

CHAPTER IV

DATA & RESULT

Specification of the Authentic Plant Drugs

The author have performed the specification of the authentic plant drugs by means of pharmacognostical study.

The four authentic plant drugs are as the following :

Smilax glabra Roxb.

Smilax corbularia Kunth

Dioscorea birmanica Prain et Burkill.

Pygmaeopremna herbacea (Roxb.) Mold.



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Smilax glabra Roxb.

- Family : Smilacaceae (7) (29) (31)
- Synonym : *Smilax hookeri* Kunth (26) (61)
- Other names : Hurina, Hurina-shook-China (India) (62), T'u fu-ling (8) (63) (64), tihu-ling, Shan ku'ei-lai kou-lang-t'ou, Chiu-lao-shu, t'u pi-chieh. (58)
- Thai vernacular names : Ya hua (ยาหิว) (7) (31)
- Distribution : India (type), Burma, Indochina, Central and Southern Continental China and Formosa (31)
- Ecology : Tropical evergreen forests at 300 to 1,400 m above sea level. In Thailand this warm-temperate element is found at altitudes from 600 to 1,300 m (31).
- Ethnobotany : Dysuria with turbid discharge, morbid leukorrhea, carbuncle, lymphadenitis, chronic eczema, contracture of limbs and muscle pain in syphilis or mercury poisoning (19).

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Description of *Smilax glabra* Roxb.

Climbing stems 3-5 mm thick, branches hardly zigzag, internodes terete, smooth, 1-5 cm long, 1-2 mm thick, leaf-blades lanceolate, 5-18 cm long, 2-7 cm wide, suddenly contracted or rounded at base, attenuate to acute or acuminate apex, coriaceous with nerved and thickened margins, upper surface shiny, pale or white-powdery on lower surface, costas 5 including a marginal pair, all divided to base; petioles 10-30 mm long, straightish, moderately laterally compressed, breaking off at apex, sheathing for 3-15 mm wings 0.3-1 mm wide, herbaceous, not auriculate at apex; tendrils slender, 7-15 cm long. Umbels on lower part of branches as well as on distal part of stem ; peduncles short and thickish, 1-9 mm long; receptacles 3-4 mm across; bracteoles ovate-acute, 1-1.7 mm long, staminate umbels globose with 30 to 60 flowers on filiform rays, 1-2.5 cm long. Pistillate umbels turbinate to hemispherical 10 to 25 flowers on filiform rays, 1-1.5 cm long. Staminate perianth depressed-globose, 2 mm high, 3-3.7 mm across, pale-greenish ; tepals free slightly open, 1.5 mm long 1 mm wide. Stamen 6, anthers 0.7 mm long, white subsessile. Pistillate perianth pale, 1.5-2 mm high, 3-2.5 mm across ; tepals free. Ovary ellipsoid, 3-furrowed, 2 mm long and wide. Stigmas annulate, 3-lobed, Berries globose, 5-8 mm in diameter maturing blue-black, 1 to 3-seeded (31).

(see Figure 1, page 38)

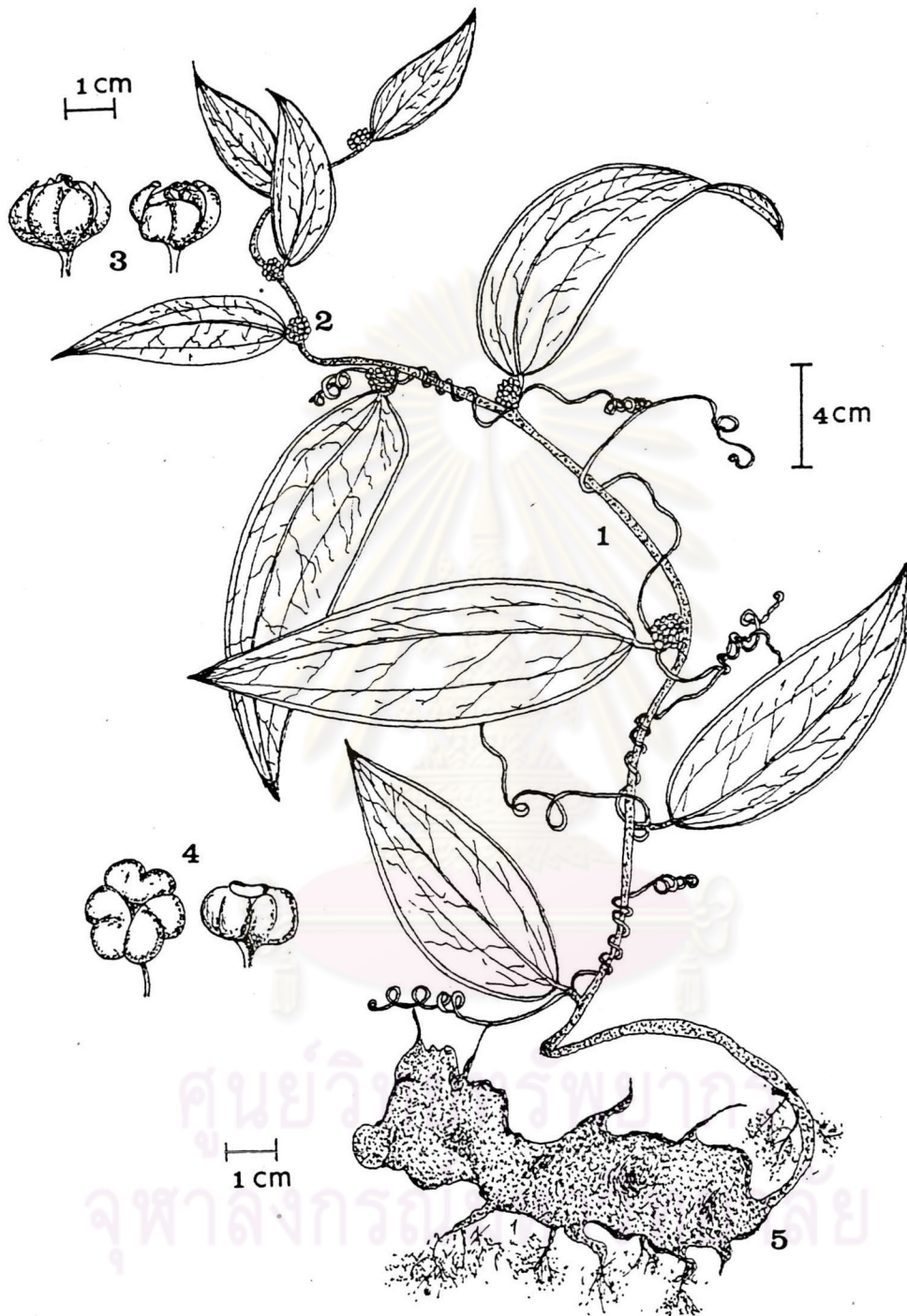


Figure 1 *Smilax glabra* Roxb.

1. whole plant
2. inflorescence
3. pistillate flower
4. staminate flower

Macroscopical Characteristic of the Rhizome of *Smilax glabra* Roxb.

The dried rhizome, horizontal, irregular cylindrical or massive tuber, often with node-like branches, about 5-25 cm long, 1.5-6 cm in diameter, the outer surface covered with reddish-brown to brown rhytidome, scattered with knotty root scars, internally almost white to reddish-brown in colour, fracture hard, tough and mealy, odour indistinct, taste starchy, dried rhizome similar to fresh one in morphology and weight except the internal surface yellowish white in colour. (see Figure 2)

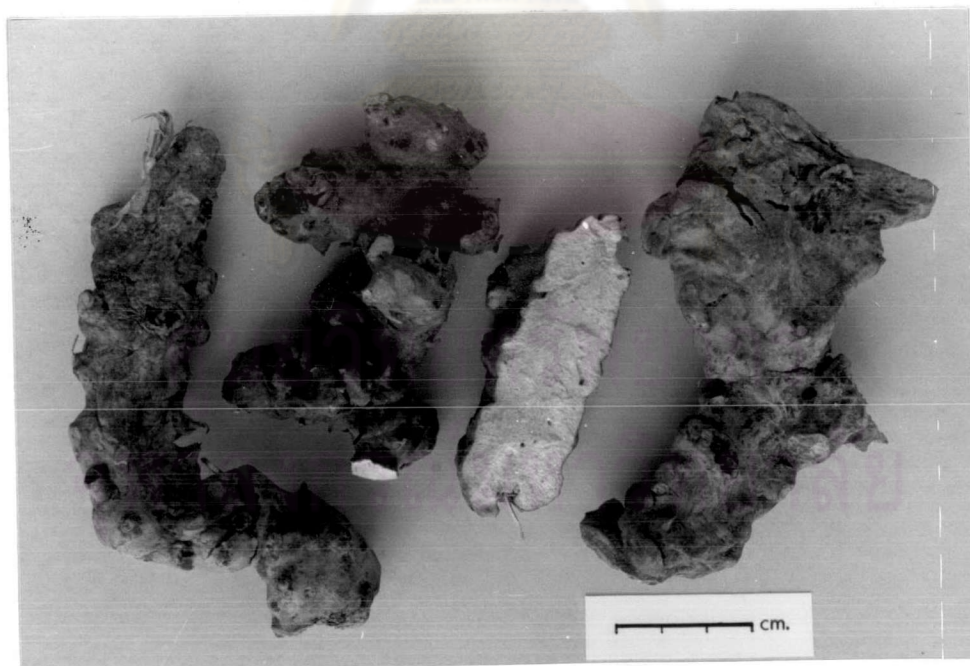


Figure 2 Dried Rhizomes of *Smilax glabra* Roxb.

Microscopical Characteristic of the Rhizome of *Smilax glabra* Roxb.

Histology (see Figure 3, page 41)

Transverse sections of the rhizome show the following features :

1. Hypodermis, composed of one or two rows of polygonal cells, the walls are brown, thick and lignified.
2. Cortex, consisting of rather round, oval or polygonal parenchyma somewhat are pitted wall large crystal cavity somewhat round, containing raphide bundles of calcium oxalate crystals 35-85 microns long, 1-3 microns wide, the large starch granules, round with radiate hilum usually simple, some are compound up to four, 8-68 microns in diameter.
3. Endodermoid is indistinct.
4. Stele, the broad central region, consisting of scattered closed collateral vascular bundle surrounded by a fiber sheath, the vessels are various types ; reticulate, scalariform, scalariformly pitted 16-65 microns in diameter. The collateral bundle are varying in size up to 278-578 microns in diameter. The very abundant starch granules also found in this region.

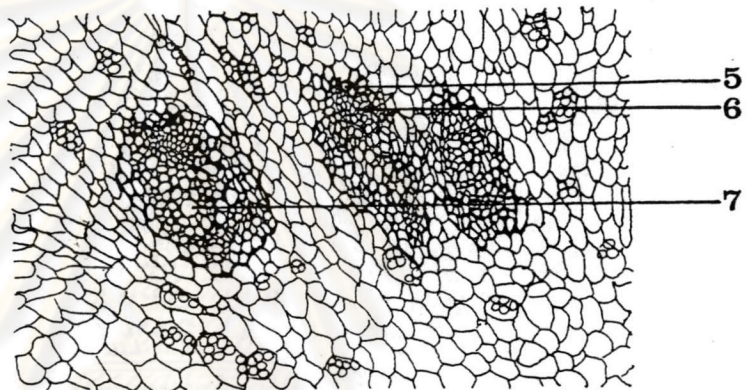
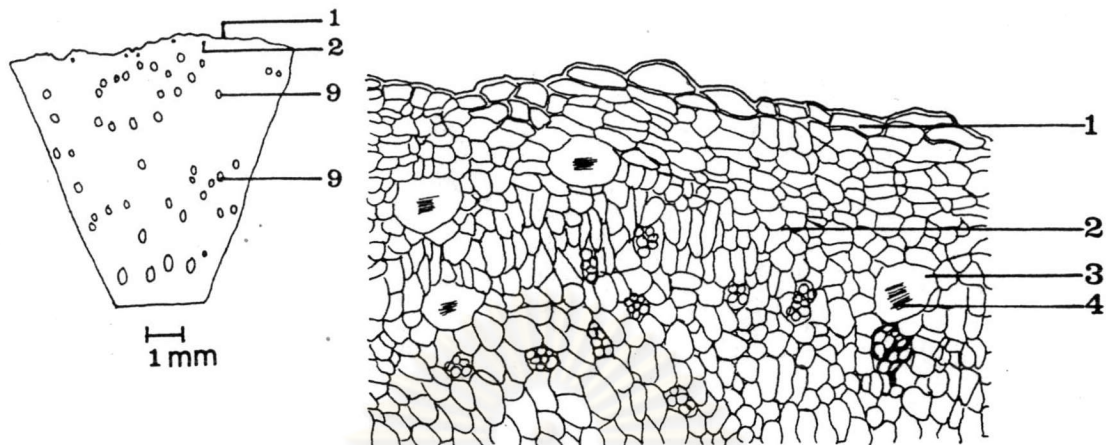
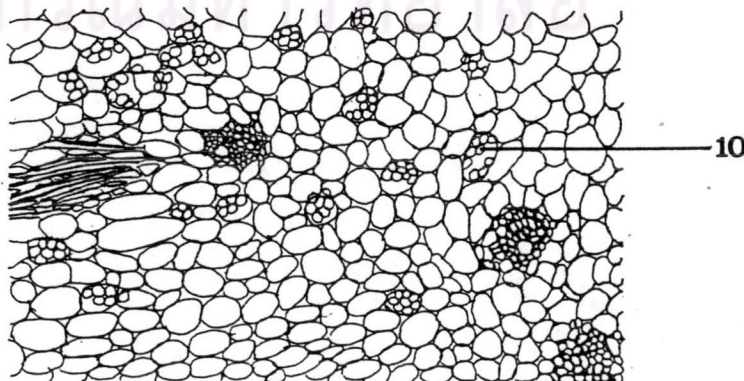
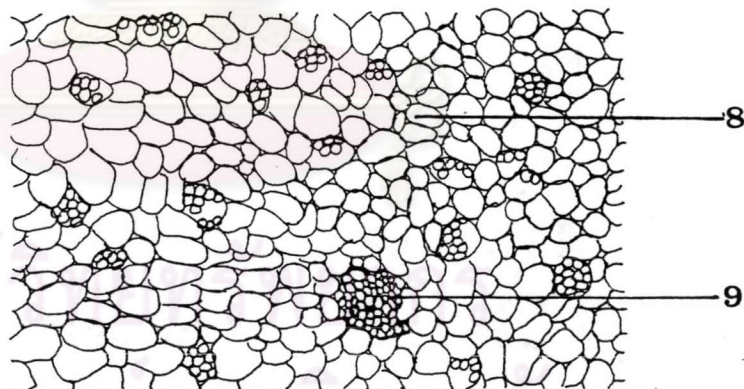


Figure 3
Transverse Section
of the Rhizome of
Smilax glabra Roxb.

- 1. hypodermis
- 2. cortex
- 3. crystal cavity
- 4. raphide crystals
- 5. fiber
- 6. phloem
- 7. vessel
- 8. parenchymatous cell
- 9. vascular bundle
- 10. starch granules



0.5 mm

Powdered Drug (see Figure 4, page 43)

The powder is light brown, mealy taste, indistinct odour, showing the following diagnostic features :

1. The abundant starch granules, are simple or compound with two, three or occasionally more components, individual granules, frequently large, spherical to ovoid with a round, linear or radiate hilum.

2. The abundant parenchyma of the ground tissue containing starch granules, the cells are round in transverse sectional view and elongated in longitudinal sectional view, the walls showing slightly thickened and pitting.

3. The vessels, which occur singly or occasionally in small groups and sometimes found in fragments, the wall lignified and usually scalariform, reticulate and elongated pit.

4. The sclereids, which found singly or in groups of two or three, slightly elongated rectangular with moderately to heavily, thickened, lignified walls and conspicuous pit.

