The pressing of raw coconut meat with an addition of cold water to the raw meat

		Fresh meat	1st cake	2nd cake	3rd cake
Fresh meat	g	900	—	—	—
Wt. of cake	g	—	410	360	330
Cake	%	—	45.5	40.0	36.6
Moisture	%	49.5	45.8	44.0	44.2
Oil content	%	34.0	34.8	35.8	35.0
Wt. of oil	g	306	143	129	116
Oil expressed	g	—	163	177	190
„ „	%	—	53.0	58.0	62.0

First pressing with an addition of 450 g of cold water. For the subsequent pressings 50% by weight of cold water was added to each pressed cake.

Table III Comparison of the pressing of steamed coconut meat, with and without an addition of water

	Fresh meat	Steamed without water			Steamed with water		
		1st cake	2nd cake	3rd cake	1st cake	2nd cake	3rd cake
Wt. of fresh meat g	400	—	—	—	—	—	—
Wt. of cake g	—	210	175	150	224	185	160
Cake %	—	52.5	43.8	37.6	56.0	46.2	40.0
Moisture %	51.2	—	36.4	37.8	37.6	41.3	43.5
Oil content %	30.2	—	39.1	37.2	43.0	37.8	33.8
Wt. of oil g	120.8	—	68.3	55.8	96.3	70.0	54.0
Oil expressed g	—	—	52.5	65.0	24.5	50.8	66.8
” ” %	—	—	43.5	53.9	20.3	42.1	55.4

The meat was steamed at 100°C for 2 hours before the first pressing. Water, 50% by weight of the cake, was added prior to each pressing.

The above tables show that steaming does not increase the yield, and steamings either with or without water differ only slightly. The pressure used in this experiment was 500-600 lbs/sq in. Higher pressure resulted in the leakage of fine pieces of meat from the holes around the wall of the cage.

By wrapping the meat with a piece of cloth before pressing, more oil was expressed. The pressure could then be raised to as high as 2,000 lbs/sq in. In the first pressing 65% of oil was expressed and after three pressings 77% of oil was obtained.

Table IV The pressing of coconut meat in cloth wrapping

	Fresh meat	1st cake	2nd cake	3rd cake
Wt. of fresh meat g	907	—	—	—
Wt. of cake g	—	311	260	235
Cake %	—	34.3	28.6	25.9
Moisture %	47.6	36.1	36.3	40.6
Oil content %	36.1	36.9	36.2	32.4
Wt. of oil g	328	115	94.0	76.2
Wt. of oil expressed g	—	213	234	252
Oil expressed %	—	65.0	71.3	76.8

First pressing without an addition of water. For the second and third pressings, 50% of water was added.

pressure: 1,900 lbs/sq in.

time : 15 min. for each pressing.

Table V below shows the analysis of the cake after 3 hand-presses (the method generally used by most Thai housewives). About 22% of oil was left in the coconut pomace.

Table V The pressing of coconut meat by hand

	Fresh meat	Pomace after 3 hand pressing
Wt. of fresh meat g	900	615
Cake %	—	68.3
Moisture %	48.4	73.3
Oil content %	33.7	10.7
Wt. of oil g	303	65.7
Wt. of oil expressed g	—	237.3
Oil expressed %	—	78.3

First pressing with an addition of 500 cc of cold water. For the second and third pressings, 1,000 cc of cold water was added.

### Separation of the oil from the coconut milk

The coconut milk is a good bacterial media for the growth of microorganism. The separation of coconut cream, therefore, had to be made immediately after obtaining the milk, and some preservatives had to be added. The separation of cream was made by two methods, namely, centrifuging and settling.

#### 1) Centrifuging with Laboratory Sharples "Super Centrifuge."

A sample of coconut milk from the first pressing of raw coconut meat without an addition of water was analyzed.

Water	60.1 %
Oil content	29.7 %
Ash	1.1 %
Protein	3.2 %

#### 2) The separation of coconut cream by standing.

If preservatives were not added, the coconut milk would become rancid within 3 hours of standing. Furthermore, the amount of cream separated out would be small. By adding about 10% of common salt to the milk and allowed to settle, the milk was preserved and the separation was improved.

Table VI shows the effect of adding sodium chloride to the milk. Two 50 cc graduated cylinders were filled to the mark with coconut milk. In one cylinder 10% of sodium chloride was added to its content.

Table VI cc of Water separated

<i>Time (hours)</i>	<i>Milk + Sodium chloride</i>	<i>Blank</i>
1	11.0	2.0
1½	13.5	3.0
2	15.0	4.0
3	17.0	9.0
4	18.5	12.0
5	19.5	12.0
6	20.0	12.0
overnight	24.0	frothed

The milk without sodium chloride began to froth after three hours of standing.

