

NATURAL TREASURES AND THEIR UTILIZATION.^{(1) (2)}

BY ARNO VIEHOEVER.

Department of Science, Ministry of Economic Affairs.

The opportunity of speaking before this Society, but a few months after my arrival from America, is doubly welcome. I desire to express my appreciation for my election as a member, and for the invitation to address you.

Your avowed aim is to serve the best interests of Thailand. This is also, happily, my official function. In particular I am charged to assist this Government and Dr. Toa Labanukrom, the Director General of the Department of Science, in the development of natural resources and I have therefore chosen this subject for my talk.

Providence obviously has set aside, right here in Thailand, a Paradise of Plenty; an Eden of Natural Resources. The abundance of life and the variety of organisms, according to Prof. Alexander, formerly biologist at Chulalankarana University, is truly enormous. "The density of variation is much greater in Siam than in the United States." The Philadelphia bird collector, Baron von Schaunsee, has found northern Thailand and neighbouring countries one of the most interesting sections of Asia for the ornithologist. He has come back again and again to this happy hunting ground of birds. Thus the list of bird species from a kingdom, with but the area of Texas, equals, if not exceeds, the list of the American Ornithologists' Union. Godfrey has described in this Society's Supplement over 700 forms of butterflies. M. R. Chakratong Tongyai, the young Thai entomologist of the Department of Agriculture, has collected over 2,000 forms of insects within 4 years. "Probably in no other country, states Dr. Hugh Smith, the well-known fish expert, now of Washington, D. C., "do shrimps exist in greater profusion." There is an inexhaustible supply of fish, of many species, in the klongs of Bangkok alone. In the laboratory of Mr. Fowler, fish expert of the Philadelphia Academy

(1) Address given June 16th 1939 before the Thailand Research Society, and illustrated with specimens and original micro-movies.

(2) Reprinted from "Vidyasastra" 4th year, No. 3, Oct. Nov. B.E. 2482.

of Natural Science, I have seen probably the most extensive collection of Thai fish. While the lower plants, cryptogams, have thus far been largely neglected, the flora of the striking forms has received the main attention. Thus Dr. A. F. G. Kerr alone has collected approximately 10,000 species of flowering plants, already partly described in the *Journal of the Siam Society*.

It is becoming increasingly apparent to the keen observer anywhere of life and nature, that there is no assured uniformity of raw materials or supplies for the continued wellbeing of a people. However, with this national wealth of life and variety of forms, both, plant and animal, it should be possible to develop further key industries for the increased economic independence of Thailand. The exploitation of these products must naturally be based upon proven value. This requires in the first place a critical selection and alert control of worth while resources, based on scientific study, interpretation and direction. Simple tests will first eliminate the worthless or the inferior. After this preliminary control, more elaborate tests in the suitably-equipped laboratory may then assure the final evaluation.

Encouraged by a favorable reaction to a brief address before the local Rotary Club, I shall demonstrate some of these tests and tools, including living reagents. These have been purposely developed for control and research, dealing with the fullest possible utilization by man of domestic natural resources.

TRANSPARENT TEST-ANIMALS.

The omnipresence and inter-dependence of life is possibly best illustrated in a film showing life in a drop of water. It gives us an opportunity also to introduce organisms serving, in the law of the jungle, as food for each other, or affecting man in the struggle for life, either with benefit or with harm.

Thus the one-celled amoebae may in some forms aid the digestive processes in the mouth, or may in other forms cause the dreaded intestinal disturbance, amoebic dysentery.

Thus the daphnia is at times eaten by the lowly hydra, which injects into it a paralyzing poison; again it may serve to prevent stagnation and pollution by bacteria and algae. It also serves, like

cyclops, in the testing of poisons, and has indeed proven its value again and again, as a "biological reagent," in the testing of foods, vitamins, and medicines. Enormous numbers of uniform biological units may be quickly bred for qualitative and quantitative studies. The cycle of egg to egg is completed within a week, the life span in less than 90 days, as contrasted to 90 years of man.