5. The acicular crystals of calcium oxalate (raphide), are fairly large and found mostly in bundles filling some of the parenchymatous cells.

6. The brownish-red masses.

7. The stone cells, which found singly, the wall heavily thickened lignified and conspicuous pit.

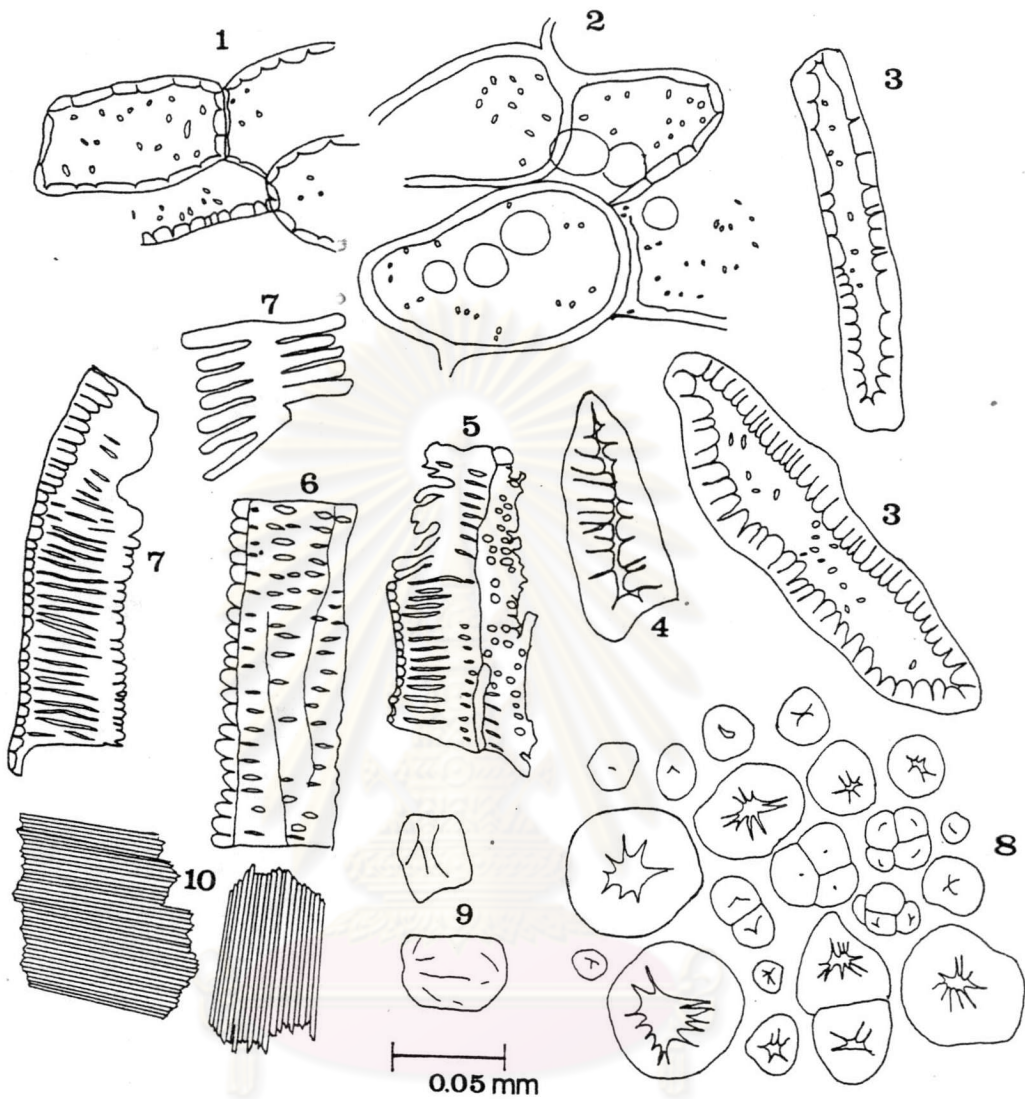


Figure 4 Powdered drug of the rhizome of *Smilax glabra* Roxb.

- | | |
|--|---------------------------------|
| 1. parenchyma with pitted wall | 6. scalariform vessel |
| 2. parenchyma with starch granules | 7. reticulate vessel |
| 3. sclereids | 8. starch granules |
| 4. stone cells | 9. brownish masses |
| 5. scalariform associated with pitted vessel | 10. raphides of calcium oxalate |

Smilax corbularia Kunth

- Family : Smilacaceae (7) (29) (31)
- Synonyms : *S. corbularia* Kunth *ssp. corbularia* Kunth. (31)
 : *S. hypoglauca* Benth (31)
 : *S. corbularia* Kunth var. *hypoglauca* (Benth) T. Koyama (31)
 : *S. peguana* A. DC. (31)
 : *S. balansaeana* H. Bon ex Gagnep. (31)
 : *S. pseudochina* Lour. (26) (61)
- Other names : Day gao, Chua Khan sang, Giay kim cang, Diay kim cang mo (26)
- Thai vernacular names : Hua Khao-yen wok (หัวข้าวเย็นออก), hua khao-yen-nuea (หัวข้าวเย็นเหนือ) (31)
- Distribution : Rather widely distributed in south-eastern Asia from Southern China and Upper Burma through Thailand and Indochina (type) southwards to Malay Peninsula and south eastwards to Borneo (31).
- Ecology : Tropical evergreen and lower montane forests from sea level to ca. 2,000 m (31).
- Ethnobotany : In Thailand, the tuber of *S. corbularia* Kunth is employed against venereal disease (25).

Description of *Smilax corbularia* Kunth

Climber 2 to 4 m long ; stems woody, terete, glabrous, smooth, 1.5-5 mm thick, rather densely branched ; branches straightish, 1-3 mm thick, internodes 3-10 cm long. Leaves variable in shape and thickness : blades elliptic, oblong-elliptic, ovate to broadly ovate, 3-10 cm long, 1.5-5 cm wide, cuneate, rounded or shallowly cordate at base, the apex obtuse or acuminate tip, herbaceous to coriaceous, sometimes thickly coriaceous with recurved margins, fresh-green and shiny on upper surface, strongly glaucous and more or less white-powdery beneath, costas 5 or 7, all separate from the base ; petioles short, bent upward 7-15 mm long, tendrils developing only on sterile branches and stems, 6-9 cm long. Flowering branches 5-20 cm long, 5 to 10 nodose, all or upper leaves reduced to bracts. Umbels with peduncles 5-12 mm long, staminate umbels 10 to 40 flowered, pistillate 8 to 20-flowered ; receptacles 2 mm across ; bracteoles depressed-deltoid, apiculate ; rays 3-5 mm long. Staminate perianth reddish, ovate-glabose, 2mm long and as wide ; tepals free slightly open, thick, outer ones broadly ovate, 1.5-1.8 mm wide ; suddenly contracted to subobtuse or mucronate apex, inner ones ovate, 1.7 mm long, 1 mm wide, subobtuse at apex, longitudinally weakly folded with inner surface facing outside. Stamen 6, nearly sessile ; anthers elliptic, 1.3 mm long. Pistillate perianth greenish to yellowish, turbinate, 1.5-2 mm long ; tepals oblique, outer ones ovate, 1.2 mm wide, subacute at apex, inner ones ovate-oblong, 0.7 mm wide, slightly shorter than the outer ones. Ovary ellipsoid,

contracted at apex, 2 mm long, 1.5 mm wide, capped with 3-lobed stigma. Staminodes 3, needle-like, 1.25 mm long. Berries globose, 6-8 mm across, purplish-black, 1-to-3 seeded (31).

(see Figure 5, page 47)



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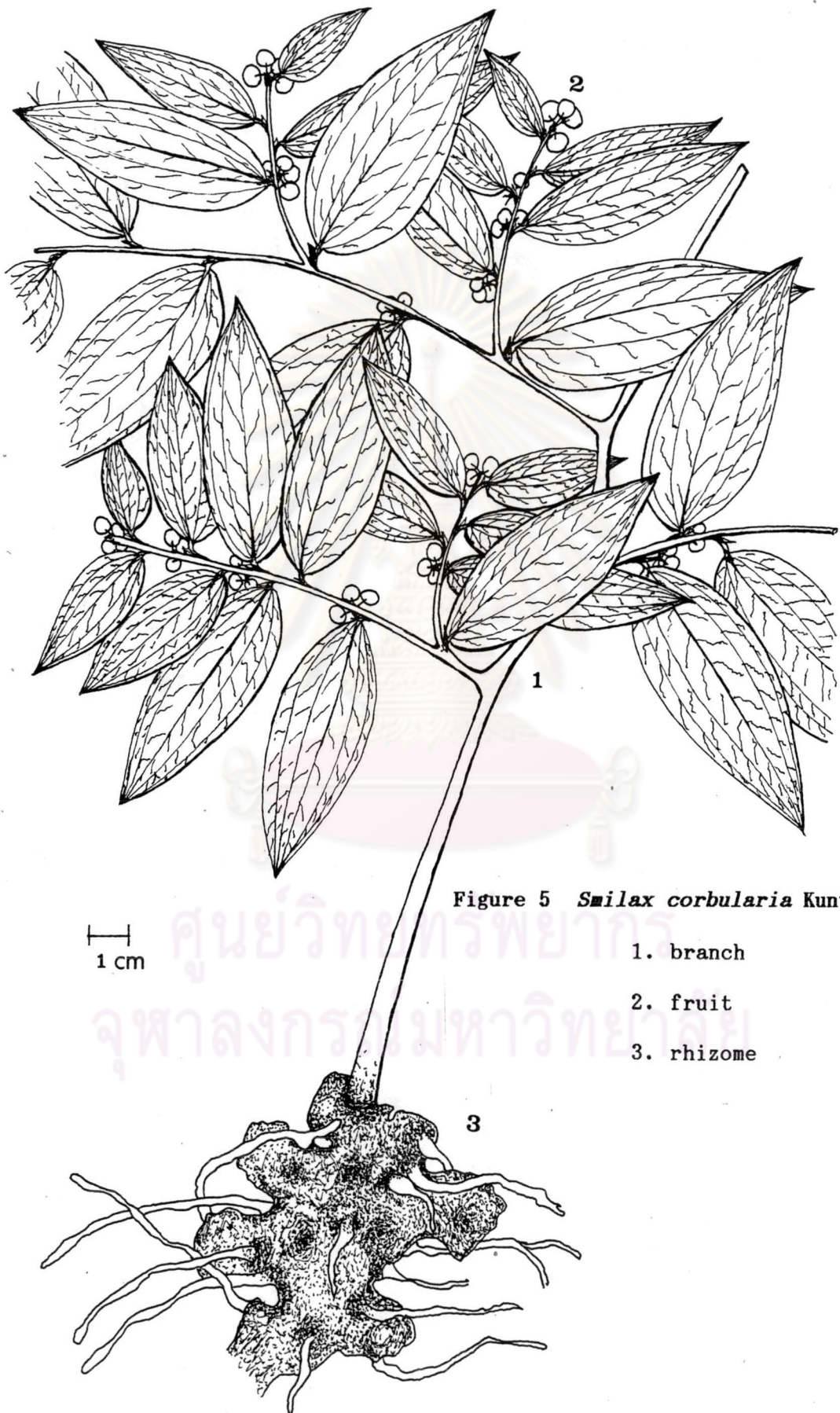


Figure 5 *Smilax corbularia* Kunth

1. branch
2. fruit
3. rhizome

Macroscopical Characteristic of the Rhizome of *Smilax corbularia* Kunth

The dried rhizome, branched, somewhat tortuous, tubercular, woody, up to 12 cm long and 3-4 cm in diameter, externally dark reddish-brown, longitudinally wrinkled or furrowed with numerous hard wiry rootlets and circular stem scars, internally yellowish white to light brown, fracture very hard and tough, odour indistinct, taste starchy, the cut surface of fresh rhizome is yellowish white in colour. (see Figure 6)

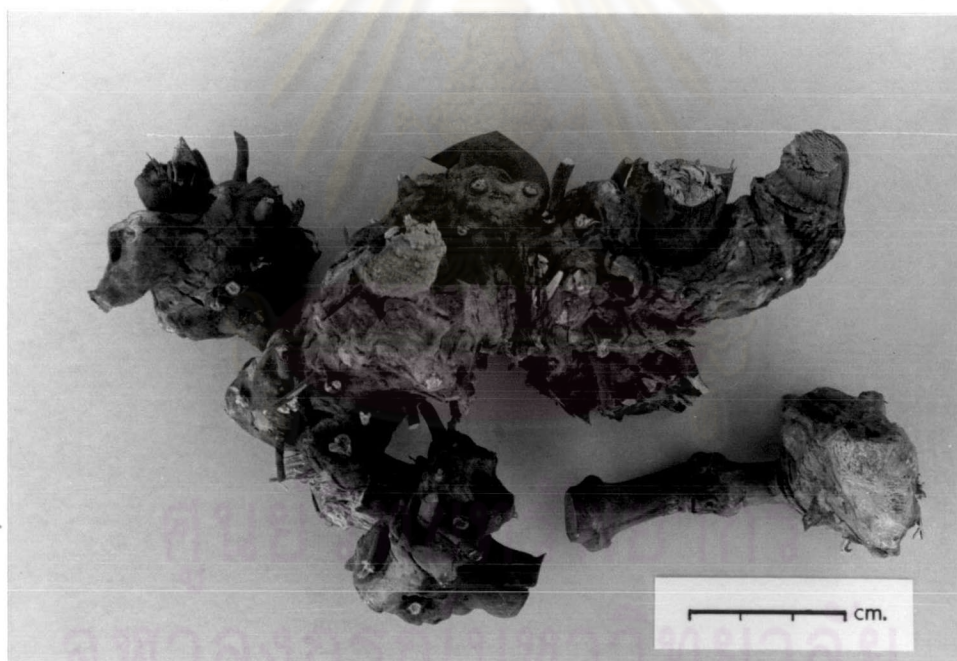


Figure 6 Dried Rhizomes of *Smilax corbularia* Kunth

Microscopical Characteristic of the Rhizome of *Smilax corbularia* Kunth

Histology (see Figure 7, page 50)

Transverse sections of the rhizome show the following features :

1. Hypodermis, composed of two or three rows of thick and lignified polygonal cells.

2. Cortex, consisting of rectangular to polygonal parenchyma, the wall are slightly thickened and lignified, large and round crystal cavity containing raphide bundles of calcium oxalate crystals 55 - 80 microns long, 1 - 3 microns wide, the starch granules, round with radiate hilum commonly found simple, compound up to four 8 - 27 microns in diameter.

3. Endodermis is not distinguishable.

4. Stele, the broadest central region consisting of scattered closed collateral vascular bundle are varying in size 317 - 625 microns in diameter. The vascular bundle surrounded by a sclerenchyma sheath of lignified fibers, the various types of vessels are reticulate, scalariform, scalariformly pitted and pitted 13-45 microns in diameter, the brownish mass usually found within the vessels. The starch granules are found throughout the ground parenchyma which cells are rather round.

