PHARMACOGNOSY AND ITS IMPORTANCE FOR THAILAND.*

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Pharmacognosy means the study of raw materials and the products manufactured from them. In a more narrow sense pharmacognosy is the study of medicinal plants and their crude products commonly known as drugs. Pharmacognosy extends into all industries, which require raw-material from the vegetable kingdom. Apart from pharmacy and the drugs trade, whence pharmacognosy originates, this science is applied in the control of foods and cereals, spices, woods and timbers, fibers and paper, oil and fats, rubber, resins, vegetable dyestuffs and many others. In short, pharmacognosy deals with the properties, identification, sources and nature of raw materials and their products. The term Pharmacognosy was introduced in 1815 by the German scientist Seydler. In 1825 a work entitled *Grundriss der Pharmakognosie des Pflanzenreiches* (Outlines of the pharmacognosy of the vegetable kingdom) was published, and until the beginning of this century pharmacognosy was essentially a European science. Since then Pharmacognosy has gained importance in all progressive countries of the world.

How has Pharmacognosy developed in Thailand ?

The first instances of a kind of pharmacognostic work can be traced back to the time when about 10 years ago the then Government Laboratory extended its work also to some indigenous drugs such as *gatom-Mitragyna speciosa* and others. The work was mainly done by chemists, but not systematically. When the late Dr. Toa Labanukrom

*Lecture delivered before the Thailand Research Society on 28th March 1943. The lecture was accompanied by an exhibition of specimens and drawings and micro-slides were projected.

became Director-General of the newly formed Department of Science, he at once recognized the importance of pharmacognosy and founded the Pharmaceutical Division with a decided trend towards pharmacognostic methods. An American expert was engaged and courses of pharmacognosy were introduced in the Pharmaceutical College of Chulalongkorn University. When I entered Government service, the Pharmaceutical Division still belonged to the Ministry of Economic Affairs. During last year the pharmaceutical division of the Department of Science was transferred to the newly created Ministry of Public Health, and in recognition of the importance of this science a separate pharmacognostic section was established. The frame and base for the progress of pharmacognosy was given. Now it is up to those responsible for the work to develop pharmacognosy and make it one of the milestones on the way of progress of the Thai nation.

Why do we need pharmacognosy ?

Because we need ever more raw materials and we want to know their quality. At the time when a doctor himself collected the drugs for the medicine which he handed to his patient, he certainly knew the plants well and mostly cultivated them in his own garden; he was sure to use the right drug. When later on a doctor prescribed a medicine which had to be mixed in a dispensary from material which might have come from a distant corner of the world, mistakes, intentional adulteration and the like, became possible. Here pharmacognosy began and has since made great progress.

Take an example: Strychnos seeds. The seeds of *Strychnos nux vomica*, in Thai called *saleng chăi*, yield an alcaloid Strychnin, which is used extensively as a tonic. Furthermore it is widely used especially in ports during epidemics, for the purpose of poisoning rats. *Strychnos nux vomica* is found in Thailand, particularly in the eastern parts. Seeds are collected and have at times gained quite a good price. Then suddenly the demand for Thai Strychnos seeds dropped to practically nil and has never gained since. Why? The collectors of seeds had either intentionally or by ignorance mixed the seeds with those of other Strychnos species, *e. g. Strychnos nux blanda*, which either do not contain any, or only little Strychnin. In some cases entirely different seeds have been exported and so spoiled the name of Thai Strychnos seeds. Unless the buyers have a guarantee to obtain the right drug it will be difficult to make

full use of this commodity and so it is with many others. Pharmacognosy will offer the means of determining the value of a drug and the Department of Pharmacognosy should become, as it is in other countries, a clearing house for such delicate merchandise as alcaloidal drugs are.

Another example. The Government Pharmaceutical Factory requires a certain quantity of Cutch, in Thai called *sisied*, which is an extract made from the wood of Acacia Catechu. Northern Thailand, in particular Pajab circle and *Changwat* Pre, produces quite a quantity of this extract which, besides its pharmaceutical use, is much in demand for chewing purposes. Now we have made a considerable number of analyses of local *sisied* and much to our astonishment we found that none of the goods obtainable in the market reaches the standard of any pharmakopoea. Whereas in most instances an intentional adulteration, chiefly by ash, was detected, in some cases in my opinion the method of production is too primitive and owing to ignorance the extract is burned nearly to ash. During my last excursion to the North I collected a sample of *sisied* in Pajau, *i.e.* in the very centre of production. A chemical analysis of this shows that it is of excellent quality and that by systematic pharmacognostic control of this commodity, by publishing analytical reports, adulterators would find it more difficult to make easy money. Thus by means of publicity and information to the people concerned, the methods of Pharmacognosy could help to improve a local industry. I could in this connection cite many more examples.