The second film shows, in detail, for the biologically inclined, the structure and function of organs active in the intricate mechanism of the life of the daphnia.

As so-called higher animals, including man, have essentially the same organization, with muscular, glandular and nervous systems, comparisons of physiological effects of foods and medicines may be justifiedly drawn. Experimental results with many substances, as demonstrated here, bear out my first observation in the Philadelphia College of Pharmacy and Science.

Many of these results have also been obtained with the transparent shrimp-like prawn, "palaemonees."

In order to study the cause and relief of faulty digestion and especially the function of the gall-bladder, the telescope-fish and the white translucent gold fish have recently been introduced by the speaker as test animals. They permit the visibility of the green gall bladder, the pulsating heart, the intestine, without surgery. Equally Gobiella, a Thai fish, discovered by Dr. Smith, will serve for many of our coming studies, (especially cathartic), after its breeding, now under way in the Thai Bureau of Fisheries, has been accomplished.

Mosquito larvae and pupae are being used in the practical comparative tests, now under way, in connection with the study of insecticidal plants and their active principles.

FOODS.

The greatest task ahead is probably the adequate utilization of Thai soil for the production of food and feed crops. As well-known the masses in Thailand, living principally on polished, highly spiced rice, are mis-nourished. This fact is conclusively proven by Dr. Yong Huar Chutima, in his recent survey on height and weight

of population, published in the Siam Science Bulletin, (No. 3, 1939). He refers to the ancient tradition which emphasizes rice as the only true and healthy food. Eggs, meat and fish are considered only as appetizers; and, still worse, chicken, meat and eggs, in the minds of most peasants, are highly toxic foods, especially for women and children. Thus he found the growth of most rural children stunted both in height and weight, their health undermined, and a high death rate; young mothers, anaemic, with a lessened flow of milk, and paralyzed by beri-beri.

Where the peasants and children eat ample fruits and raw vegetables, he found excellent dental health. Of 400 pupils in a northern high school, 2 boys, sons of Bangkok officials sent there, had decayed teeth, while more than 65% of Bangkok children, consuming more sweets and boiled foods, had defective teeth. In a school for girls from the wealthy class, who were especially fond of bananas boiled in syrup, 84% showed tooth decay. He found other afflictions due to faulty nutrition, such as repeated formation of stones or calculi, goiters, and a universal condition of bow-leggedness.

The soybean has recently received much increased attention as a food, by this and Western countries, as well as for technical products. The milk of the soybean, where used, has proven extremely beneficial. Cow's milk, fed as an exclusive diet to rats, did not permit complete maturity, and terminated the animal's life before the normal life span could be attained. Animals of the same age and mother showed advanced or retarded growth, according to their diet, even though basically milk.

Chemical and biological assays of foods and vitamins are being further applied and perfected at the Department of Science.

A critical survey is needed of the nutritional value and safety of certain foods, such as *Puak* (เผือก) and certain beans. There is some evidence, as we have heard in the last lecture before this Society, given by Dr. Oberdoerffer, that *Puak* may pre-dispose to leprosy. Certain domestic beans, related to the so-called Burma or Rangoon Lima beans, (from *Phaseolus lunatus*) may be especially unsafe for consumption. The first may contain, as do related plants, a toxic substance ("sapotoxin") foaming in water; the second may contain excessive amounts of a substance called "linamarin," yielding

the toxic prussic acid. Ammonia colors the tissue yellow where the seed is attached to the pod of these possibly harmful beans.

CONDIMENTS.

Confucius' admonition of "Everything in moderation" certainly applies to the consumption of spices. "India, Java, Burma and Thailand," says Dr. Yong Hua Chutima, "are lands where every dish is red hot with condiments. The appetite has been jaded since early childhood."

