CHAPTER I

INTRODUCTION

General Introduction

The flowering plant family Loganiaceae has been divided into 10 Tribes. Only two of the Tribes, namely the Gelsimeae and the Strychneae contain indole alkaloids with C- or C- monoterpene moiety (1,2).
9 10

The Genus Strychnos, the largest genus of the Tribe Strychneae is a wealthy source of indole alkaloids (2). The genus is organized into 12 sections (Table 1 page 2),arranged according to a more or less natural system (3-5). This genus comprises about 200 species which are pantropical in distribution and may be subdivided into three geographically separated groups. There are at least 73 species which are the native of the South and Central America (6), 75 species of Africa (5,7), and 44 species of Asia including Australia (4,8-10). The distribution of Strychnos species is quite clear separated from overlapping among three continents. The only exception, Strychnos potatorum Linn. is found both in Africa and Asia (9).

Table 1 (5)

Taxonomic Position of the Genus Strychnos within the Family Loganiaceae

Family	Tribe	Genus	Section
Loganiaceae	Spigelieae		
	Loganieae		
	Strychneae	Gardneria	
		Neuburgia	
		Strychnos	Strychnos
			Rouhamon
			Breviflorae
			Penicillatae
			Aculeatae
			Spinosae
			Brevitubae
			Lanigerae
			Phaeotrichae
			Densiflorae
			Dolichanthae
			Scyphostrychnos
	Gelsemieae		
	Plocospermeae		
	Antonieae		
	Buddlejeae		
	Retzieae		
	Potalieae		
	Desfontainieae		

The Strychnos species are well-known for their muscle-relaxant (curarizing) activity such as in Curare as well as in South America's arrow and dart poisons (11,12). In Southeast Asia region, some of Strychnos species especially S. ignatii Berg. have been also used for producing arrow and dart poisons (13-15). The poisons cause convulsive death similar to the action of strychnine and some weak curare-like action is also observed (16-17). African Strychnos species are not only used as ordeal poisons but a few of them are also consumed as curarizing arrow poisons (18,19).

The major constituents in the Strychnos plants are complex indole alkaloids, of which more than 350 alkaloids have been isolated (2). Many studies (5-7,11,20) have been carried out to establish the types and the structures of the alkaloids responsible to their pharmacological and toxicological activities.

Hill (3,21) and Leenhouts (4) have published several articles concerning the botanical informations of Asian Strychnos species and later these are revised by Bisset et al. (9). Other researches have dealt with their ethnobotany (10) and alkaloids (20). However no intensive systematic pharmacological studies have been taken although these are greatly to be desired (20).

On the phytochemical screening for tertiary alkaloids of Asian Strychnos species (20) by using Thin-layer, gas-liguid chromatrography and mass spectrometry have shown that numerous known as well as unidentified bases were present.

Among 44 recorded Asian Strychnos species, at least 20 Strychnos species have been collected in Thailand. Bisset et al. (9) carried out the taxonomic revision of those Asian Strychnos species and adjusted them into 13 species. This is due to the fact that they are including either synonyms or forms of the accepted known species. Smitinand (22) recorded the presence of 12 species of Strychnos in Thailand, ten of which are consistent with Bisset et al.' consideration (9,10). The two remaining species, Strychnos colubrina Linn. and Strychnos kerrii A.W. Hill with according to Bisset et al. (9) are the synonymous of Strychnos wallichina Steud. ex DC. and Strychnos nitida G.Don, respectively. In conclusion,there are at least 14 Strychnos species growing in Thailand and these currently accepted species are in accordance with 4 botanical sections : Strychnos, Penicillatae, Brevitubae and Lanigerae.

Strychnos Species in Thailand

An account of Strychnos species growing in Thailand together with their synonyms and vernacular names are given individually as follows.

(The well-known vernacular names of each species are in solid-printed.)

A. Section I : Strychnos

1. Strychnos ignatii Berg. (9,22)

Strychnos krabiensis A.W. Hill (9,22)

"Phaya mue lek พญามือเหล็ก, Salaeng chi Khruea แสลงใจเครือ, Salaeng chi thao แสลงใจเถา (Central), St.Ignatius Bean (Seeds-English), Ya mue lek ยามือเหล็ก (Krabi)."

2. Strychnos lucida R.Br. (9,22)

Strychnos roborans A.W. Hill (9,22)

"Phaya mue lek พญามือเหล็ก, Phaya muun lek พญามูลเหล็ก (Central) ; Sieo duuk เสี้ยวดูก (Northern) ; Ya mue lek ยามือเหล็ก (Krabi)."