For those who are not acquainted with the methods and ways of pharmacognostic routine and research work, it may be useful to hear something about them.

Schleiden, an early German pharmacognostic worker, called pharmacognosy the mother of all scientific discipline. You will understand this when you learn that pharmacognosy connects systematic botany with pharmacy, medicine with pharmacology and that an all-round knowledge of biology, biochemistry, chemistry including microchemistry and physics, is required to solve efficiently pharmacognostic problems.

The problems of pharmacognosy may be summarised as follows :—

Pharmacognosy has as its object the study of drugs and the plants which yield them. The main object is however not only to determine the identity of the drug and its origin, but also to study its constituent parts by all means of modern science, in particular by chemistry, and also to

study the factors influencing variations of constituents both in the living plant as well as in the drug. In pharmacognostic routine drugs have often to be examined, which are powdered or consist only of broken fragments. From these pieces which are frequently microscopic in size, the plant of origin has to be determined. It is quite obvious that in many cases only a study of the live plant, that means in the jungle, in the field, or in the experimental garden, will clear particular questions as to the identity or constituents. I have undertaken more than a dozen excursions with the aim of tracing the origin of many local drugs. Nearly 2,000 specimens have been collected either in markets, dispensaries or in the jungle. Following my request by circular letters, another similar quantity has been sent to the department from nearly all *Changwat* authorities.

The basis of all pharmacognostic work is the cellular structure of plants and their various tissues as well as the fact that the cells and their contents or arrangement are constant for most parts of the same drug and vary in different plants or drugs. Observation of cells or tissues, or as we call it, Histology, requires the use of a microscope and for the greater part pharmacognosy is applied microscopic technic or microscopical technology. Pharmacognosy has developed quite its own microscopical appliances, but makes good use of many instruments which so far have been used only in Mineralogy or Cristallography. Thus the polarizing microscope has considerably facilitated pharmacognostic work. Another problem includes the study of the difference in constituents in different parts of the plants and in allied or related species. We can tackle this problem efficiently, only by cultivation and observation of the plant in an experimental garden. I shall revert to the experimental garden later on. *The historical study* of our local drugs would indeed be of great interest, but since we are fully occupied with elementary investigations, this kind of work remains wishful thinking for the time being. One of the most important departments of pharmacognosy in Thailand is the *study of synonyms*. While there have been gratifying attempts to collect synonyms of Thai plant names *e. g.* by Dr. Kerr in his *Flora Siamensis*, by the Agriculture Department, by the Forestry Department, nothing systematically has been done as regards medicinal drugs. As the problem of synonyms was and still is of utmost importance to our work I shall explain it somewhat in detail. Two years ago I started to collect plant-names and drug-names systematically in a card index which has since developed into a system incorporating a Thai-name-index, a Botani-

cal index and a so-called pharmacognostical index in which all data concerning constituents, analyses etc. are collected. Our collection of more than 4,000 drugs and the herbarium are organized on the same system. More than 5,000 different drug-names are already being handled, but of course only a few hundred species have as yet been scientifically worked upon or properly classified. A tremendous task still awaits us, the importance of which I shall explain by a few examples :—

The name *Kwau* or *hua kwau* is given to several species of the Papilionacea family, amongst them to *Butea frondosa*, *Butea superba* and to another unclassified species which up to now has been mistaken for *Butea superba*. I found that the *same* name is also used for quite a different species of the Rubiacease family *Odina cordifolia*.

Hua Kwau, is a drug which years ago caused some sensation as a reputed rejuvenator. In 1933 Dr. Kerr and Phya Vinit published articles about the drug in the Natural History Supplement of the *Journal of the Siam Society*. At that time a botanist stated that the drug derives from *Butea superba*, a tree belonging to the Papilonaceae family. The drug was later on investigated in the Siriraj Hospital by Dr. Term Bunnag and his co-worker Dr. Dara, for its supposed oestrogenous action, which was confirmed beyond doubt. Dr. Ouay, at that time likewise of the Siriraj Hospital, made pharmacological studies on the water-soluble principle of *Hua Kwau*, the results of which have been published in the *Journal of the Medical Association of Thailand*. When about 2 years ago I received the tubers of *hua kwau* for identification, I could not come to a successful conclusion as at that time I knew nothing about them. On my next excursions I tried to find authentic specimens and much to my surprise I found that *Butea superba* is also called *hua kwau*, but that it yields tubers which are quite different from what I had got for identification, and different also from those which are under investigation in the Siriraj Hospital. We now know that *hua kwau* is quite a distinct species which still has to be classified. How difficult it is to collect such material can be seen from the following :—

When I had ordered tubers of *hua kwau* for cultivation in our experimental garden last year, the tubers were spoiled by the flood as was our whole experimental garden. Then in December last I went up to Chiengmai, to observe the plant on the spot and found tubers, but no stem, no leaves and flowers. This because the plant is an annual creeper, of which after the flowering season only the subterranean tuber is left.