The spices, used to stimulate the appetite for monotonous diets, consist mainly of red peppers, (chillies and capsicums), and black or white peppers. Both products are extensively grown in this country as well as exported. The evaluation and standardization of these products is being carried on by Nai Tiddaw Bunnag and Nai Chiet Apai-wongse with the help of Dr. Prachuab Bunnag and myself.

The physiological effects of capsaicin, (the pungent principle of red pepper) and of piperine, (the pungent principle of the black or white pepper) were recently studied in America by Dr. Cohen and myself. The excitatory effect on certain tissues such as the male sex organs was pronounced.

These pungent substances were less toxic in comparative tests than the aphrodisiac substances, yohimbine (from yohimbe bark) and cantharidin (from blister beetles, Spanish and Chinese flies). Simple color tests permit their detection in the tissues, and solution in the crystalline form. Prepared mustard, commonly used as a spice, when fed daily with liver sausage (3 g. to 30 g.), caused the death of rats after 3 months, the tissues of the lungs and the intestines being most severely inflamed.

A comparative study, by Dr. Sung and myself in America, of the common and oriental cardamons, including Thai cardamons, showed the high quality of the Thai product; its general condimental use was recommended as a worthy substitute for the commonly recognized type.

MEDICINES.

From all available records, and discussions with experts, medical men and missionaries, it is evident that Thailand abounds in

medicinal resources. Some probably are either identical with or related to known medicinal agents. Many obviously are unexplored by science. The study of the native medicinal resources is under way at the Department, of Science, carried on by a staff of capable and enthusiastic workers. The materials are being supplied in part by collectors working under the direction of the botanical experts, Prince Laksanakorn of the Department of Agriculture, and Phya Vinit Vanandon of the Forestry Department. Their kind assistance cannot be praised too highly.

Among the bitter woods of the forest, one ("Picrosma Javanica") may likely become useful as a substitute for the Quassia wood, commonly used as a stimulant in bitter tonics. The isolation of the bitter crystalline principles is being carried out by Dr. Siri Tevayananda. These, like quassin and neoquassin, have likely insecticidal effect, but probably no pronounced effect against fever, altho the bitter taste, resembling quinine, often suggests such value of the barks or woods.

Quinine bark, now reputedly cultivated on an experimental scale, should thrive as in other tropical countries with adequate rainfall and care. A bark submitted as quinine bark by a lay collector proved to be worthless by the simple heating in a glass tube. Genuine quinine bark yields a red tar distillate, never observed in false barks. Of course, subsequent tests, of the fluorescence properties of quinine and related plant principles, as well as their quantitative isolation, will complete the evaluation.

The aloe plant is possibly better known as an ornamental than as a medicinal plant. It grows, we understand, thruout Thailand and is readily cultivated. The sap of its leaves has given relief in skin injuries and X-ray burns. When dried, it is a valuable laxative. The experiments now being carried out by Dr. Komol Peng Sritong with native daphnia, isolated by the speaker from local waters, and therefore accustomed to the tropical climate, are indeed encouraging. The results of speedy evacuation of the food canal are comparable to those carried on with *Daphnia magna* and previously published.

The illustrations of slides and films show the quantitative effects of aloe, and the mechanism of intestinal excitation. The

cathartic here used was a substance chemically related to aloe, and obtained from American Cascara, a small tree now introduced into Colombo.

To test the effect of stimulants or depressants on the heart, and respiratory system of "higher" animals, a special apparatus "stethographone" has been designed by the speaker. It utilizes supersensitive microphones for the pick up of the sound of organ action, and a powerful amplification system, for the audible recording, as well as cathode rays for the visible recording. It has been found applicable for the study of vertebrates from mouse to man, and permitted us to check the physiological results obtained with the "lower" animals or invertebrates.

POISONS.