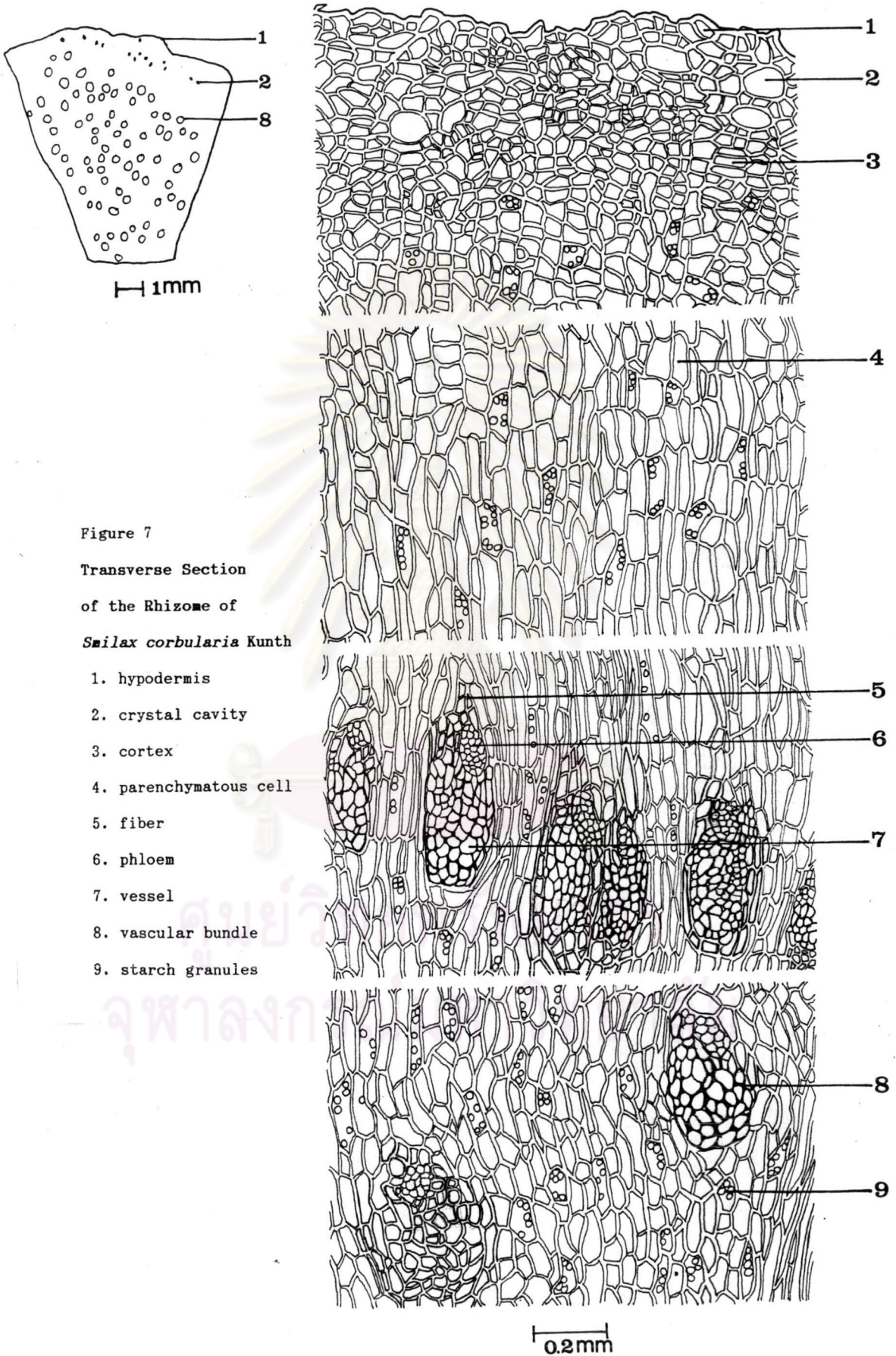


Figure 7
 Transverse Section
 of the Rhizome of
Smilax corbularia Kunth

- 1. hypodermis
- 2. crystal cavity
- 3. cortex
- 4. parenchymatous cell
- 5. fiber
- 6. phloem
- 7. vessel
- 8. vascular bundle
- 9. starch granules

0.2mm

Powdered Drug (see Figure 8, page 52)

The powder is reddish brown, indistinct odour, starchy taste, showing the following diagnostic features :

1. The very abundant starch granules, mostly simple, some compound occur with two, spherical to polyhedral with a linear or radiate hilum.
2. The abundant lignified ground parenchyma, composed of rectangular and longitudinally elongated cells.
3. The vessels, found singly or in small group, lignified wall with scalariform, reticulate, pitted and elongated bordered pit.
4. The occasional sclereids, usually found singly, rectangular elongated with moderately and unevenly thickened wall.
5. The acicular crystals of calcium oxalate (raphide) are vary in size and mostly arranged in group.
6. The spherical masses of brownish-red resin.
7. The stone cells, which wall are heavily thickened, lignified and conspicuous pit, found singly or in small groups.

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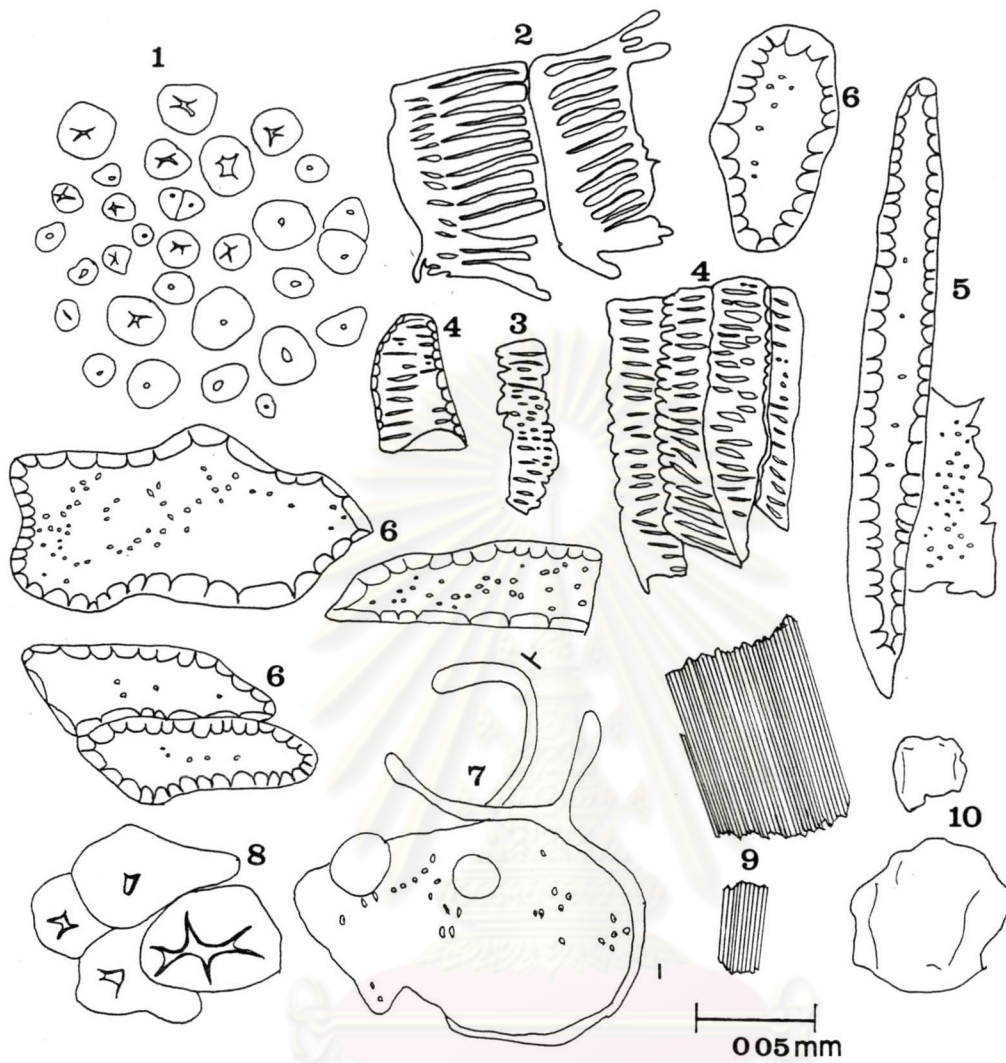


Figure 8 Powdered drug of the rhizome of *Smilax corbularia* Kunth

- | | |
|------------------------|------------------------------------|
| 1. starch granules | 6. lignified ground parenchyma |
| 2. scalariform vessels | 7. parenchyma with starch granules |
| 3. pitted vessels | 8. stone cells |
| 4. reticulate vessels | 9. raphides of calcium oxalate |
| 5. sclereids | 10. brownish masses |

Dioscorea birmanica Prain et Burkill.

- Family : Dioscoreaceae (7) (65) (66)
- Synonyms : *D. horrida* Buch-Ham. (66)
 : *D. rangunensis* R. Knuth (66)
 : *D. spinosa* Wall. (66)
- Other names : Yang (66)
- Thai vernacular names : Kloi-khao (กลอยเข่า), man chuak (มันจั่วก), man nok (มันนก) (7), man chitak (7)
- Distribution : Northern, central and lower Burma, Thailand, excluding the Peninsula (61).
- Ecology : In scrub jungle at nearly 330 m to ca. 500 m(66)
- Ethnobotany : C.E Parkinson states that in Thaton the Burmese eat the very young cooked leaves, at Prome, the root is regarded as a contraceptive if taken by the male. Both uses need confirmation (66).

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Description of *Dioscorea birmanica* Prain et Burkill.

Stem reaching a length of 20 m or more, pubescent or puberulous or glabrous, about if pubescent than as it ages glabrescent faintly grooved, armed with scattered prickles, most abundant lower down about the leaf bases. Bulbils never observed. Leaves scattered, cordate to broadly cordate, with broad rounded auricles and a sinus, up to 15 cm in length by 16 cm in width, the acumen long, upper surface glabrous or pubescent towards the base, with the 7-11 nerves scarcely prominent but quite distinct : in the lower surface likewise glabrous or pubescent on all the larger nerves, and the largest commonly carrying one or more sharp recurved prickles ; petioles with prickles, pubescent, puberulous or glabrous, 4.5-9 cm long, Male flowers group into few-flowered cymes with arranged along the axis of a spike-like inflorescence, flower sessile, attain 35-45 cm in length with the basal 3-8 cm sterile, axis pubescent; cymes 1 cm long, perianth deeply campanulate, stamen 6, equal inserted into the throat of the perianth-tube. Female flowers, 20-40 on a spike perianth-segments, staminodes minute, ovary densely pubescent. Capsule crowded, 20 to 30 mm long, 10 to 15 mm wide (61). (see Figure 9, page 55)

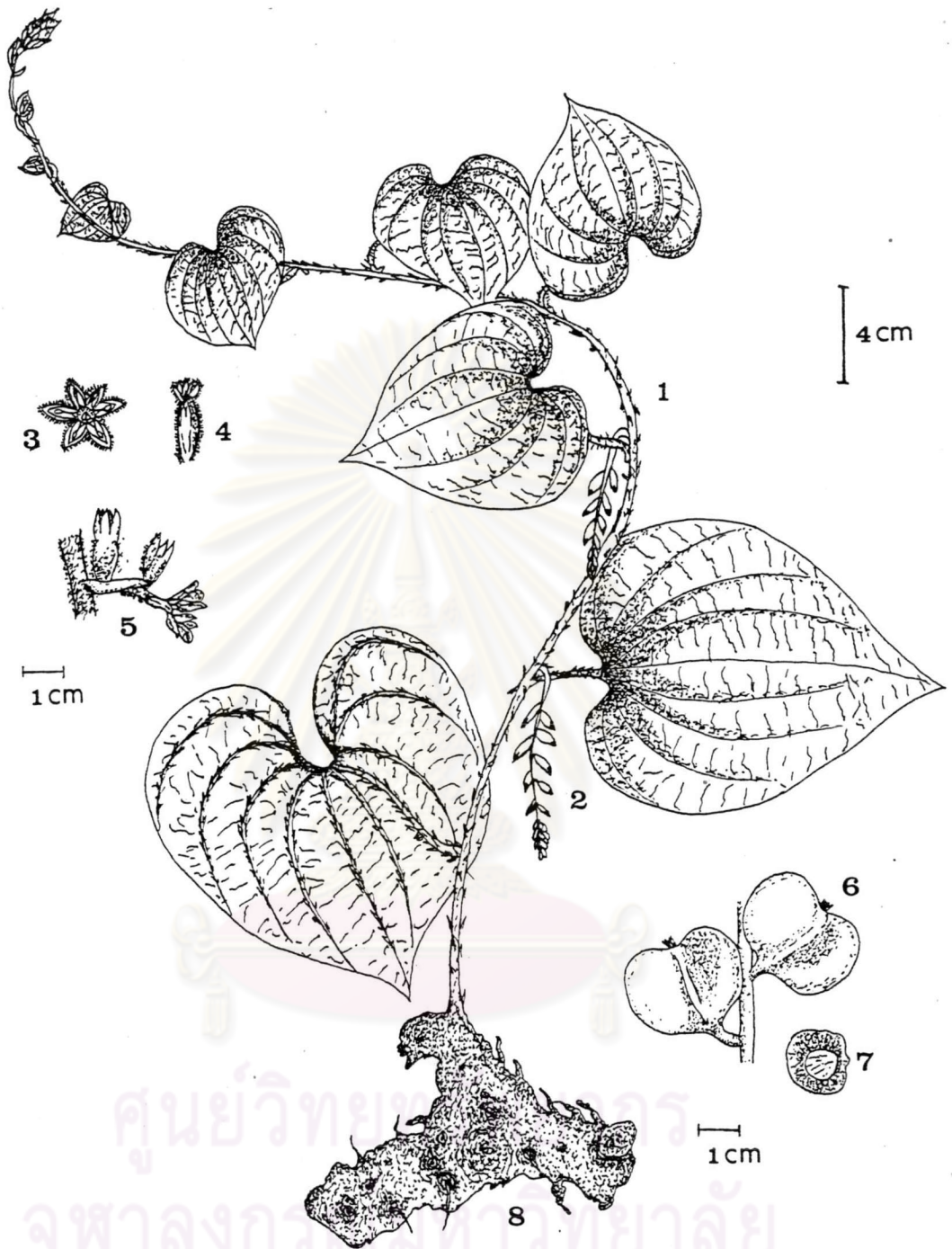


Figure 9 *Dioscorea birmanica* Prain et Burkill.

- | | |
|-------------------------|------------------------------|
| 1. whole plant | 5. male inflorescence (cyme) |
| 2. female inflorescence | 6. fruits |
| 3. staminate flower | 7. seed |
| 4. pistillate flower | 8. rhizome |

Macroscopical Characteristic of the Rhizome of *Dioscorea birmanica*
Prain et Burkill.

The dried rhizome, horizontal, knotted, elongated, often bent and indurate branched, up to 30 cm long and 2-7 cm in diameter, tough filiform rootlets or thorn-like root remained in circular projections, outer surface cracked as a tessellated appearance, externally grayish-brown, internally orangish-brown or brown, fracture brittle, light, odour indistinct, taste slightly bitter. The fresh rhizome spongy and heavy, internally pale red. (see Figure 10)

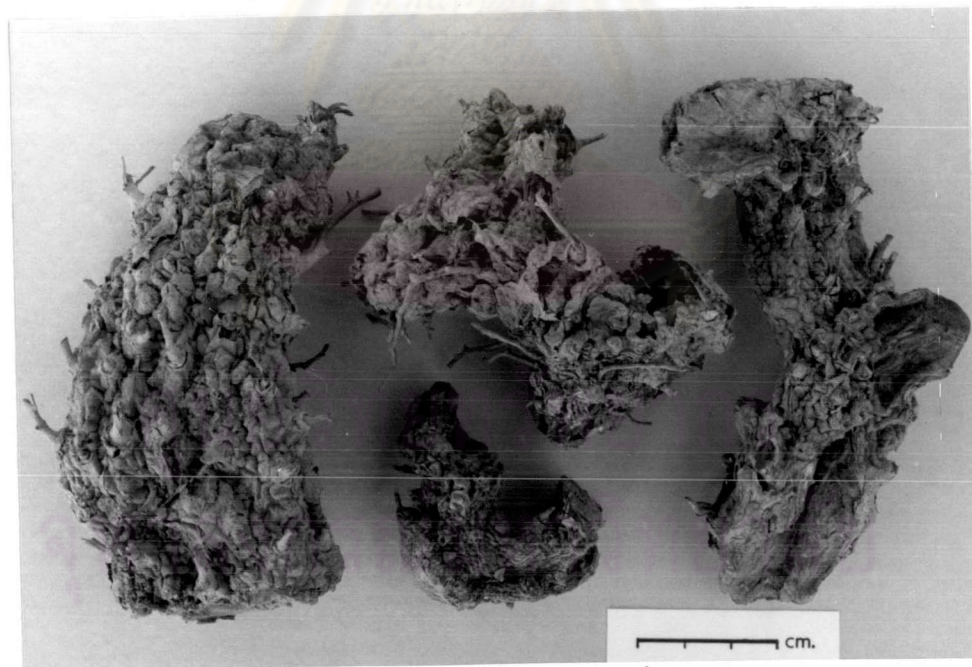


Figure 10 Dried Rhizomes of *Dioscorea birmanica* Prain et Burkill.