### **The separation of oil from coconut cream**

The separation of oil from coconut cream could be done by several methods. Evaporation of water by heating resulted in dark colour oil which easily turned rancid. Addition of acid to separate the oil in the method of Lava was found to give oil of high acid content.

The method of Robledano-Luzuriaga was, therefore, chosen. By this method the cream was chilled to below 18°C, then warmed up to 30-50°C. The cream separated into 3 layers. The oil formed the top and the water formed the bottom, with the protein-oil emulsion in the middle layer. The oil obtained at this stage was still turbid. Clear oil could be obtained by centrifuge. Further purification could be effected by filtration under reduced pressure through diatomaceous earth. This resulted in oil of high quality with a free fatty acid (F.F.A.) content of 0.3%, but it still had a distinctive odour. Subsequent alkaline refining reduced the F.F.A. to 0.03% and the odour was eliminated at the same time, giving an oil of higher keeping quality.

The disadvantage of this method lies in the difficulty in separating the readily formed protein-oil emulsion. Separation could, of course, be effected by warming up the emulsion so that the protein coagulated and the oil separated out, but the final oil, recovered by solvent extraction, was rather discoloured.

### **By-products**

The use of copra as raw material for coconut oil expression give no other by-products except copra cake which can be used only for animal feed and fertilizer. The coconut cake from fresh coconut meat has still some food value and may be used as a flour substitute. The quality of the cake depends on amount of water added and the number of times of pressing. The analysis of cake at various stages of pressings shows the changes in their constituents as tabulated below:-



Table VII Coconut Cakes and their Constituents

	Mois- ture %	Oil content %	Protein %	Ash %	Crude fibre %
Fresh coconut meat	52.2	31.5	3.2	1.0	2.9
Cake after first pressing	35.4	38.5	3.2	0.9	7.1
Cake after fifth pressing	46.8	26.3	1.9	0.3	—

Skimmed coconut milk is also a good refreshment. It contains coconut sugar and proteins. The analysis of a sample of skimmed coconut milk after the first pressing without water being added is shown below

Total solids	17.2 g/100 cc
Ash	1.1 " "
Protein	1.7 " "
Oil content	0.3 " "

### Conclusions

1) The use of cage hydraulic press in the extraction of fresh coconut milk gave low yield. Increasing the yield by pressing repeatedly diminished the food value of the pomace.

2) The separation of the oil from coconut milk by the new process was not completely satisfactory.

3) The oil produced by extraction from the fresh coconut meat is clear, has no rancid odour and taste, and is low in free fatty acid content.

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## ABSTRACTS

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### RESEARCH ON AMOEBIASIS (*in Thai*)

Chamlong Harinasuta, M.B., M.D. (U.M.S.); D.T.M. (Cal.), Ph.D. (L'pool) Siriraj Hospital, Bangkok.

*Commemorative Publication of The Microbiologists Association of Thailand. Microbiologists Association of Thailand.*

The sources of *Entamoeba histolytica* used in this study were (a) stools from four dysenteric cases, and (b) four stock cultures.

Trophozoites from the cultures were small in size and had slower movement than those from the faeces. Besides, particles of rice starch, and bacteria were also seen in their cytoplasm, in contrast to fine granules and digested red blood cells observed in direct smears from faeces.

The process of disintegration, however, seems to be similar, beginning with bubble-like vacuolization in the cytoplasm. The nucleus became clearly visible; coarse granules were observed in the cytoplasm. Later the wall of the organism became thinner and thinner, and finally in some it was broken at one point, whereas in others complete disappearance of the wall was noticed.

It is believed that the disintegration of *E. histolytica* was due to the unsuitable condition of the Oxidation-reduction potentials and the pH of the medium. It varied according to the temperature; 37°C shortened their lives, while 4°C preserved them for a period of time.

*E. histolytica* from the culture survived a longer time than that from the faeces, because the associated bacteria conditioned the medium solution so that the latter was suitable for the amoeba for a time.

Distilled water, tap water or normal saline solution without buffers shortened the survival time of *E. histolytica*, while buffered saline lengthened it.

## HATCHING OF THE EGGS OF GIANT GOURAMI (in Thai)

*Sanit Tongsanga, Department of Fisheries, Bangkok.*

*Thai Fisheries Gazette, Vol. 11, No. 1, 1958, p. 11. Department of Fisheries, Bangkok.*

The hatching of the eggs of Giant Gourami in a battery of cement circular tanks with controlled water system has been fairly successful at Bangkhen Fisheries Station.

With old methods, the survival was 55-60%. The causes indicated were the accumulation of oils from the eggs to form the sheet on the surface of water, the eventual lack of oxygen and the collection of scum and dirt.