For the legitimate use of pest control, poisons are particularly valued. Thus the poison strychnine, obtained from seeds of certain trees in the Philippines as well as this country, is much used for the eradication of mice. Ton lots are used in America for the extermination of rats, coyottes and prairie dogs. In medicine it is still used as a general stimulant, tho its value as such has likely been over-rated. It excites certain locomotory muscles to convulsions, thruout the animal kingdom where the nervous and muscular system is sufficiently developed. It serves as a key-substance like alcohol, showing that the difference between the so-called lower and higher animals, on the basis of the absence or presence of a back bone, is not marked enough to justify such classification.

The complete freedom from these toxic alkaloids in certain related strychnos seeds, as tested chemically, as well as on our test animals, shows the need for vigilance, such as the application of simple field tests, chemical and physiological. These are being worked out with the help of Nai Thong Dee Suvarnakasa. The convulsive effect of strychnine, followed by the shift of body functions, and then also the beneficial effect of barbiturates, as counter agents of this effect, are demonstrated in the 3rd film of *Daphia magna*.

Comparative exploratory experiments with insecticides from various plant sources, such as derris, rotenone, pyrethrum and stemona, promise success in the destruction of mosquito larvae and pupae

for extracts of and active principles isolated from stemona. In this connection it is interesting to record that tubers of *Stemona Collinsae* were submitted to the Rothamsted Experiment Station in England 5 years ago. The report was unfavorable, as the sample had little or no toxicity, when tested on aphids. The plants grow wild in several varieties, in Thailand. This special work has been begun with the assistance of Dr. Kamthorn Suvarnakich and Nai Chula Kanchanalaksana. Plants are being grown in order to study the characteristics of flower, fruit and seed, and thus to assure the identity of the materials and to obtain the basic information for subsequent cultivation.

The recent success with the poisons of bees and snakes (moccasin) in the treatment of rheumatism would suggest a study of domestic sources and their applicability for the same affliction. *Daphnia* has also proven helpful in the testing of venoms and antivenins.

TECHNICAL VEGETABLE RESOURCES.

One of the promising domestic resources, worthy of commercial exploitation, we trust, will be the sweetish licorice root, surely known to the Europeans among you, While certain supplies are said to be imported from China, others are said to be collected in the river valleys of northern Thai. The material is under investigation with the assistance of Nai Chamnong Prasomdong, who isolated the specific sweetish substance "glycyrrhizin" which, soap or saponinlike, causes the foaming in aqueous solutions. The extract gives the color reactions, characteristic to the common licorice collected in Asia Minor and in Spain, Italy and Greece. Huge amounts of the root are imported into America for the manufacture of 1. a flavoring extract for chewing tobacco; 2. for a foaming solution, releasing into carbon dioxide and thus serving as "Firefoam;" extinguishing especially fires in gasoline tanks; 3. for the manufacture of a fiber board from the extracted roots. The root or the extract have been used since ancient times as a drug and a flavoring agent. It is an ingredient of root beer. Its "glycyrrhizin" might furnish a better substitute for sugar than saccharin for diabetics, as it is broken down in the metabolism. The leaves furnish a sticky secretion, suitable, like "Tanglefoot," for trapping orchard pests. The critical survey of licorice will be completed

when flowers, fruits and mature seeds are made available for precise classification of the botanical source. Much confusion and failure in results can be avoided when the source for our raw materials is thus established and the complete evidence is available in type specimens.

Natural dye and tanning materials will likely be studied as such products come to our attention. Also certain nuts as those from *Bassia* trees, will be further studied, since they yield a butter like fat (long resisting rancidity), or a technical fat for soap production. An interesting prospect is to consider the utilization of products from *Albizzia* or related trees. Preliminary literature surveys have been made for this and the *Bassia* plants. The survey for the *Albizzia*, related to *Acacia*, shows 1) that it may, like the latter, exude gum, valuable in technic; 2) that its wood may be easily worked for furniture, and in some varieties is particularly valuable; 3) that its leaves may be eaten by animals; 4) that its fruit pulp contains a sticky, sweetish substance in substantial amounts; and 5) that its seeds furnish an oil beneficial in the skin affections of leprosy, (possibly containing the acids, now designated as vitamin F.). As well recognized, *Albizzia* furnishes the shade trees, par excellence, thruout the Orient. We have them in the beautiful avenues of Bangkok.