Microscopical Characteristic of the Rhizome of *Dioscorea birmanica*
Prain et Burkill.

Histology (see Figure 11, page 58)

Transverse sections of the rhizome show the following features :

1. Hypodermis, are compactly arranged, consisting of 3-4 layers of spheroidal thick-walled parenchyma cells.
2. Cork, composed of several layers of rectangular cells.
3. Cortex, consisting of a region of round somewhat oval-shaped parenchyma cells separated by intercellular spaces, idioblasts containing raphide bundles of calcium oxalate crystals 46-94 microns in length and 1-3 microns in width.
4. Endodermoid layer, the cell is not clearly distinguishable endodermis, separates the cortex from the stele.
5. Stele, the broadest zone composing of moderately thicken, polygonal elongated parenchyma cell, the scattered vascular bundle is distinguishable by the outer one is small, the inner one is larger, composing of phloem and two large vessels, possessing groups of bordered pit tracheids 19-21 microns in diameter, reticulate and spiral vessels 8-8.5 microns in diameter. The small starch granules are single and compound with two, three or more, 3-14 microns in diameter.

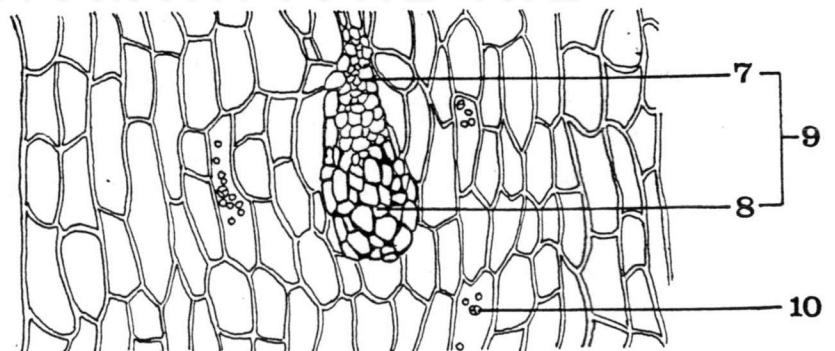
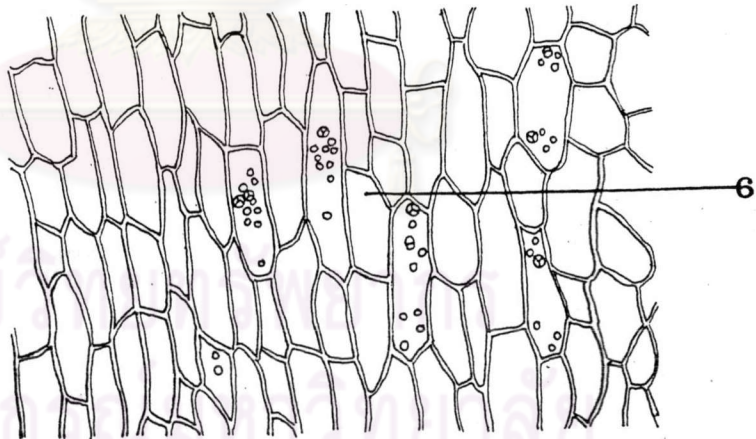
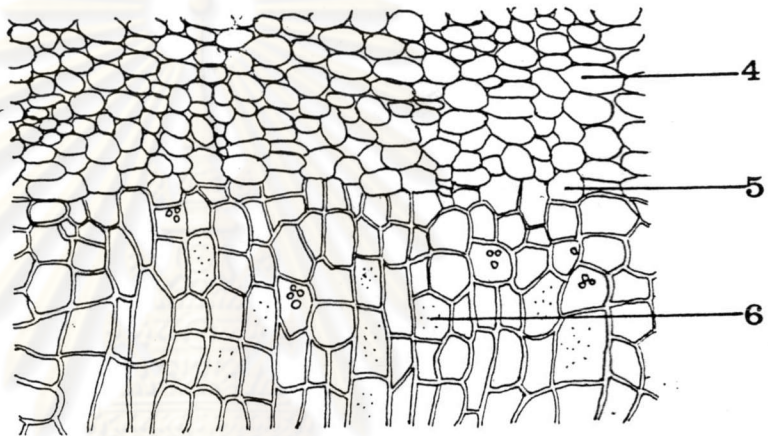
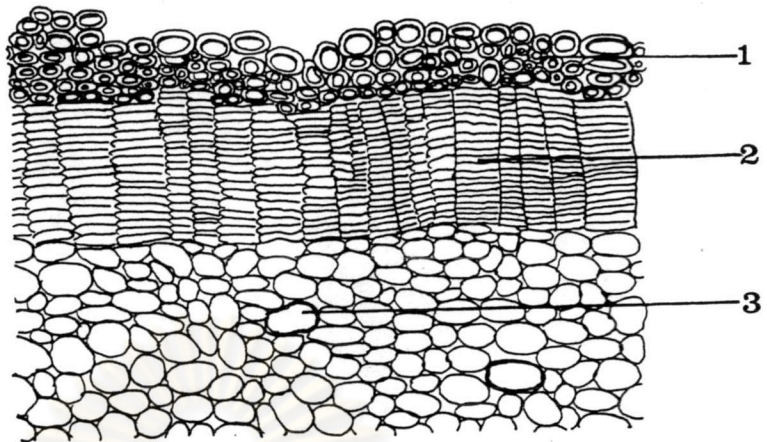
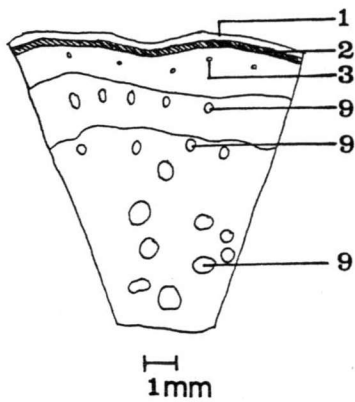


Figure 11
 Transverse Section
 of the Rhizome of
Dioscorea birmanica
 Prain et Burkill

- 1. hypodermis
- 2. cork
- 3. idioblast
- 4. parenchyma
- 5. endodermoid
- 6. thick-walled parenchyma
- 7. phloem
- 8. vessel
- 9. vascular bundle
- 10. starch granules

0.2 mm

Powdered Drug (see Figure 12, page 60)

The powder is grayish brown, slightly bitter taste, indistinct odour, showing the following diagnostic features :

1. The fairly abundant starch granules, mainly simple and rather small, spherical to slightly, polyhedral, compound granules, also occur with two, three, four or more components with a small point hilum.

2. The abundant thin-walled parenchymatous cells of the cortex contain starch granules, the cells polygonal to rectangular in transverse sectional view.

3. The abundant parenchyma cells of the stele, are polygonal to round in outline with moderately thickened, pitted walls.

4. The vessels, which occur singly or more usually in small groups, lignified, mostly pitted or bordered pits.

5. The fibrous cells of the vascular bundle compose of longitudinally elongated cells, thickening and lignified walls.

6. The sclereids, usually occur singly, individual cell long rectangular with moderately thickened walls, numerous large, and conspicuous pits.

7. The fairly large acicular crystals of calcium oxalate, are found mostly in bundles.

8. The reddish-brown masses.

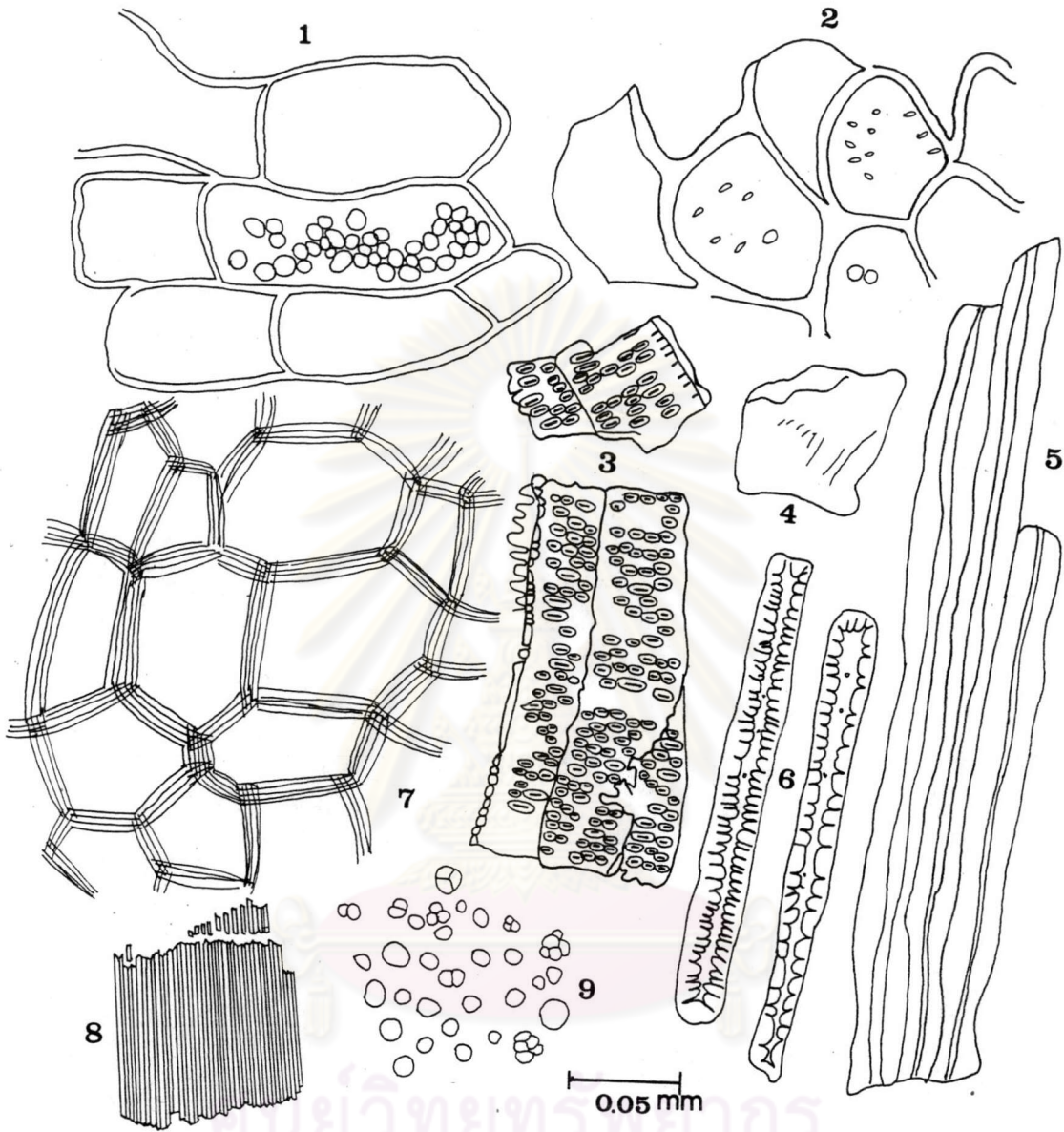


Figure 12 Powdered drug of the rhizome of *Dioscorea birmanica* Prain et Burkill

- | | |
|---|-----------------------------------|
| 1. thin-walled parenchyma
with starch granules | 6. sclereids |
| 2. thickened wall with
pitted cells | 7. surface view of
cork cells |
| 3. bordered pitted vessel | 8. raphides of calcium
oxalate |
| 4. brownish masses | 9. starch granules |
| 5. fibers | |

Pygmaepremna herbacea (Roxb.) Mold.

- Family : Verbenaceae (67)
- Synonyms : *Premna herbacea* Roxb. (67)
 : *Premna gandaria* Hamilton (67)
 : *Clerodendron humile* Hamilton ex Wall (67)
 : *Tatea subacaulis* F. Muell. (67)
 : *Pygmaepremna humilis* Merr. ex Moldende. (67)
 : *Pygmaepremna obovata* Merr. (67)
 : *Pygmaecopremna herbacea* (Roxb.) Mold. ex Saxena (67)
- Other names : Siritekku, Shirutek, Bhumi jambu, Kada met, Kamraj, Nela nivedu and Huniyan (67).
- Thai vernacular names : Khaang hua lek (ขางหัวเล็ก), Phaen din yen (แผนดินเย็น) Som kang (ส้มกั้ง) (7)
- Distribution : Widely distributed from Burma, southern China, Thailand, and Indo-China to the Philippines, Indonesia and New Guinea to Australia. It is said to be cultivated in India and Ceylon (67).
- Ecology : It is a pyrogenous species, supposedly permanently dwarfed and forced to survive by subterranean stems by periodic jungle or grassland-fires over long periods of time. It is often found in hard, stiff, dry soils in open barren places (67).

Ethnobotany

: It has been used as medicine in India and Ceylon, the part used is root, and rhizomatous stem is also involved. The juice is described as " hot, bitter, pungent and digestive " and has been used in the treatment of dropsy, cough, phlegm, asthma, fever and rheumatism, as well as, in Bihar for atrophy emaciation, cachexia, and cholera. The root juice is mixed with juice of ginger and warm water in the treatment of asthma and it enters into the composition of several medicines used to treat lung ailments (67).



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Description of *Pygmaeopremna herbacea* (Roxb.) Mold.