3. Strychnos nitida G. Don (9,22)

Strychnos kerrii A.W. Hill (9,22)

"Saan dee lok สานดีลอก(Chiang Mai) ; and the vernacular names of S. kerrii is Kluai khieo กล้วยเขียว (Nakhon Ratchasima)."

4. Strychnos nux-blanda A.W. Hill (9,22)

"Khee kaa ขี้กา (Northeastern) ; Kla-ue กล๊ะอื๊, Klo-ue กล้ออื, Klo-wuu-sae กล้อวูแซ (Karen-Mae Hong Son) ; Mating มะติ่ง, Mating maak มะติ่งหมาก, Mating ton มะติ่งต้น (Northern); Pluu-wiat ปลูเวียต (Khmer) ; Tuumkaa khaao ตูมกาขาว (Central)."

5. Strychnos nux-vomica Linn. (9,22)

"Ka kling กะกลิ้ง, Krachee กระจี้ (Seeds-Central);Hong-buai-chee โฮงบ้วยจี้(Seeds-Chainese), Saeng buea แสงเบือ (Ubon Ratchathani) ; Salaeng buea แสลงเบือ (Nakhon Ratchasima);Salaeng chi แสลงใจ (Central); Salaeng thom แสลงหม (Nakhon Ratchasima) ; Snake Wood (English) ; Tuumkaa daeng ตูมกาแดง (Central)."

6. Strychnos rupicola Pierre ex Dop (9,22)

Strychnos usitata Pierre ex Dop (9,22)

"Kheekaa khruea ขี้กาเครือ(Prachin Buri)."

7. Strychnos wallichina Steud. ex DC. (9)

Strychnos colubrina Linn. (9,22)

"Thao kwaang duu thuuk เถากวางดูถูก (Surat Thani) ;Thao plong เถาปลอง (Ranong)."

This species is reported by Smitinand (22) as Strychnos colubrina Linn. but Bisset et al. (9) recognized that S.colubrina Linn. are the synonymous of S. wallichina Steud.ex DC.

B. Section II : Penicillatae

8. Strychnos axillaris Colebr. (9,22)

Strychnos chloropetala A.W. Hill (9,22)

Strychnos kawbet A.W. Hill (9,22)

Strychnos mucronata A.W. Hill (9)

Strychnos plumosa A.W. Hill (9,22)

Strychnos schmidtii Gilg (9)

Strychnos viridiflora A.W. Hill (9)

"Ben เบน, Ben kho เบนขอ (Northeastern); Khee raet ขี้แรด (Prachin Buri); Khieo nguu เขี้ยวงู (Chumphon) ; Kho bet ขอเบ็ด (Nong khai) ; Khwaak kai ขวากไก่ (Chaiyaphum) ; Lep khrut เล็บครุฑ (Chanthaburi) ; Lep rok เล็บรอก (Phatthalung) ; Maak taa kai หมากตาไก้ (Laos),Naam-khem หนามเข็ม (Chaiyaphum); Tueng khruea dam tua mae ติ่งเครือดำตัวแม่ (Lampang)."

C. Section III : Brevitubae

9. Strychnos vanprukii Craib (9,22)

"Thao chaang เถาช้าง (Northern)."

D. Section IV : Lanigerae

10. Strychnos curtisii King et Gamble (9)

11. Strychnos myrioneura Gilg (9)

12. Strychnos minor Dennst. (9,22)

Strychnos beddomei Clarke (9,22)

Strychnos sivicola A.W. Hill (9,22)

"Tum kaa daeng ตุมกาแดง, Tum kaa khaao ตุมกาขาว (Lampang)."

13. Strychnos polyantha Pierre ex Dop (9)

14. Strychnos thorelii Pierre ex Dop (9,22)

"Chong la aa จองละอา , Chong ra aa ชองระอา (Chanthaburi) ; Khieo nguu เขี้ยวงู, Lum nok ลุ่มนก (Chumphon); Sa-eng สะเอ้ง, Thao sa em เถาสะเอม (Trat)."

Most of Strychnos species growing in Thailand are large lianes, scrambling, erect shrubs, or small trees. Some species such as S. nux-blanda A.W. Hill and S. nux-vomica Linn. are known as trees; S. lucida R.Br. is found both as a small tree and as a shrub ; S.ignatii Berg.

grows as a liana, shrub or small tree. Some species like S. minor Dennst., S. rupicola Pierre ex Dop, S. axillaris Colebr. and S.vanprukii Craib are as scrambling shrubs as well as lianes (9,10,22).

The well-known Strychnos species of Thailand are probably S. nux-vomica Linn. and S.ignatii Berg. (S.krabiensis A.W. Hill). The seeds are used as powerful poisons which is possessing stimulant action on the central nerveous system.