The planting of hemp for the commercial exploitation of the fiber has brought with it the narcotic or dope problem, inasmuch as the tops of the plant "*Cannabis*" furnish a narcotic resin. While well known in the Orient under various names as "*Hashish*" or "*Ganje*" etc., as a dope, the plant material has suddenly become popular, under the Mexican name "*Marihuana*" with the American Underworld and, thru it, with the American youth. It is specially distributed in the form of cigarettes or reefers, sold secretly at enormous prices. The habit has led, not infrequently, to the worse dope addiction—to heroine. Such by-products as hashish are decidedly not among the natural treasures, we are discussing, altho they, like opium and morphine (to be used in emergency only) can either benefit man,—or destroy him, as he chooses.

INDUSTRIAL MINERAL RESOURCES.

Most promising among such resources is the rock material, collected in Northern Thai, by Dr. Prachuab Bunnag, Head of the Pharmacy section, Department of Science, and consisting almost entirely of asbestos fibers. A simple flotation test in a water-kerosene mixture demonstrates this quite strikingly. It contains long and short fibers in amounts yet to be determined by a simple sifting process, after the mass has been broken up by a disintegrator mill. Together with Thai cement it certainly could furnish the durable roof covering, with which we are so familiar in modern construction. For what other possible uses this asbestos may be commercially exploited, only further study will disclose. This work is now being carried on in the technical section under Nai Ari Supol's direction.

Finally, the precious metal gold, in the granite mineral, as displayed in the exhibit, has been obtained from surface mines in southern Thai in sufficient amounts to permit commercial production. This is now in progress on a rather simple scale, made possible by the obvious richness of the ore. Both the pure gold as well as the pyrite (gold-arsenic-sulphur compound) with a silvery sheen, are visible in the specimens collected by Phra Krasapna Bibhag, the Assistant Director General, and Nai Chiet Apai-wongse in a recent expedition to this mine. In contrast to this surface mine, we may mention the mine at Homestake in the Black Hills of America. There recently 2 million dollars were expended for a new shaft and hoisting equipment to operate 5000 feet underground. Many more millions must be spent to develop tonnage of the low grade ore from that level.

SUMMARY AND OUTLOOK.

Interpretative surveys will bring to our attention new resources, and challenge us to find a means for their adequate development and utilization.

We trust that the Department of Science can continue to serve as a clearing house. Its experimental method, illustrated here with a few examples, assures the rational exploitation of an ever widening

scope of national resources. With the alert search for these by the lay people, as well as by collectors and scientists, providing, all possible evidence, (complete specimens with flowers, fruits and seeds, and records of local experiences)—such co-operative endeavour cannot but be crowned with success.

Most Recent Publications.

(With references to previously published research).

Arno Viehoever, (Assoc. Referee A.O.A.C.)

“ Report on Daphnia Methods ”

J. Official Agricultural Chemists vol. 22, 15-18-1939.

A. Viehoever and I. Cohen,

“ Evaluation of Veratrum ”

A. J. Pharm. vol. 111, No. 3, March 1939.

Arno Viehoever : “Visualization of Drug Action in Basic Training.”

A. J. Pharm. Education vol. 3, 68-72-1939.

A. Viehoever and Le Kya Sung

“Common and Oriental Cardamoms.” J. A. Pharm. Ass. vol. 26.872.

1937.

Arno Viehoever,

Edible and Poisonous Beans of the Lima Type (*Phaseolus limatus*).

Thai Science Bull. No. 5, 1-100 in Print.