Dwarf or very small subshrub or undershrub, often forming extensive colonies in open ground, with a long woody taproot ; stems rhizomatous, annual, aerial, 2-30 cm tall, glabrous or subglabrous ; leaves few, decussate-opposite, bright green above, very pale beneath, 1-3 pairs (usually only 4) or crowded in a rosette-like whorl at the much abbreviated branch apex, sessile or subsessile, all subequal in size or the uppermost smaller, submembranous-chartaceous, obovate, 2.5-15 cm long, 1.5-7.7 cm wide, apically obtuse, basally cuneate, glabrous on both surfaces, microscopically dotted above, or puberulent on the venation above and pubescent or villous beneath with soon deciduous hairs, often nigrescent in drying; inflorescence cymose, corymbiform, terminal or pseudoterminal in the uppermost leaf-axils, mostly solitary, trichotomous, 2-4 cm long, 1.5-4 cm wide, rather densely flowered ; peduncles absent or 0.7-3.7 cm long ; flowers small, purple in bud, fragrant ; calyx cupuliform, pale green, somewhat 2-lipped, 1-2.5 mm long, 2 mm wide, sparsely and closely pubescent externally, the rim ciliate, subequally and obtusely 5-toothed or the upper lip 3-toothed, the lower lip 2-toothed, the teeth ovate ; corolla hypocrateriform, varying from yellow or pale yellow to yellowish-purple, cream, white, greenish-white, or greenish, 2.5-4 mm across, the tube subinfundibular, 1.5-3 mm long, externally glabrous on the lower portion and pubescent above, barbate - pubescent in the throat, the limb obscurely or conspicuously 2-lipped, externally pubescent, the lower lip often white, yellow at the base, the lobes 4, of which 2 are about 1.5 mm long and the other 2 only 1 mm long; stamens 4, included,

didynamous but reaching the same height; filaments very short, less than 1 mm long ; anthers about 0.5 mm long ; style short, 0.7-1 mm long, included; stigma very minutely bifid ; ovary globose, 0.7-1 mm in diameter, glabrous, apically glandular - punctate ; fruit drupaceous, globose, 5-10 mm in diameter, at first green, finally black, fleshy, glossy, seated on a slightly enlarged and persistent fruiting-calyx, 1-4 chambered, 1-4 seeded (67).(see Figure 13, page 65)



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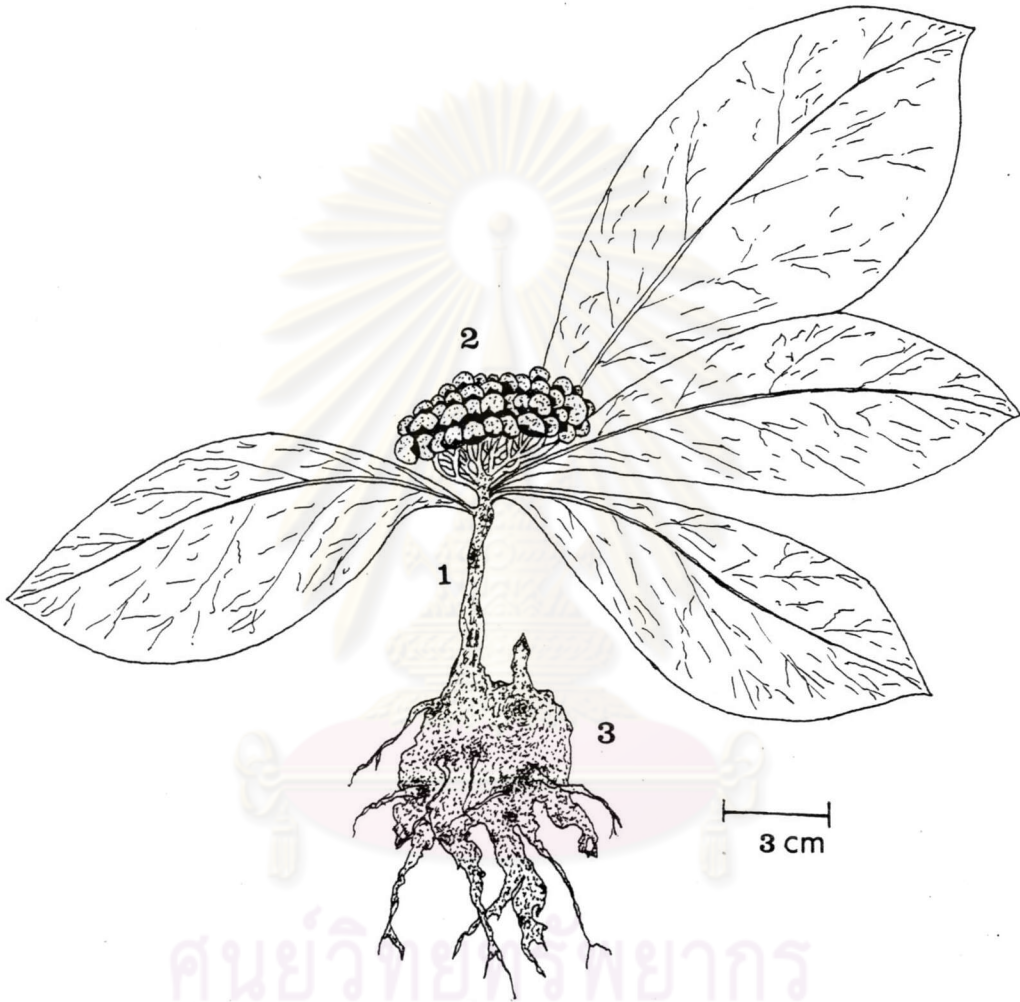


Figure 13 *Pygmaeopremna herbacea* (Roxb.) Mold.

1. whole plant
2. fruits
3. rhizome

Macroscopical Characteristic of the Rhizome of *Pygmaeopremna herbacea* (Roxb.) Mold.

The dried rhizome, rather small, branched, longitudinal, tuberculated, up to 7 cm long, 1-3 cm wide in diameter, the outer surface somewhat smooth or having some root scars, grayish-white in colour, the fractured face yellowish white to yellow, the smoothed transversed surface exhibits one or two cambium line surrounding a central brownish pith, fracture hard and short, odour indistinct, taste insipid. (see Figure 14)

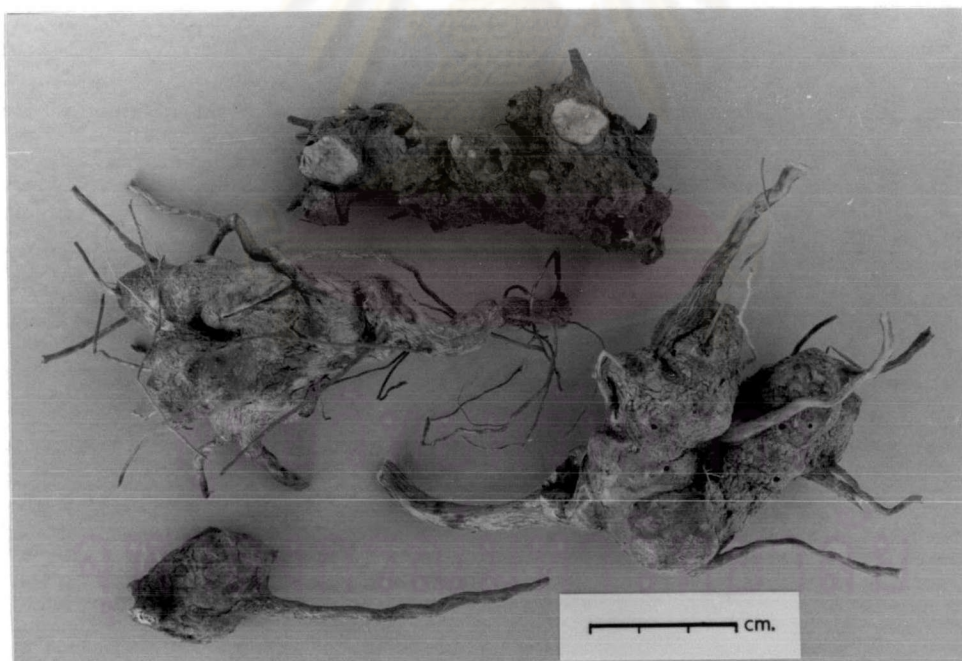


Figure 14 Dried Rhizomes of *Pygmaeopremna herbacea* (Roxb.) Mold.

Microscopical Characteristic of the Rhizome of *Pygmaeopremna herbacea*
(Roxb.) Mold.

Histology

I Transverse sections of the rhizome passing through the xylem part show the following features : (see Figure 15.1, page 69)

1. Cork, composed of several layers of rectangular cells

2. Cortex, consisting of two zones

2.1 an outer region of several layers of narrow thin walled cells usually found clusters of small prism crystals of calcium oxalate, 6 - 24 microns in length, 3 - 6 microns in width.

2.2 a broad zone of larger, thick and lignified walled cortical parenchyma cells are rectangular to polygonal.

The numerous starch granules usually found in parenchymatous cell mostly simple and small are 5 - 16 microns in diameter.

3. Endodermis, the innermost layer of cells of the cortex, the cell is rectangular, can be distinguishable from the parenchyma cell.

4. Xylem, a zone of elongated radially arranged xylem patches, separates from each other by 1-2 rows of medullary rays which are continuous through the pith. Each xylem patch consists of a matrix of starch and wood parenchyma imbedded in which are small pitted and compact groups of thick-walled fiber.

5. Pith, a central zone of parenchyma, the thin-walled phloem cell imbedded in the pith.

II Transverse sections of the rhizome show the following features : (see Figure 15.2, page 70)

The cortex and endodermis region are similar to the section passing through the xylem patch and pith. The sclerenchyma bundle is 100-590 microns in diameter, composing of sclerenchyma cell with pitted wall, commonly found scattered in the round parenchyma instead of the xylem region.



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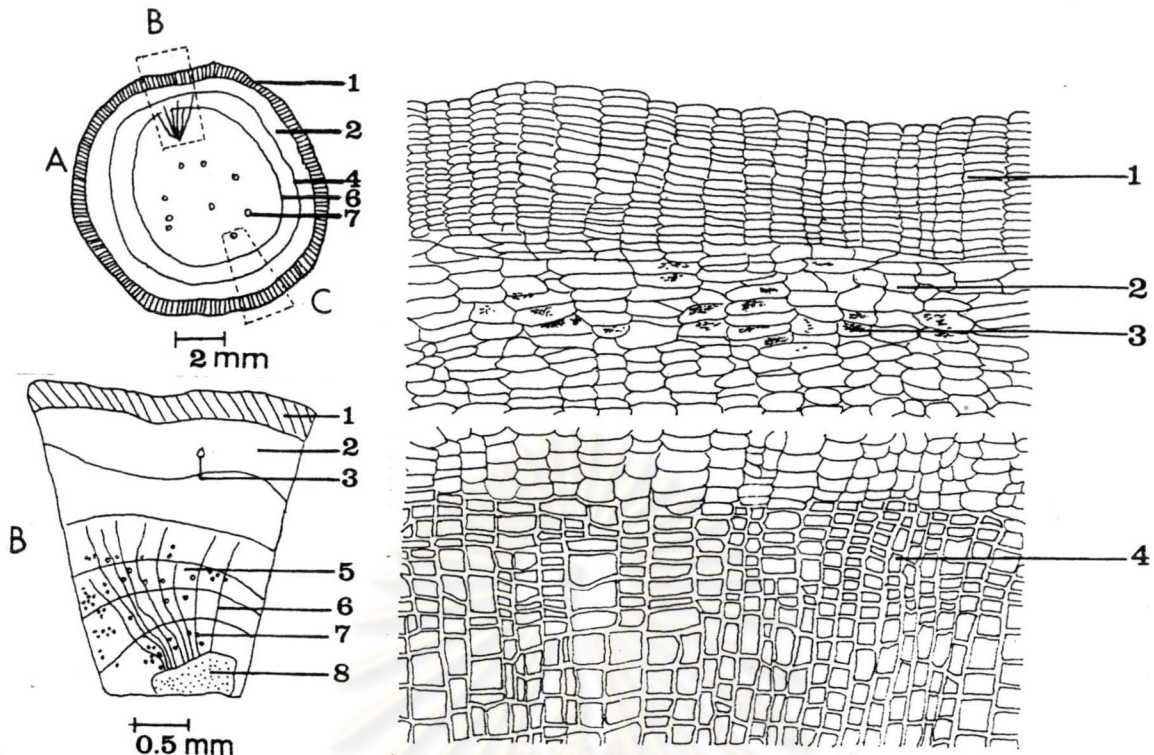
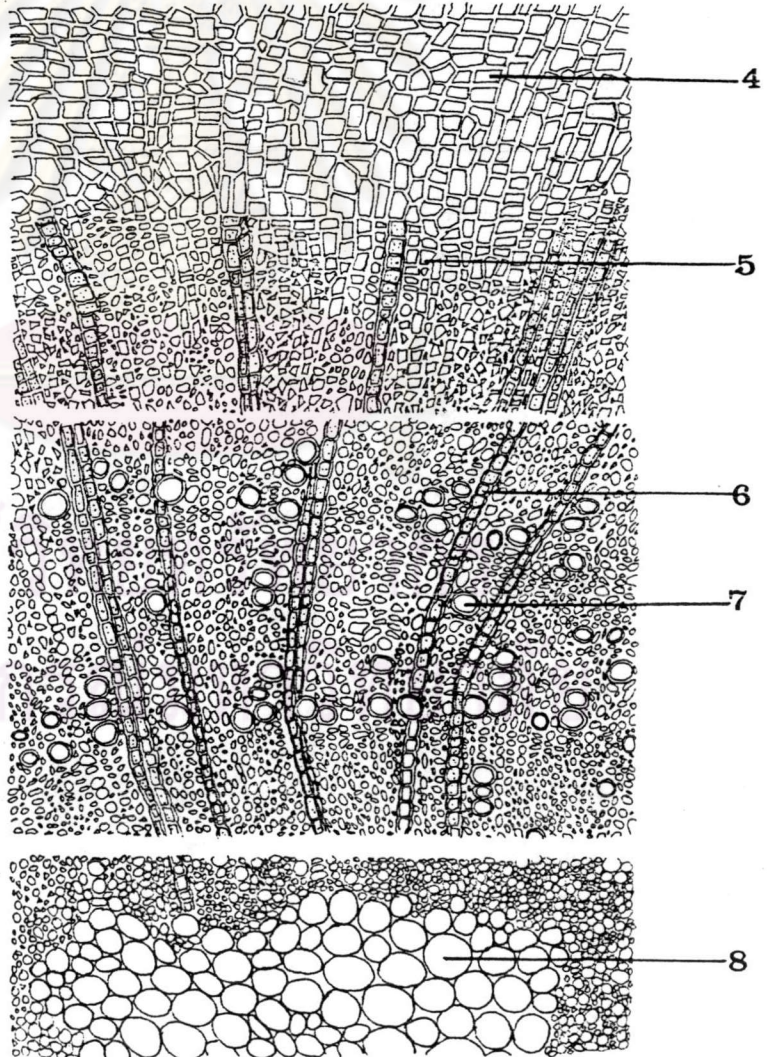


Figure 15.1
 Transverse Section
 of the Rhizome of
Pygmaeopremna herbacea
 (Roxb.) Mold. passing
 through the xylem

- 1. cork
- 2. cortex
- 3. cluster crystal of calcium oxalate
- 4. thick-walled parenchyma
- 5. xylem
- 6. medullary ray
- 7. vessel
- 8. pith

Diagram
 A = whole rhizome
 B = a part of rhizome
 C = a part of rhizome passing through xylem



0.2 mm

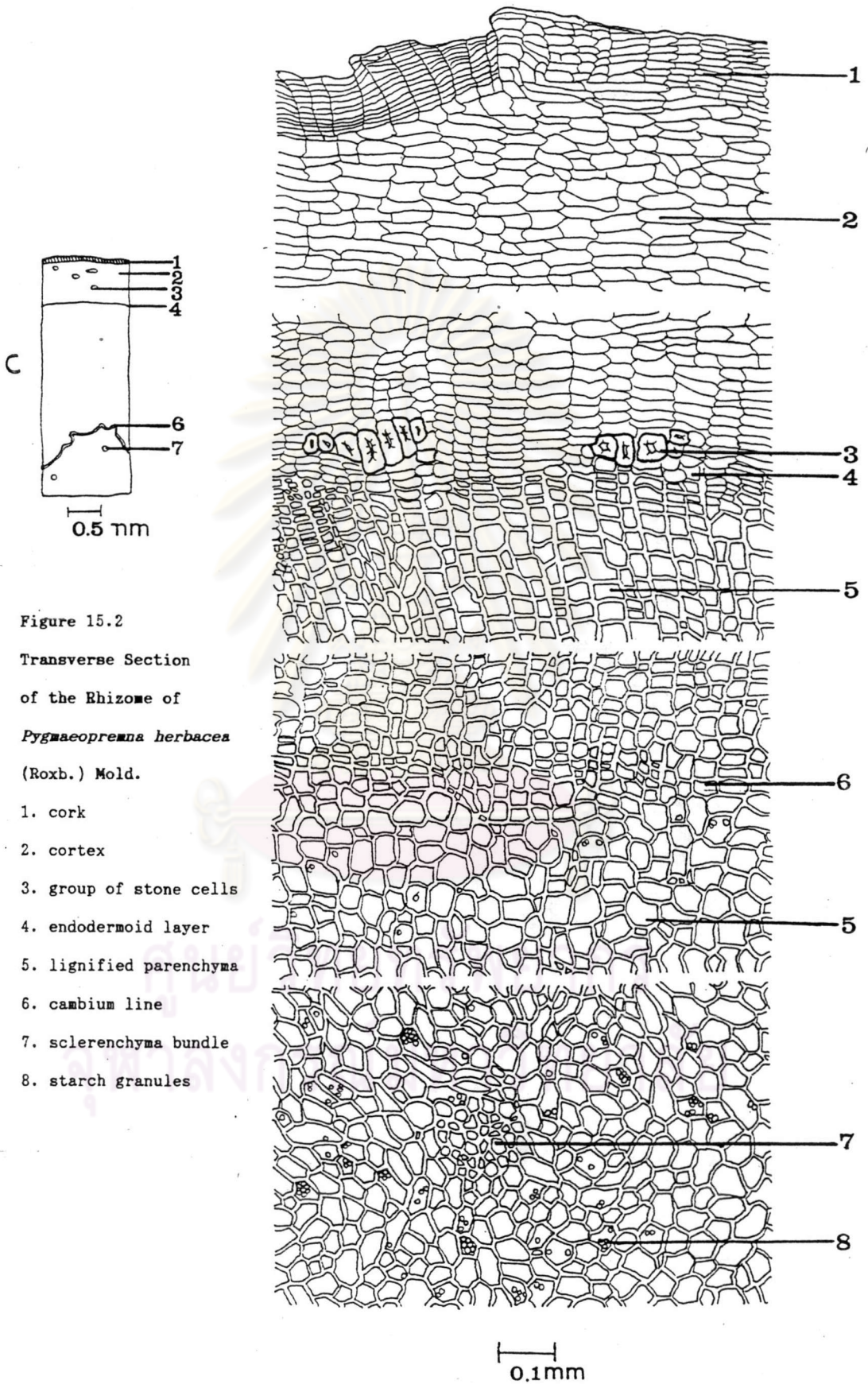


Figure 15.2
 Transverse Section
 of the Rhizome of
Pygmaeopremna herbacea
 (Roxb.) Mold.