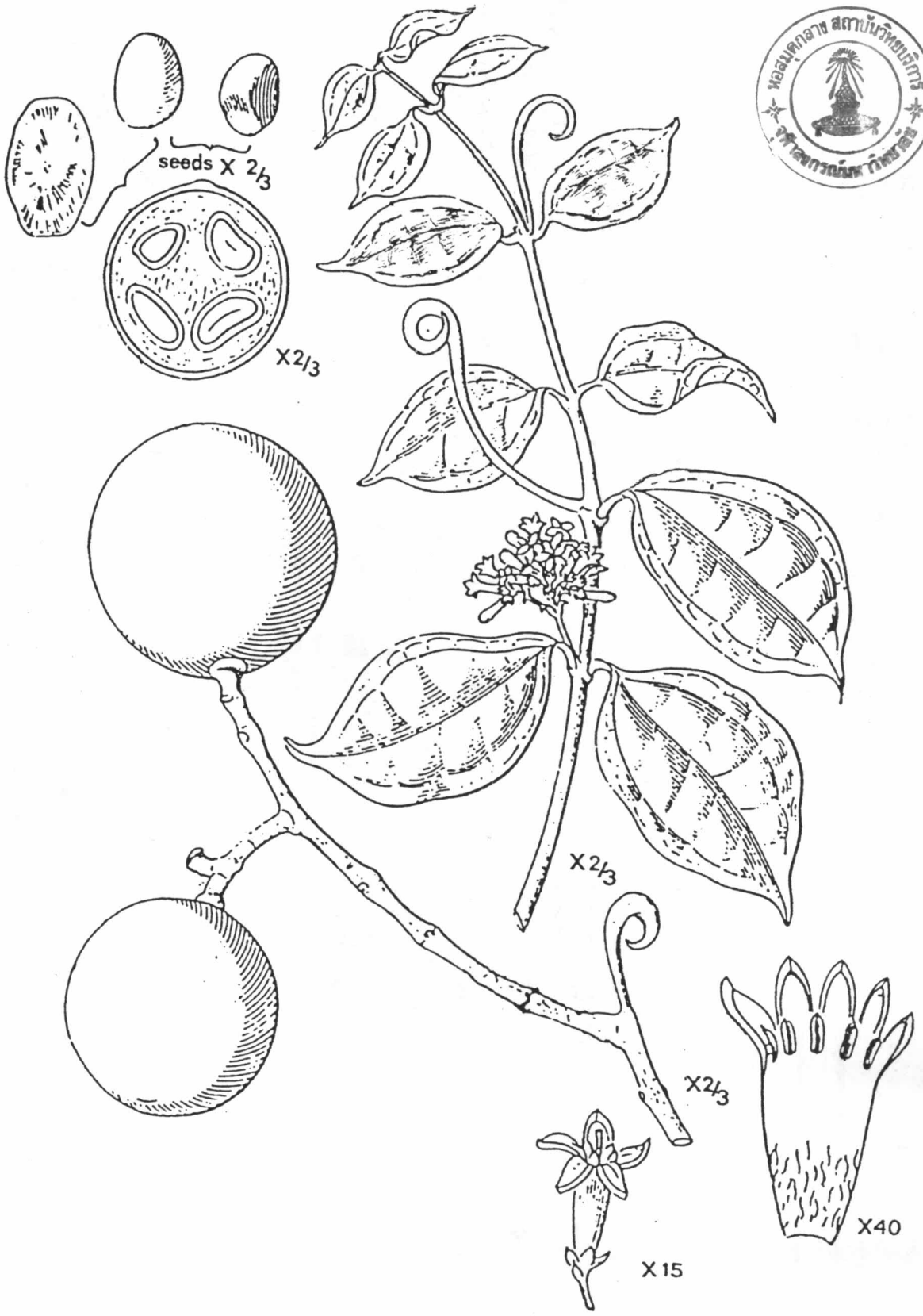

Figure 1 Strychnos ignatii Berg. (S.krabiensis A.W.Hill) flowering branch, fruits and seeds.

Figure 2 Strychnos ignatii Berg. (S.krabiensis A.W.Hill) flowering branch.