With this new set up, about 86.6% of the fry are obtained.



## I 131 THERAPY OF HYPERTHYROIDISM (in Thai)

*Romsai Suvarnig, M.B. Department of Roentgenology, Siriraj Hospital, Bangkok.*

*Siriraj Hospital Gazette, Vol. 10, No. 3, 1958, p. 141. Publication of the Faculty of Medicine and Siriraj Hospital, University of Medical Sciences, Bangkok.*

In the Siriraj Hospital I 131 has been applied since January 1957. Thus far it has been used in more than one hundred cases for diagnostic purposes and in nine cases of hyperthyroidism as therapeutic agent. Only four cases are reported since the follow-up in other cases has not been complete. All patients are female, from 37 to 51 years old, suffering from nodular toxic goiter for 1 to 15 years. Classical symptoms are present, and the B.M.R. ranges from plus 13 to plus 96 percent. The estimated degree of severity is from 1 plus to 4 plus. The 24-hour I 131

uptake ranges from 47 to 92 percent. The dosage of I 131 employed is 4 to 12 mc according to severity. Five to seven weeks later the gland has been found to be much reduced in size ("60 percent reduction" to "almost impalpable"). Results have been highly satisfactory in general.

(Three figures. Six references)



### ASCARIDES IN THE BILIARY PASSAGES (*in Thai*)

*Kasem Limwongse, M.B. Department of Surgery, Siriraj Hospital, Bangkok.*

*Siriraj Hospital Gazette, Vol. 10, No. 4, 1958, p. 211. Publication of the Faculty of Medicine and Siriraj Hospital, University of Medical Sciences, Bangkok.*

The complex symptom that follows obstruction of biliary passages by the entry of ascarides—an involvement of fairly common occurrence in the tropics—may present the clinical picture of either acute obstruction, simulating an impacted calculus, or chronic obstruction with jaundice, secondary infection and liver damage. A third group of cases develop the obstruction as complication to operation on the bile passages. The author cites as illustration 2 cases in the first group, 3 in the second, and 2 in the third. Acute abdominal pain was the principal symptom in the first group. Ascarides were found lodged in the common bile duct in both cases. One of these had the same affection 3 times in succession at one or two years' intervals. In the second group the chief complaint was recurrent pain in two cases and fever with cough in one case. In the last case multiple liver abscesses with perforation into the base of the right lung were found at autopsy. In the other case which died of purulent peritonitis ascarides were found in a cavity in the liver and in abscesses near the gall-bladder. The patients in the third group were operated upon for cholecystectomy. Signs of biliary obstruction developed 2 and 11 days after the operation respectively.

The first case was reoperated and an ascaris and a small stone were removed from the common bile duct. In the second case an ascaris emerged through the drain tube all by itself on the third postoperative day, and when the tube was taken out to determine the cause of recurrent obstruction a few days later another worm was found impacted inside. The patient recovered without re-operation.

The author emphasizes that in the tropics the possibility of ascarides being involved in biliary obstruction should always be kept in mind.



### VARIATION IN THE ORIGIN OF THE TRAPEZIUS (in Thai)

*M.R. Virabhadhu Dhavivongse, M.B. Department of Anatomy,  
Siriraj Hospital, Bangkok.*

*Siriraj Hospital Gazette, Vol. 10, No. 6, 1958, p. 330. Publication of the Faculty of Medicine and Siriraj Hospital, University of Medical Sciences, Bangkok.*

The points of origin of the trapezius have been studied in 46 cadavers of Thai and Chinese used in class dissection. All 92 muscles have their cranial origin on parts of the occipital bone, while the vertebral part in most cases extends as far down as the tenth and eleventh thoracic vertebral spines. There was no significant difference between findings in Thai and those in Chinese, nor between the two sexes.

(Three tables, six references.)



**FUNGUS ISOLATION FROM 'KONG KAO KIEU'**  
(in Thai)

*Kahn Jalavicharana, Ministry of Agriculture, Bangkok.*

*The Journal of the Microbiological Society of Thailand, Vol. 2, No. 2, 1958, p. 92. Microbiological Society of Thailand, Queen Saovabha Institute, Bangkok.*

The present paper is the preliminary report on the study of 'Kong Kao Kieu', the stained wood of verdigris-green colour. 'Kong Kao Kieu' is found only in certain localities in the north of Thailand. The stained wood is used as an immediate cure for insect sting, or pain caused by mechanical injuries, or even by poisonous jelly fish.

The staining of the wood is shown to be due to a member of the cupfungi, *Chlorociboria aeruginosa* (Oed.) Seaver.

The isolation of the fungus by spore-dilution-plate method from the apothecia found on the stained wood gave rise to verdigris-green conidia. The fungus obtained is believed but not yet proved to be the conidial stage of *Chlorociboria aeruginosa* (Oed.) Seaver.