1. cork
2. cortex
3. group of stone cells
4. endodermoid layer
5. lignified parenchyma
6. cambium line
7. sclerenchyma bundle
8. starch granules

Powdered Drug (see Figure 16, page 72)

The powder is greenish yellow or brownish yellow insipid taste, indistinct odour, showing the following diagnostic features :

1. The very abundant parenchyma containing starch granules, the majority of the cells are slightly thickened and lignified with numerous distinct pits.

2. The abundant starch granules, are mostly simple and rather small, a few compound granules occur with two and three components. Individual granules are small, spherical to ovoid and mostly show a round or slit-shaped hilum.

3. The thin-walled parenchyma of the cortex, containing crystals of calcium oxalate.

4. The stone cells, which found in small group, are more or less isodiametric and the wall heavily thickened with bordered pits.

5. The fragments of light brown cork, composed of thin-walled lignified cells, are polygonal and elongate in surface view.

6. The occasional sclereid, which are singly, individual cell elongated rectangular in outline and moderately thickened and pitted wall, found singly.

7. The infrequent fiber, found singly or in groups, are moderately and evenly thickened wall.

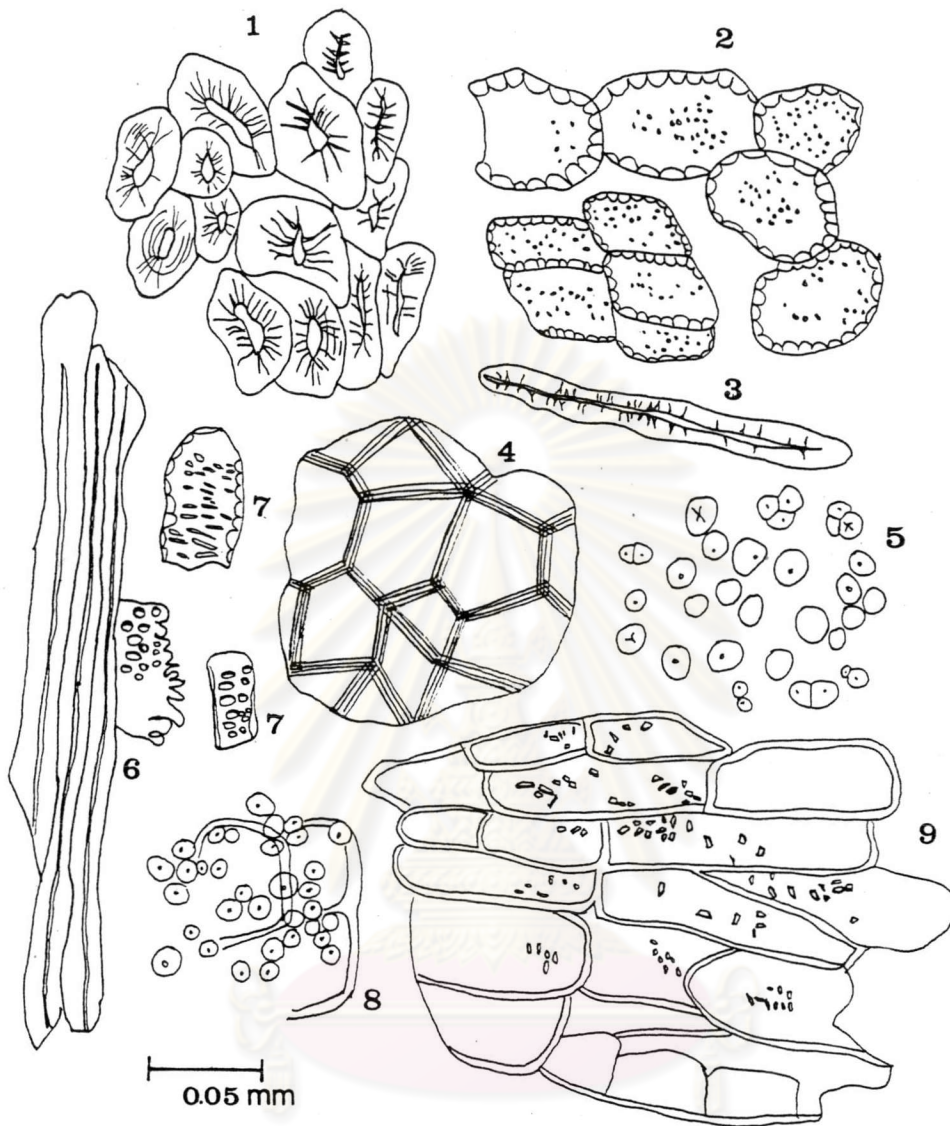


Figure 16 Powdered drug of *Pygmacopremna herbacea* (Roxb.) Mold.

- | | |
|--|---|
| 1. group of stone cells | 6. pitted vessels associated with fibers |
| 2. thickened wall with pitted parenchyma | 7. pitted vessels |
| 3. sclereid | 8. parenchyma containing starch granules |
| 4. surface view of cork cells | 9. parenchyma containing cluster crystal of calcium oxalate |
| 5. starch granules | |

Comparison of morphological, macroscopical, microscopical characteristics of the four authentic plants are shown in Table 3, Table 4 (page 74), Table 5 (page 75-76)

Table 3 Comparison of Morphological Characteristic of the *Smilax glabra* Roxb., *S. corbularia* Kunth, *Dioscorea birmanica* Prain et Burkill and *Pygmaeoprenna herbacea* (Roxb.) Mold.

Elements	<i>S. glabra</i>	<i>S. corbularia</i>	<i>D. birmanica</i>	<i>P. herbacea</i>
Stem	climber, smooth	climber, woody smooth	climber, scattered prickles	undershrub, small
Leaf : type	simple, alternate	simple, alternate	simple, alternate	simple, opposite
form	lanceolate oblong-ovate	elliptic, ovate, oblong	cordate, broadly cordate	obovate, oblong
size	5-18 x 2-7 cm	3-10 x 1.5-5 cm	upto 15 cm long, 16 cm wide	upto 13 cm long, 6.5 cm wide
apex	acuminate	obtuse, acuminate	acute, acuminate	acute
base	contracted, rounded	cuneate, rounded	cordate	attenuate
texture	coriaceous	coriaceous	membranous	chartaceous
vein	palmately vein, 5	palmately vein, 5	palmately vein, 7-11	palmately vein, 5
Petiole	long, straight, sheathing 1-2 cm	short, bent, upward 0.7-1.5 cm	prickles, pubescent 4.5-9 cm	very short 0.2-0.4 cm
Tendril	present	present	absent	absent
Flower	unisexual	unisexual	unisexual	bisexual
type	umbel	umbel	male-cyme, female- spike	corymb corolla-greenish white
Fruit	berry	berry	capsule	drupe

Table 4 Comparison of Macroscopical Characteristic of the *Smilax glabra* Roxb., *S. corbularia* Kunth, *Dioscorea birmanica* Prain et Burkill and *Pygmaeoprenna herbacea* (Roxb.) Mold.

Elements	<i>S. glabra</i>	<i>S. corbularia</i>	<i>D. birmanica</i>	<i>P. herbacea</i>
Rhizome :				
shape	horizontal, tortuous, irregular-cylindrical	branched, woody tortuous	horizontal, knotted, elongated with thorn-like root	branched, longitudinal, tuberculate
size	5-25 cm long 1.5-6 cm in diameter	upto 12 cm long 3-4 cm in diameter	upto 30 cm long 2-7 cm in diameter	upto 7 cm long 1-3 cm in diameter
Colour :				
external	reddish brown to brown	reddish brown to dark brown	grayish brown, orangish brown to brown	grayish yellow
Fracture	hard, tough, mealy	very hard, tough	brittle, light	hard, short, tough
Odour	indistinct	indistinct	indistinct	indistinct
Taste	starchy	starchy	slightly bitter	insipid

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Table 5 Comparison of Microscopical Characteristic of the *Smilax glabra* Roxb., *S. corbularia* Kunth, *Dioscorea birmanica* Prain et Burkill and *Pygmaeoprenna herbacea* (Roxb.) Mold.

Elements	<i>S. glabra</i>	<i>S. corbularia</i>	<i>D. birmanica</i>	<i>P. herbacea</i>
Hypodermis	present	present	present	absent
Cork	absent	absent	present	present
Cortex :				
Starch granules :				
type	simple, compound	simple, compound	simple, compound	simple, compound
size	large (8-68 μ)	rather large (8-27 μ)	small (3-14 μ)	rather small (5-16 μ)
shape	round with radiate hilum	round with radiate hilum	round with small point hilum	round with small point hilum
Crystals of calcium oxalate :				
type	raphides (acicular crystals in bundle)	raphides (acicular crystals in bundle)	raphides (acicular crystals in bundle)	small prisms
size	35-85 μ long 1-3 μ wide	55-80 μ long 1-3 μ wide	45-95 μ long 1-3 μ wide	6-20 μ long 3-7 μ wide
Stone cell	few	few	none	much
Sclereid	few	few	much	few
Endodermis	not distinguishable	not distinguishable	endodermoid	distinguishable
Stele	present	present	present	absent
Vascular bundle	present	present	present	absent
	scattered	scattered	scattered	wood xylem region
	collateral fibro - vascular	collateral fibro - vascular	collateral fibro - vascular	

Table 5 continued

Elements	<i>S. glabra</i>	<i>S. corbularia</i>	<i>D. birmanica</i>	<i>P. herbacea</i>
Vessel :				
type	reticulate, scalariform, scalariformly-pitted, pitted	reticulate, scalariform, scalariformly-pitted, pitted	reticulate, bordered pitted	bordered pitted,
size	16-65 μ	13-45 μ	19-55 μ	13-32 μ
Fiber	few	few	much	much
Brownish masses	few	much	few	absent
Pith	not distinguishable	not distinguishable	not distinguishable	clearly

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Crude Drug of Khaao-Yen-Nuea Khaao-Yen-Tai in Commercial Market

Crude drugs of Khaao-Yen-Nuea Khaao-Yen-Tai were investigated in market as commercial sources (see Table 6, page 78-79), they were available in four main types. (see Figure 17)



Figure 17 Four Main Types of Crude Drugs of
Khaao-Yen-Nuea Khaao-Yen-Tai in Commercial Market

1. Thai-Smilax type
2. Dioscorea type
3. Pygmaepremna type
4. Chinese-Smilax type

Table 6 List of Crude Drugs Sold in Commercial Markets under the Name "Khao-Yen-Nuea",
"Khao-Yen-Tai", "Khao-Yen" and the Authentic Samples

Sample No.	Crude Drug Name	Traditional Drug Store/Place	Province
1	Ya Hua (ยาหัว)	Mo Waeo (หมอแวว)	Loei (เลย)
2	Khao-Yen-Nuea (ข้าวเย็นเหนือ)	Doi Suthep (ดอยสุเทพ)	Chiang Mai (เชียงใหม่)
3	Khao-Yen-Tai (ข้าวเย็นใต้)	Chanthaburi Medicinal Plant Garden (สวนสมุนไพรจันทบุรี)	Chanthaburi (จันทบุรี)
4	Khon-Kra-Tae (ค้อนกระแต)	Bunsan Osot (บุนสันทอสด)	Ubon Ratchathani (อุบลราชธานี)
5	Khon-Kra-Tae (ค้อนกระแต)	Mo Wet-Suchada (หมอเวทสุชาดา)	Ubon Ratchathani (อุบลราชธานี)
6	Khao-Yen-Chin (ข้าวเย็นจีน)	Wetchaphong (เวชชงษ์)	Bangkok (กรุงเทพฯ ๙)
7	Khao-Yen-Nuea & Khao-Yen-Tai (ข้าวเย็นเหนือ-ข้าวเย็นใต้)	Chao Kron Pua (เจ้ากรมเปือ)	Bangkok (กรุงเทพฯ ๙)
8	Khao-Yen-Tai (ข้าวเย็นใต้)	Ngi-Tien-Ong (เง็กเทียนอึ้ง)	Songkla (สงขลา)
9	Khao-Yen-Nuea (ข้าวเย็นเหนือ)	Wetchaphong (เวชชงษ์)	Bangkok (กรุงเทพฯ ๙)
10	Khao-Yen-Tai (ข้าวเย็นใต้)	Wetchaphong (เวชชงษ์)	Bangkok (กรุงเทพฯ ๙)
11	Khao-Yen-Daeng (ข้าวเย็นแดง)	Ngaun-Heng-Chan (ง่วนเฮงจีน)	Bangkok (กรุงเทพฯ ๙)
12	Khao-Yen-Khao (ข้าวเย็นขาว)	Ngaun-Heng-Chan (ง่วนเฮงจีน)	Bangkok (กรุงเทพฯ ๙)
13	Khao-Yen-Nuea (ข้าวเย็นเหนือ)	Wat Mahathat (วัดมหาธาตุ)	Bangkok (กรุงเทพฯ ๙)
14	Khao-Yen-Luang (ข้าวเย็นเหลือง)	Wat Mahathat (วัดมหาธาตุ)	Bangkok (กรุงเทพฯ ๙)
15	Khao-Yen (ข้าวเย็น)	Suan Chatuchat (สวนจตุจักร)	Bangkok (กรุงเทพฯ ๙)
16	Khao-Yen-Nuea & Khao-Yen-Tai (ข้าวเย็นเหนือ-ข้าวเย็นใต้)	Pho Pra-dit (โพธิ์ประดิด)	Bangkok (กรุงเทพฯ ๙)
17	Khao-Yen-Daeng (ข้าวเย็นแดง)	Ayuravet (อายุรเวท)	Bangkok (กรุงเทพฯ ๙)
18	Khao-Yen-Khao (ข้าวเย็นขาว)	Ayuravet (อายุรเวท)	Bangkok (กรุงเทพฯ ๙)
19	Khao-Yen-Nuea (ข้าวเย็นเหนือ)	Va-Rin Osot (วารินทร์โอสด)	Phichit (พิจิตร)
20	Khao-Yen-Khok (ข้าวเย็นดอก)	Va-Rin Osot (วารินทร์โอสด)	Phichit (พิจิตร)
21	Khao-Yen-Nuea (ข้าวเย็นเหนือ)	Mo Pud (หมอปุด)	Songkla (สงขลา)
22	Khao-Yen-Tai (ข้าวเย็นใต้)	Mo Pud (หมอปุด)	Songkla (สงขลา)