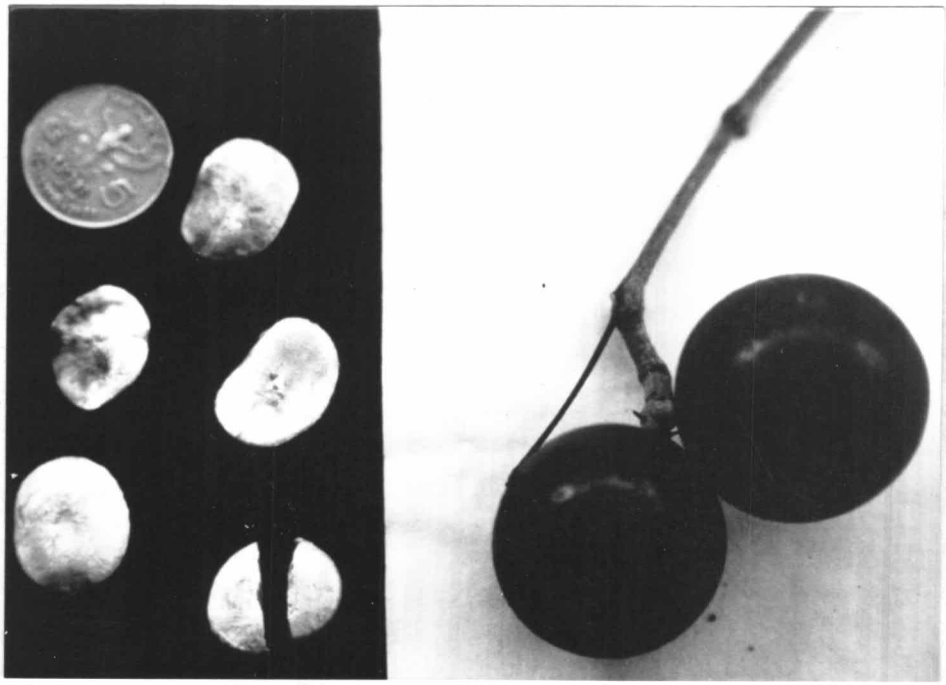

Figure 3 Strychnos ignatii Berg. (S.krabiensis A.W.Hill) fruits and seeds.

Introduction to Strychnos ignatii Berg.

Strychnos ignatii Berg. comprises many forms which widely distributes in a large area throughout Southeast Asia region (4,9,10). One of its forms in Thailand is Strychnos krabiensis A.W. Hill which first be collected by Kerr as Kerr 18582 in March 1930 (23). Many other forms of S. ignatii Berg. have been collected ; they are S. balansae A.W. Hill (North Vietnam), S. beccarii Gilg (Borneo), S. cuspidata A.W. Hill (Borneo), S. hainanensis Merr. et Chun (Hainan), S. ignatii Berg. sensu stricto (Philippines), S. lanceolaris Mig. (South Sumatra), S. ovalifolia Wall. ex G. Don (Malaysia), S. philippinensis Blanco (Philippines), S. pseudo-tieuté A.W. Hill (Malaysia), S. tieute Lesch. (Java) (3-4,9-10).

Leenhouts (4) described the characteristic feature of Strychnos ignatii Berg. as follows. :-

Large liana (in Borneo sometimes a shrub or treelet) ; twigs glabrous ; branches greyish brown, more or less scabrous. Leaves ovate or elliptic to lanceolate, 4-8(-22) by 2.25-9(-22) cm, thin to coriaceous-characeous, glabrous, acute to rounded at the base, always slightly attenuate, apex distinctly acuminate, acumen up to 1.75 cm long, slender and blunt or acute ; triplinerved at or above the base ; petiole 0.5-1 cm. Inflorescences axillary, mostly in the axils of already fallen leaves, laxly branched, 2-4(-7) cm long, with some 10-20 flowers, minutely pubescent. Calyx 1-1.5 mm high, sepals ovate, acute, outside densely minutely tomentose, inside glabrous. Corolla salver-shaped, 7-17 mm long, tube 5-12 mm, inside in the lower half with some long woolly hairs. Stamens inserted in the mouth, filaments short, anthers deeply cleft, oblong, 1.25-2 mm long, apiculate, glabrous. Ovary globular, ca. 1 mm ø, glabrous ; style ca. 5-12 mm, glabrous or rarely with a few long woolly hairs about the middle ; stigma truncate. Fruits few on stongly thickened

branches, (ellipsoid to) globular, 4-12 cm ø, pericarp up to 5 mm, thick, hard and woody, smooth and glabrous. Seeds usually several either lenticular, elliptic to orbicular, ca. 20-35 by 16-20 by 8-9 mm and silky to felty or irregular castorbean-shaped, ca. 2 by 1 by 1 cm, rough but glabrous.