**THE SEROLOGIC IDENTIFICATION OF VIBRIO CHOLERAЕ**  
(in English)

*C.E. Lankford (Visiting Professor of Bacteriology, The University of Texas, U.S.A.), Departments of Sanitary Engineering and Biology, Chulalongkorn University.*

*The Journal of the Microbiological Society of Thailand, Vol. 2, No. 2, 1958, p. 93. Microbiological Society of Thailand, Queen Saovabha Institute, Bangkok.*

Within the limits of present inadequate knowledge, methods for the preparation and use of high quality antisera for identifica-

tion and serotyping of *V. cholerae* are discussed. The difficulties and errors which may result from the use of unreliable antisera, especially in relation to the recent cholera epidemic in Bangkok, also are discussed.



### JAUNDICE DUE TO OPISTORCHIASIS (*in Thai*)

*Pantpis Sakornpant, M.D. Sakol Nakorn Hospital, Sakol Nakorn.*

*Medical Journal, Vol. 8, No. 1, 1959, p. 19. Official Journal of the Department of Medical Service, Ministry of Public Health, Bangkok.*

Jaundice produced by opistorchis infestation, is not an uncommon symptom. It is manifested following the intrahepatic obstruction. Mostly the patients have no fever; anorexia and abdominal discomfort are the common symptoms found. Five case-demonstrations of various ages have been reported. The pathological changes of livers obtained by needle liver biopsy are discussed.



### REPORT OF THE RESULT OF EXPERIMENT ON TEAK REGENERATION (*in Thai*)

*Sa-ard Boonkird and Pramuan Unahanand, The Royal Forest Department.*

*Vanasarn, Vol. 17, No. 1, 1959, p. 13. The Royal Forest Department, Bangkok.*

Five methods of seedbed preparation were arranged in Latin square for testing of teak seed germination from adjacent trees. There were five treatments in each plot as follows,

1. Control
2. Ground clearing



3. Burning over the area
4. Ground clearing and breaking up the soil surface
5. Combination of ground clearing, burning, and breaking up the soil surface.

The data from two plots were tested with the analysis of variance. There was no significant difference between control and other treated blocks. Also there were no significant differences among the results produced by five different methods.



### THE USE OF GIBBERELIC ACID FOR STIMULATING THE GROWTH OF ORCHID SEEDLINGS (*in Thai*)

*Rapee Sakarik, Kasetsart University, Bangkok.*

*Kasikorn, Vol. 32, No. 2, 1959, p. 100. Department of Agriculture, Bangkok.*

Three applications at 48-hour intervals of 10 p.p.m. of potassium salt of gibberellic acid were employed with hand sprayer on young *Dendrobium* grown in four community pots. Two crosses of *Dendrobium* were used, i.e., No. 315 (*D. Mme. Pompadour* × *D. Annemieke*) and No. 316 (*D. Mme. Pompadour* × *D. phalaenopsis* var. *Schroederianum*, F.C.C., RHS). It was found that the chemical used significantly promoted the growth of *Dendrobium*.



### USING PINEAPPLE LEAF FOR BUDDING RUBBER TREES (*in Thai*)

*Nop Suksan, Department of Agriculture, Ministry of Agriculture, Bangkok.*

*Kasikorn, Vol. 32, No. 2, 1959, p. 104. Department of Agriculture, Bangkok.*

To substitute the use of grafting tape, plastic cloth and some kinds of palm leaves, the pineapple leaves have been found

to be useful for budding young rubber trees in the province of Naradhivas in the eastern coast of southern Thailand. The success obtained during the months of low rainfall in July and August was 70-80%. The method of doing it is shown by good illustrations.



### THE IMPREGNATION OF WOODEN SLEEPERS (in Thai)

*Rasmi Namawong, The Royal Forest Department, Bangkok.*

*The Vanasarn, Vol. 17, No. 2, 1959, p. 30. The Royal Forest Department, Bangkok.*

The auther reports that the wood impregnation plant of the Royal Thai State Railways at Huey Mud, Changwat Surathani, has been established and operated since 1954. The capacity of this plant is about 378-400 treated sleepers (.15 x .20 x 1.90 metre) per shift, 2 shifts per day.

The Bethell or Full cell and Lowry processes are used and the preservatives are creosote oil and diesel fuel mixed in the proportion of 50 : 50. An average cost of treated sleeper is about 17 baht per piece or 290 baht per cubic metre.

Eleven species of wood were tested but the preferable one is 'Mai Yang Yung' (*Dipterocarpus spp.*). Twenty-three more species have been recommended by the Royal Forest Department to be tested for substituting this species in the future.



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