Table 6 continued

Sample No.	Crude Drug Name	Traditional Drug Store/Place	Province
23	Khaao-Yen-Nuea (ข้าวเย็นเหนียว)	Ngi-Tien-Ong (เง็กเทียนอึ้ง)	Songkla (สงขลา)
24	Khaao-Yen-Tai (ข้าวเย็นโต)	Chanthaboon (จันทบูรณ์)	Chanthaburi (จันทบุรี)
25	Khaao-Yen-Nuea (ข้าวเย็นเหนียว)	Chanthaboon (จันทบูรณ์)	Chanthaburi (จันทบุรี)
26	Khaao-Yen-Nuea (ข้าวเย็นเหนียว)	Chai Langka (ชัยลังกา)	Chiang Mai (เชียงใหม่)
27	Khaao-Yen-Tai (ข้าวเย็นโต)	Chai Langka (ชัยลังกา)	Chiang Mai (เชียงใหม่)
28	Khaao-Yen-Nuea (ข้าวเย็นเหนียว)	Ae-di (เอ็ดดี)	Chiang Mai (เชียงใหม่)
29	Khaao-Yen-Tai (ข้าวเย็นโต)	Ae-di (เอ็ดดี)	Chiang Mai (เชียงใหม่)
30	Khaao-Yen-Nuea & Khaao-Yen Tai (ข้าวเย็นเหนียว-ข้าวเย็นโต)	Tang-Nguan-Seng (ตั้งวงวันเซ็ง)	Bangkok (กรุงเทพฯ ๖)
31	Khaao-Yen-Nuea (ข้าวเย็นเหนียว)	Sai Ngan (ทรายงาม)	Chanthaburi (จันทบุรี)
32	Khaao-Yen-Tai (ข้าวเย็นโต)	Sai Ngan (ทรายงาม)	Chanthaburi (จันทบุรี)
33	Khaao-Yen-Nuea (ข้าวเย็นเหนียว)	Thai-An-Chan (ไถอันจัน)	Bangkok (กรุงเทพฯ ๖)
34	Khaao-Yen-Tai (ข้าวเย็นโต)	Thai-An-Chan (ไถอันจัน)	Bangkok (กรุงเทพฯ ๖)
35	Khaao-Yen-Nuea (ข้าวเย็นเหนียว)	Thai-Hua-Chan (ไถฮัวจัน)	Bangkok (กรุงเทพฯ ๖)
36	Khaao-Yen-Tai (ข้าวเย็นโต)	Thai-Hua-Chan (ไถฮัวจัน)	Bangkok (กรุงเทพฯ ๖)
37	Khaao-Yen-Nuea & Khaao-Yen-Tai (ข้าวเย็นเหนียว-ข้าวเย็นโต)	Suan Chatuchat (สวนจตุจักร)	Bangkok (กรุงเทพฯ ๖)
38	Ya Hua (ยาหัว)	Mo Wet Suchada (หมอเวทสุชาติดา)	Ubon Ratchabani (อุบลราชธานี)
39	Khaao-Yen-Chin (ข้าวเย็นจีน)	Cha-loen-khet Pharmacy (เฉลิมเขตค้ำมารี)	Bangkok (กรุงเทพฯ ๖)
40	Khaao-Yen-Nuea (ข้าวเย็นเหนียว)	Wang Nan Yen (วังน้ำเย็น)	Prachinburi (ปราจีนบุรี)
41	Khaao-Yen-Tai (ข้าวเย็นโต)	Wang Nan Yen (วังน้ำเย็น)	Prachinburi (ปราจีนบุรี)
42	Khaao-Yen-Nuea (ข้าวเย็นเหนียว)	Chi-An Osot (ฉิมอันโสถ)	Cha-Choeng-Sao (ชะเชิงเสตรา)
43	Khaao-Yen-Tai (ข้าวเย็นโต)	Chi-An Osot (ฉิมอันโสถ)	Cha-Choeng-Sao (ชะเชิงเสตรา)
44	Khaao-Yen-Khok (ข้าวเย็นคอก)	Khao Sup Pradu (เขาน้ำประดู่)	Nakhon Ratchasima (นครราชสีมา)

Table 7 Investigation of Macroscopic Characteristic, Starch granules and Crystals of
 Khaao-Yen-Nuea and Khaao-Yen-Tai Sold in the Market

Sample No.	Macroscopic Appearances of Crude Drugs	Powdered Drug			
		starch granule		crystal	
		type	diameter (μ)	type	size (μ)
1	horizontal, hard, reddish brown	S&C	11-43-65	ra	l 35-85, w 1-3
2	branch, hard, reddish brown	S&C	10-28	ra	l 55-80, w 1-3
3	horizontal, light, grayish brown	S&C	2.5-13.5	ra	l 45-95, w 1-3
4	longitudinal, hard, grayish yellow	S&C	5-16	np	2.5 x 4 - 3 x 15
5	chopped, hard, grayish yellow	S&C	5-14	np	2.5 x 5 - 2.5 x 11
6	sliced thin pieces, white	S&C	11-35	ra	l 110-125, w 1-3
7	chopped, hard, reddish brown	S&C	11-35	ra	l 155-160, w 1-3
8	sliced thin pieces, light, white	S&C	8-43	ra	l 120-131, w 1-3
9	chopped, hard, reddish brown	S&C	16-35	ra	l 83-110, w 1-3
10	chopped, hard, pale brown	S&C	11-43	ra	l 102-110, w 1-3
11	chopped, hard, reddish brown	S&C	11-40	ra	l 91-99, w 1-3
12	chopped, hard, pale brown	S&C	11-35	ra	l 107-123, w 1-3
13	chopped, hard, reddish brown	S&C	16-35	ra	l 60-95, w 1-3
14	chopped, hard, grayish yellow	S&C	15-37	np	2.5 x 2 - 2.5 x 10
15	horizontal, light, grayish brown	S&C	2.5-14	ra	l 50-90, w 1-3
16	chopped, hard, reddish brown	S&C	13-43	ra	l 61-78, w 1-3
17	chopped, hard, reddish brown	S&C	11-43	ra	l 88-96, w 1-3
18	chopped, hard, reddish brown	S&C	13-65	ra	l 72-91, w 1-3
19	chopped, hard, reddish brown	S&C	13-54	ra	l 123-147, w 1-3
20	chopped, hard, grayish yellow	S&C	5-16	np	2.5 x 4 - 3 x 14
21	chopped, hard, reddish brown	S&C	12-65	ra	l 107-134, w 1-3
22	chopped, hard, pale brown	S&C	12-38	ra	l 69-94, w 1-3
23	chopped, hard, reddish brown	S&C	13-42	ra	l 95-110, w 1-3

Table 7 continued

Sample No.	Macroscopic Appearances of Crude Drugs	Powdered Drug			
		starch granule		crystal	
		type	diameter (μ)	type	size (μ)
24	chopped, hard, reddish brown	S&C	13-42	ra	l 45-104, w 1-3
25	sliced pieces, light, grayish brown	S&C	5-16	ra	l 40-85, w 1-3
26	chopped, hard, reddish brown	S&C	9-45	ra	l 61-85, w 1-3
27	chopped, hard, reddish brown	S&C	9-51	ra	l 64-94, w 1-3
28	chopped, hard, reddish brown	S&C	11-51	ra	l 83-126, w 1-3
29	chopped, hard, pale brown	S&C	9-35	ra	l 61-77, w 1-3
30	chopped, hard, reddish brown	S&C	9-46	ra	l 51-85, w 1-3
31	sliced pieces, light, grayish brown	S&C	4-14	ra	l 59-91, w 1-3
32	chopped, hard, reddish brown	S&C	8-39	ra	l 112-139, w 1-3
33	horizontal, hard, dark brown	S&C	13-40	ra	l 69-91, w 1-3
34	chopped, hard, reddish brown	S&C	8-41	ra	l 48-88, w 1-3
35	chopped, hard, reddish brown	S&C	10-54	ra	l 110-136, w 1-3
36	chopped, hard, pale brown	S&C	10-43	ra	l 104-126, w 1-3
37	horizontal, hard, reddish brown	S&C	9-40	ra	l 77-96, w 1-3
38	horizontal, hard, reddish brown	S&C	10-38	ra	l 85-107, w 1-3
39	sliced, thin pieces, light, white	S&C	10-38	ra	l 123-131, w 1-3
40	chopped, hard, reddish brown	S&C	10-40	ra	l 85-99, w 1-3
41	chopped, hard, reddish brown	S&C	11-41	ra	l 77-118, w 1-3
42	chopped, hard, reddish brown	S&C	11-37	ra	l 94-126, w 1-3
43	chopped, hard, grayish yellow	S&C	5-22	mp	2.5 x 5 - 2.5 x 11
44	chopped, hard, gray	S&C	4-24	mp	0.3 x 2.5 - 3 x 16

S&C = simple and compound ra = raphide crystal μ = micron mp = micro prism

l = length w = width

Figure 18 Starch Granules of the Rhizome of Khaao-Yen-Nuea Khaao-Yen-Tai

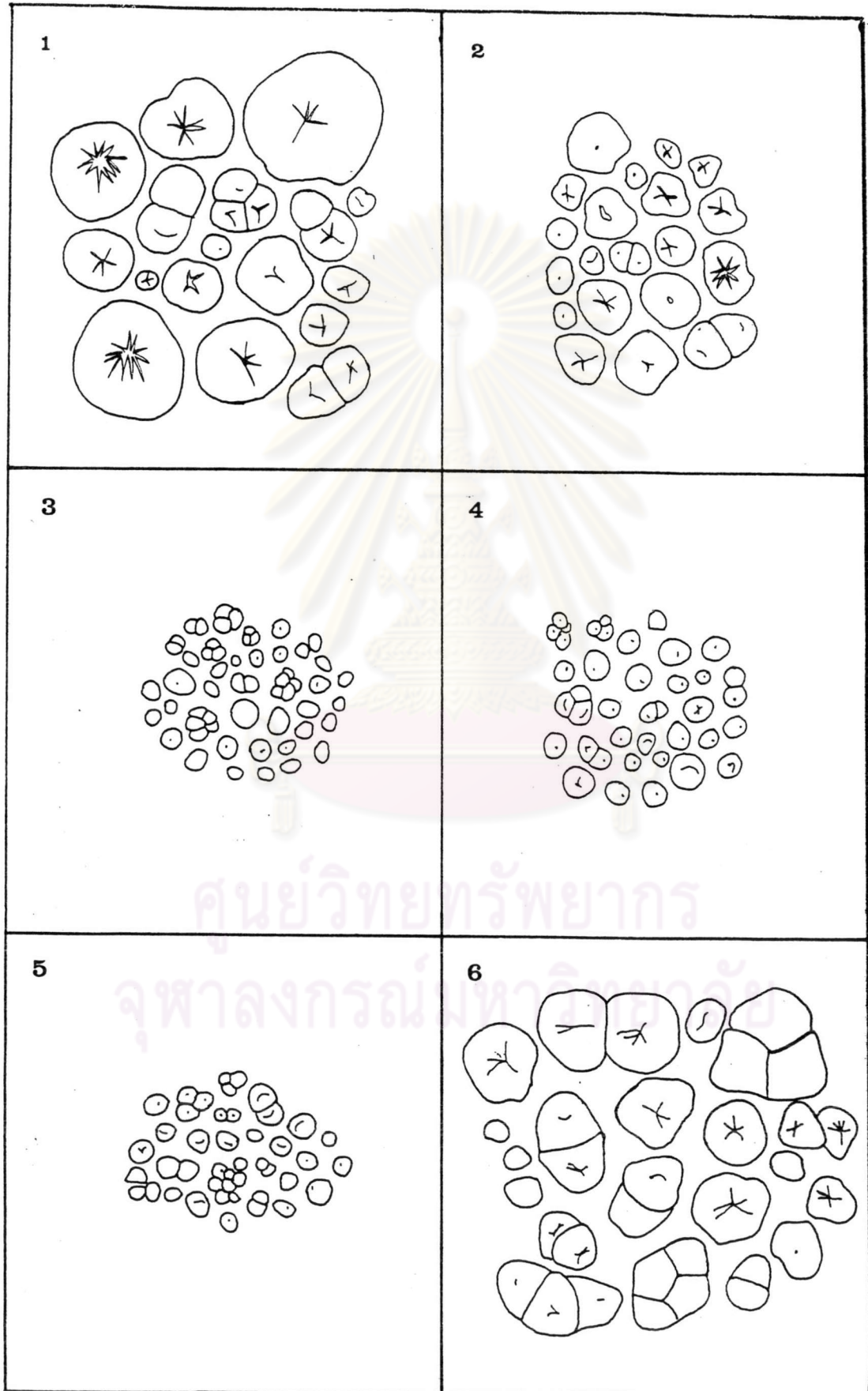
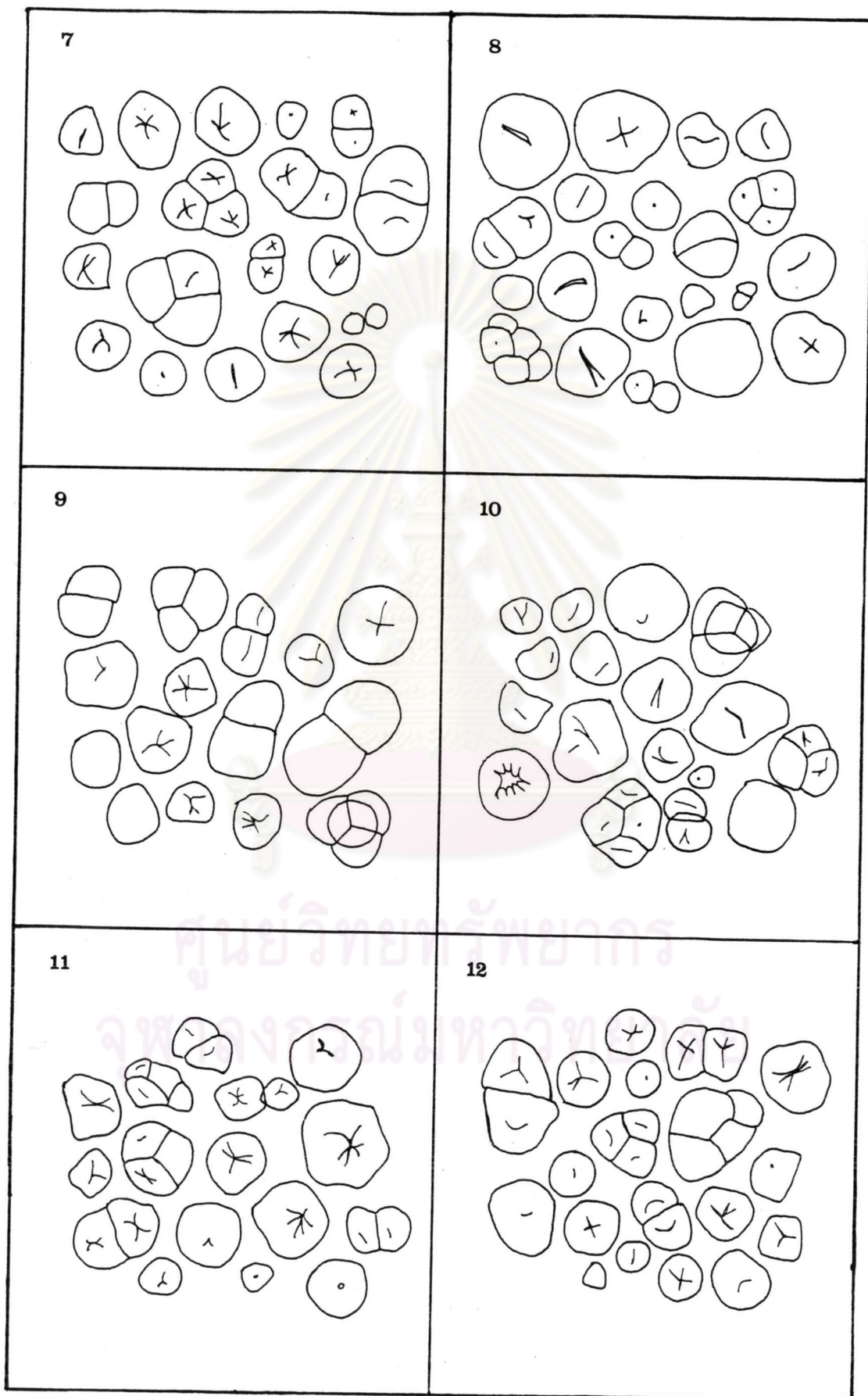
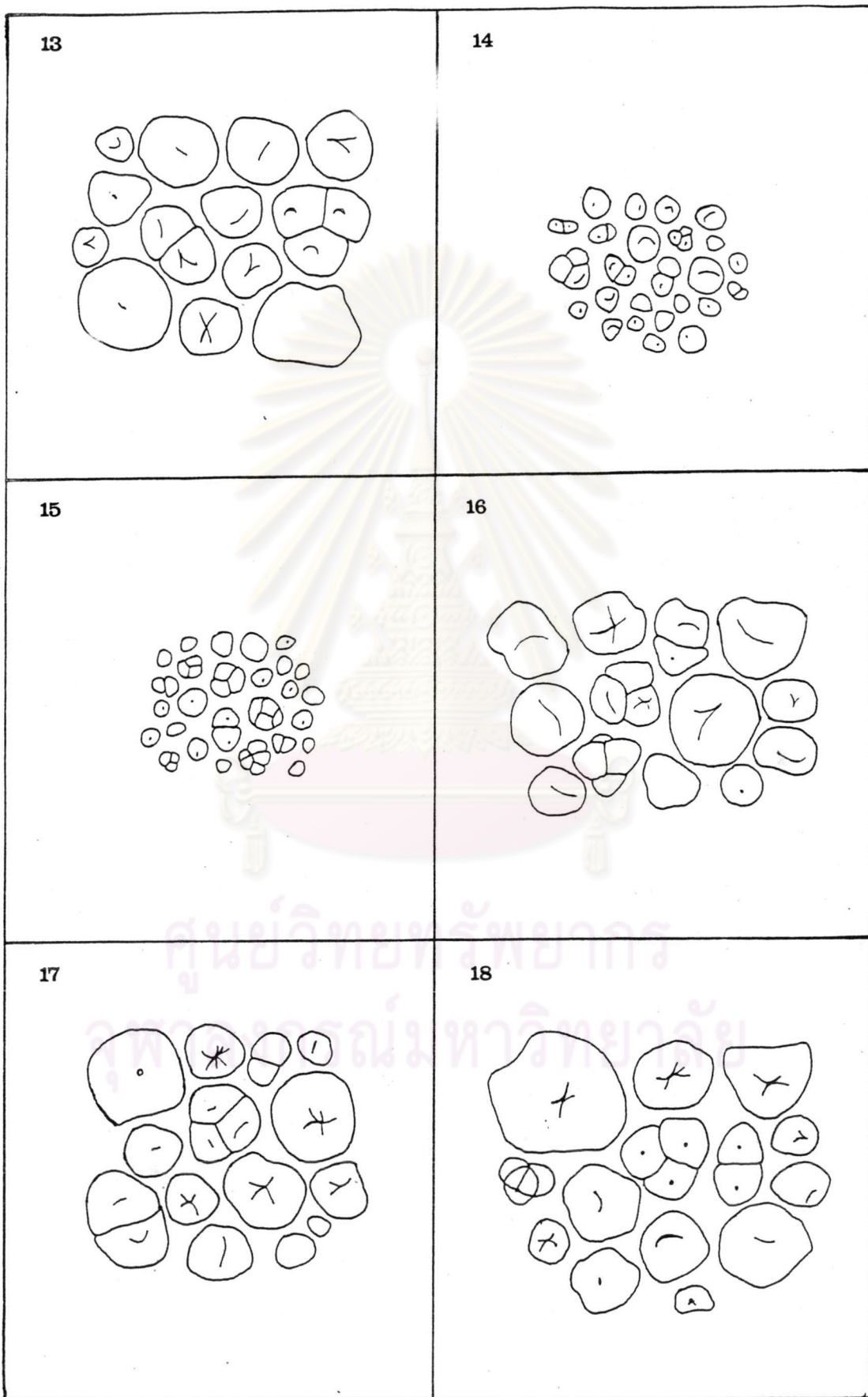