Leenhouts (4) on the course of his revision of Asian Strychnos species reconized that the characteristic forms of their flowers and their leaves are absolutely necessary for a trustworthy identification. The characteristic features of S. ignatii Berg. are that the inflorescences are axillary, the corolla tubes are distinctly longer than the limbs and the leaves are slender to caudate with acuminate apices. (Figure 1 page 9)

As for the seeds, Leenhouts (4) concluded that the characteristic features of S. ignatii Berg. seeds are useless for specific distinction while Krukoff and Monachino (24) also reached the same conclusion for the American Strychnos species. Since the seeds of S. ignatii Berg. from each area showed some variation that only irregular shaped seeds are found in the Philippines while only lenticular ones are confined to Borneo or Java, respectively, but both types of the seeds are found in Malaysia from the plants which otherwise showed no difference (4).

On Leenhouts distinction (4), S. krabiensis A.W. Hill is conspecific with Strychnos ignatii Berg. (Figure 1,2). The plant has been described (4,23) as a woody scandent, petiole is 1 cm long, glabrous with channeled or grooved longitudinally. The leaf is thin, glabrous which turned dark green when dry and is distinctly looping in the upper part. The leaf is elliptic or ovate elliptic in shape, 8-13 cm long, 5-5.75 cm wide, angular or rounded at the base, apex acuminate with acumen is 1 cm long and having three nerves starting from the base. The inflorescence is panicle cymes, 7 cm long and borne in the axils. The peduncle is glabrous,3-3.4 cm long. The rami inflorescence is shaggy with short yellowish-brown hairs. The flower is 5 merous. The calyx is 1.75 mm long and sepal is ovate, subacute or acute and pubescence. The corolla is 13 mm long, corolla tube is 11 mm,and the limb is triangular, subacute-shaped with 2 mm long. At the lower half inside the corolla lobe has long woolly hairs. The stamen is 8 mm long and fixes above the base of the tube. The anther is 2 mm long,dorsifixed,and subsessiles. The ovary is globose about 1 mm diameter and glabrous. The style is glabrous, 6.5 mm long.

The present fruit specimen (Figure 3) has thick walled which is globose about 4 cm diameter, smooth and glabrous with 4-5 seeds. The seed is lenlicular in shaped, elliptic with 20 by 25 by 1 mm and covering with silky hairs.

Strychnos ignatii Berg. is growing in Southern Thailand. Its vernacular name "Phaya mue lek" is also used for Strychnos lucida R.Br. The later species is recognized as a small tree or a shrub and commonly growing in Central and Northeastern Thailand (22,25).

The Medicinal uses of Strychnos ignatii Berg. (10,25-26)

The commercial irregular shaped seeds of Strychnos ignatii Berg. from Philippines are called Saint Ignatius Beans. They are official in many local pharmacopoeias in Europe region. They are also used in several countries in Asia region, especially in the Philippines, India, Malaysia and China. Strychnos krabiensis A.W.Hill, a form of Strychnos ignatii Berg. from Thailand are also used in midicine. The medicinal purposes of the seeds as well as the barks in each countries seem to be indifference. The seeds and the barks in small dose are an excellent remedy in cholera and obtinate vomiting. They are also employed for against fever, nervine tonic, certain form of heart trouble and in some forms of paralysis (10,25-26). However, using of the plant must be with greatest caution because of its powerful activity as well as toxicity which acting on the spinal cord as causing convulsive death (25-26).

The seeds are mentioned as drugs for febrifuge, eye-ache, suppression of urination and of menstruation, difficult diliveries, asthma, dropsy, rheumatism, haemorrhoids, emetic, bites of poisonous animals or other infirmities and uses for killing dog or poisoning fish (4,10,26).

Moreover, the leaves are used in chronic ulcer and the roots are used for anti-inflatulence (25). The roots are also used for poisoning darts and blow-pipes in Malay Penninsular, Java and Borneo. Bisset et al. (11) reported that the negritos of the Trang-Phatthalung Hills in Southern Thailand prepared the poisons from S. tieute Lesch. which had been identified by Evans (11). However, the identification was not clear due to the lack of S. tieute Lesch. specimen collected in Thailand. Later, S. tieute Lesch as well as the used plant is believed as being a form of S. ignatii Berg. (9).

The plant is used in the "Ipoh Lampong" poison in Malay Penninsular (14-17). The poison possesses curare-like activities in mice with LD 300 mg/kg (17). The pharmacological experiment has been dealt with both tertiary and quaternary alkaloids fractions extracted from the poison and the overall action indicates that the muscle-relaxant (curarizing) effect has been strong enough to overcome the tetanic (stimulant) action.

Although Strychnos ignatii Berg. has been greatly used in medicine, only little amount of its phytochemical studies have been carried out. Owing to the similarity of the medicinal properties of the seed and the stem bark, it would be very interesting to carry further investigation on the stem bark of the plant.