The name *sisied* covers quite a number of plants which have astringent properties *e. g.* Acacia catechu, which is distinguished as *sisied nua*, the northern *sisied*, *Pentace burmanica*, a tree very common in Thailand, belonging to the Tiliacea family, *Cedrela Toona*, a tree of the Meliacee family, sometimes known as *sisied hom* and *sisied tet*, *i. e.* the foreign *sisied*, called Gambir, an extract from a Malayan Rubiacea *Uncaria gambir*. I furthermore found that in certain localities the bark of oak, which is also used for chewing, is likewise called *sisied*.

Quite a list of species go under the name of *gasambig*. Recently Dr. Sem from the Chiengrai Hospital sent an elaborate report on the anti-malarial action of a plant called *gasambig* in Chiengrai. On my last excursion up North I took the opportunity to investigate the species on the spot and found 3 different Desmodium spec. instead of as I had expected, a Vitex. From literature we know that *Vitex pubescens*, a Verbenacea, has been used with success in India against blackwater-fever. Dr. Sem had heard about it and as he had the information that *gasambig* is Vitex, he had worked on the drug in the belief that it was Vitex. Strange to say, he found an anti-malaria action, or at least an antipyretic action, though I had to tell him, that the drug is Desmodium, a Papilionacee quite different from Vitex. To make matters worse I may state that three more different species under the name *gasambig* are known to me. If the work of collecting Thai Synonyma is carefully and diligently continued, we may in a few years have a suitable list of Thai plant and drug names.

Let me say a few words about poisonous plants. There are plants which if used in moderate doses are effective medicines, in overdoses poisonous. They are dealt with in our investigations on medicinal plants. There are however quite a number of plants which resemble harmless plants very closely and which are none the less harmful or poisonous. Poisonings occur either accidentally or criminally. In such cases too pharmacognostic identification besides toxicological investigation will help to clear the case. During recent years cases of poisoning by eating wild tubers occurred frequently. In times when food is scarce or expensive to the poorer classes, all sorts of so-called famine food, very often tubers of wild plants, are collected.

In many cases these tubers or roots have an unpleasant taste, but are otherwise harmless. In some cases however such tubers contain

poisonous substances as was the case in Radburi, from where tubers were sent for identification last year. Pharmacognostic investigation revealed that the tubers belonged to a species of the Convolvulacea family, some of which are poisonous. We have cultivated the plant from fresh tubers and identified it as *Ipomoea palmata*. The authorities in Radburi were informed to warn people against consuming such tubers.

Another case of poisonous effect of foodstuff occurred in Petriu. The *Changwat* Commissioner claimed, that after the consumption of a variety of *mansampalang—Manihot utilissima*, toxic effects occurred frequently. An investigation revealed that the variety of Manihot cultivated in Petriu contained an excess of hydrocyanic acid which is the cause of the poisoning. Our recommendation to abandon the cultivation of the toxic variety will have solved the problem.

I do not want to conceal the fact that in other cases we were not successful in identifying a drug. But when you know that to be able to recognize something, it is necessary to have seen it at least once before, you will not blame our pharmacognostic section for it. There is plenty of work for skilled pharmacognostic workers for the future.

In connection with the systematic botanical work, a herbarium has been created which is still in its initial stage, but which will be one of the indispensable instruments to eliminate unclassified or doubtful specimens. As drugs are mostly dried parts or fragments of plants, in particular if they are powdered, it is necessary to study not only the part of the plant which furnishes the drug, but the entire plant alive, in order to understand the real significance of the characteristics of a drug. This brings me to the problem of a pharmacognostic experimental garden. In the beginning of last year I started such a garden in the compound of the pharmaceutical factory in Phya Thai. Several excursions were undertaken with the aim of collecting live medicinal plants which have been cultivated in our garden. More than 400 species were already collected when the flood came and destroyed everything. It is not so much the value of the plants but the time lost which it takes to raise the stock again, which is to be regretted. If I bring the problem of a pharmacognostic experimental garden before the forum of this society, it is because I consider it a problem not purely confined to the interests of the Department of Medical Science, but as much to the interests of Educational Institutions such as the Universities and High Schools, and to the public in general. That we need such

a garden, that it should be created without delay, is beyond doubt, and has been emphasized by others before. But how to organize it is a question which I put before this Society, because I feel that the Thailand Research Society should also take an active part in the promotion of this scheme. My idea is that instead of splitting up the different garden schemes which might be started by the Department of Medical Science, by the University, by the Forestry Department for an arboratum, by horticultural societies etc., combined efforts should be made in order to create something which guarantees success.

Comparatively few of the drugs concerned and of interest in Thailand are well known from the chemical point of view. This means practically everything has to be determined and investigated anew. Even when a species is concerned which is well known from a moderate climate, experience shows that analytical data of our Thai species are quite different from the standards. Let us take Datura as an example. This species is represented in Thailand by 2 or 3 subspecies, amongst them *Datura fastuosa* called *lampong*. Owing to lack of trained assistance no investigation on the real contents of our Daturas have been made yet, we do not know which part of the plant, roots, stem., leaves or seeds contain most of the alcaloids, which is the best time for collecting, on which soil the highest yield of alcaloids is obtainable and quite a lot of other questions can only be solved if an experimental garden is maintained and if enough trained workers are at hand. (Experimental work on Datura is underway in the meantime).

Besides the well known routine methods of analytical chemistry, our investigations require more and more the application of microchemical and histochemical methods. Microchemical methods, if handled with skill, will save time and material and what is very important, save a lot of reagents which are very scarce nowadays. A few words about the significance of histochemical methods. Histochemistry means chemical investigation and reactions in a tiny little section under the microscope. It offers the possibility of localization of active principles. Suppose we find by ordinary chemical means that the stem of a wood contains an alcaloid, we still do not know whether it is only in the bark or only in the wood. By a histochemical localization test we may find that only the outer bark contains the principle and for the manufacturing process it will facilitate work, if only the outer bark is extracted.

Of the pending problems the foremost is the research in antimalarial drugs. I have mentioned before, that a drug called *gasambig* was found in Chiengrai, which has some antimalarial, or at least antipyretic action. Our aim is the systematic investigation of indigenous plants for the desired action.

Of course the cultivation of Cinchona, *i.e.* Quinine-Trees, also belongs to the duties of our section. Unfortunately here we are confronted with great difficulties, the most serious one being the complete lack of seeds for the propagation of the species. In all there are, to my knowledge, at present only 40 Cinchona trees in Thailand, about 40 in an experimental plot on Doi Sutep near Chiengmai. These trees are about 2 years old. One single tree, left from a group planted some years ago, is on Kuntan mountain. They belong to the Succirubra and hybrida type. It will take another 5 or 6 years before any bark can be collected and naturally you cannot expect much Quinine to be gained from only 40 trees. Anyhow the bark of Thai-Cinchonas contains Quinine, as has been proved beyond doubt.

We are also concerned with the Leprosy problem. First of all we analyze the raw material, the *grabau*-seeds, from which the Hydnocarpusoil, resp. the Esters are made. Since the work of Dr. Oberdoerffer, who read a paper before this Society about 3 years ago, is continued by Dr. Gehr in the Leper-Asylum in Chiengmai, we are doing chemical investigations on Sapotoxins contained in *pueg* or *Colocasia antiquorum*. Dr. Oberdoerffer emphasized the possibility that frequent consumption of *pueg* might cause a predisposition for leprosy. Our aim is first to establish the presence of sapotoxins in different varieties of Colocasia and then to find out which local factors *e.g.* soil, moisture etc. influence the quantity of sapotoxins present. I hope that by increasing the knowledge of the ethiology of leprosy, this research work in co-operation with Dr. Gehr will bear fruit in the near future.

Now I have explained the methods and application of pharmacognosy, I want to touch on the future work and plans ahead of us.

A very concrete aim of the work of the pharmacognostic division in co-operation with others is the creation of a Thai Pharmacopoea. You will agree with me, that the use of foreign Pharmacopoeas as a Standard for Thailand is not the final solution. Each country has its drugs and medicines which fit it best. Likewise Thailand. Responsible quarters have recognized the fact that also in the sphere of pharmacy Thailand

should make all efforts to become independent as soon as possible. The pharmaceutical factory in Phya Thai was built when the war broke out and made the purchase of necessary machinery practically impossible. On the other hand this war with its consequences has given a great impetus to the increased use of indigenous raw materials. All the present difficulties can only harden the will of all concerned, to do their share to make pharmacognosy an efficient instrument on the way to independence in the economic sphere.

Finally I want to emphasize the importance of co-operation. For more than one year I have repeatedly voiced the opinion that successful work in pharmacognosy is only possible if all Thai resources are made use of. At that time I proposed a close co-operation between the Forestry Department, the Agricultural Department, in particular the Experimental Station in Bangken, the Faculty of Medicine and the College of Pharmacy. I am glad to say that co-operation with the Forestry Department is very close and as gratifying, as in the case of co-operation with the Experimental Station of Bangken. I also want to mention that quite a number of people, in particular physicians up-country, have already taken interest in the work and by facilitating our investigations have rendered great services to the promotion of knowledge concerning Thai drugs.

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