Figure 18 continued



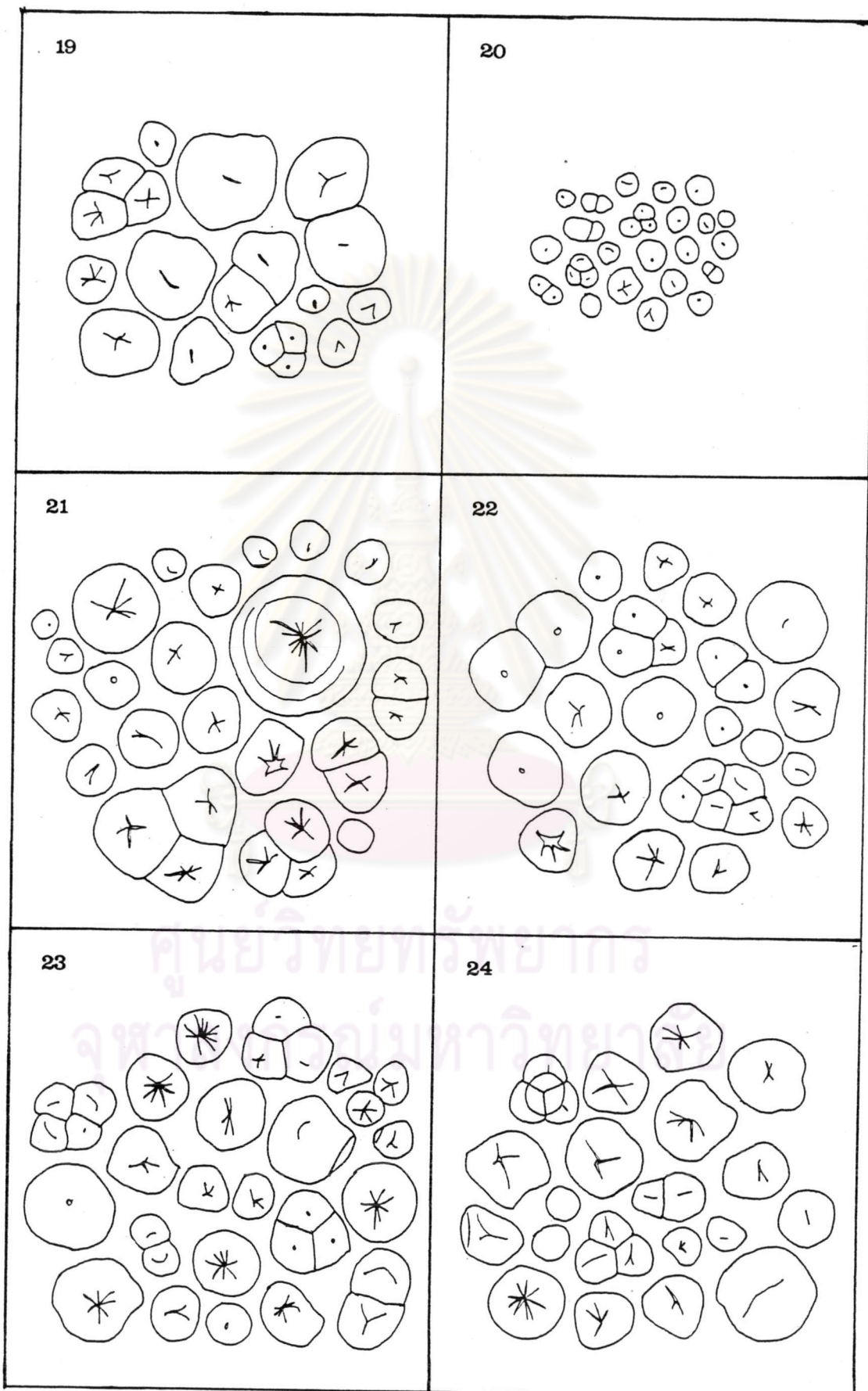
0.05 mm

Figure 18 continued



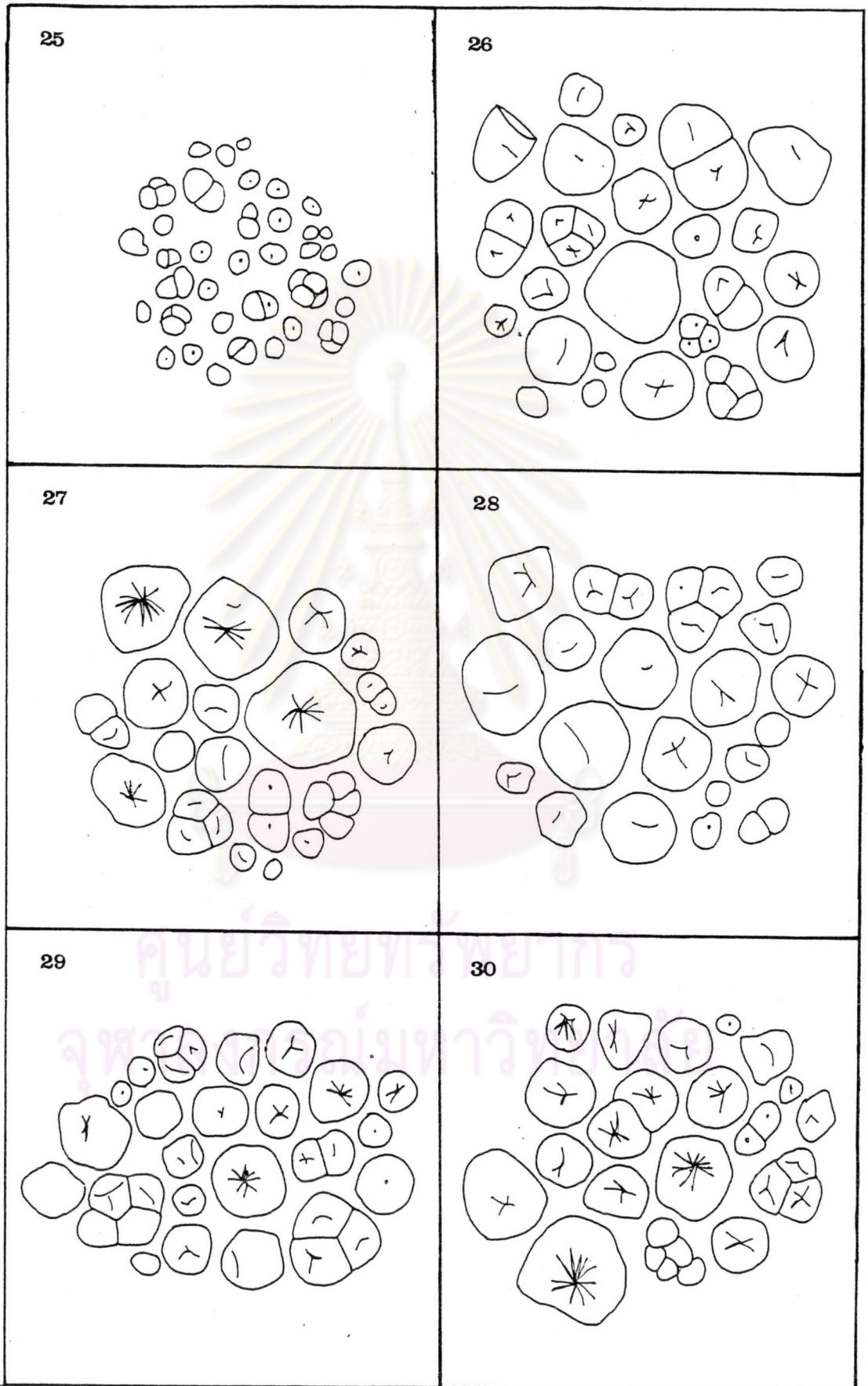
0.05 mm

Figure 18 continued



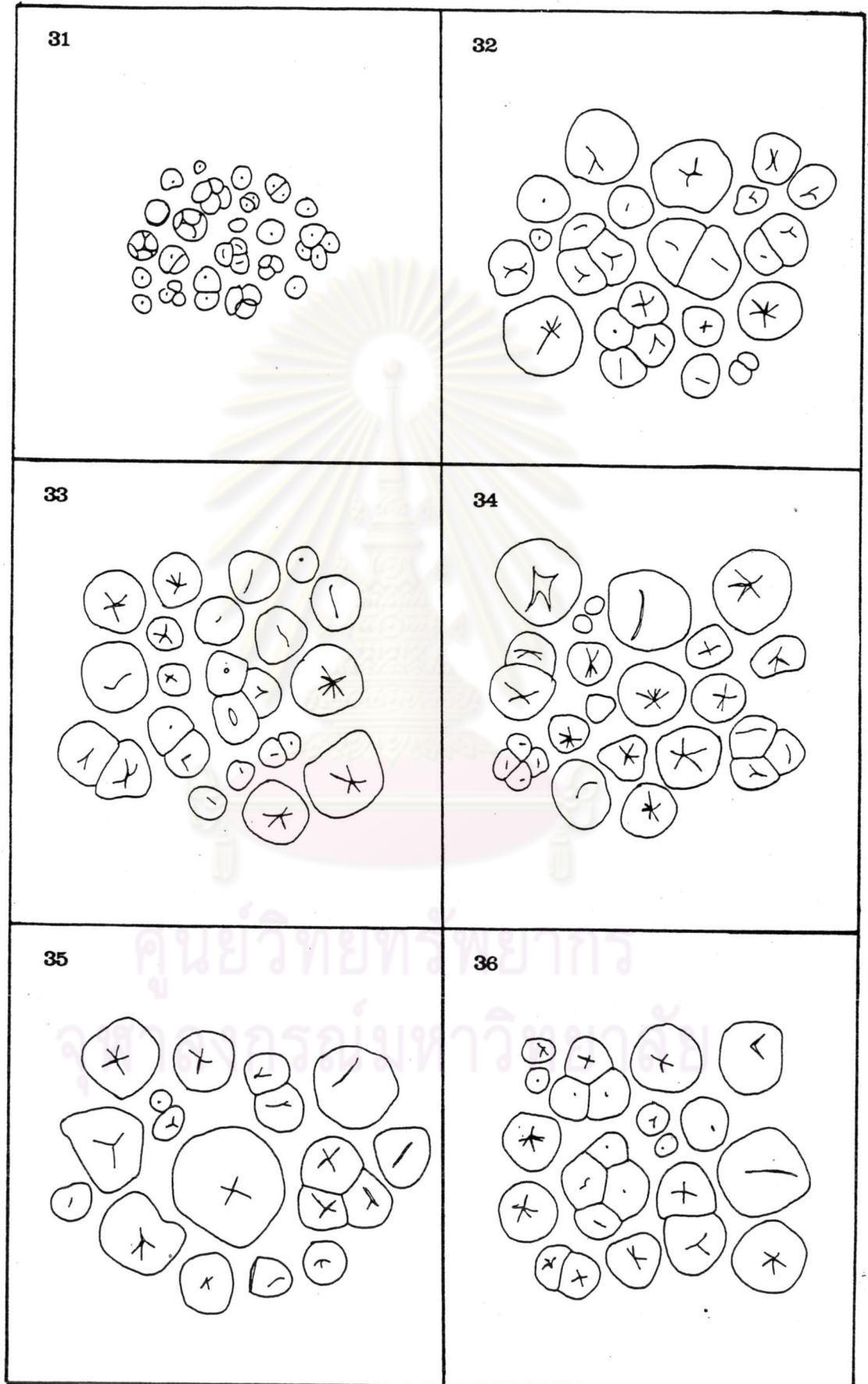
0.05 μm

Figure 18 continued



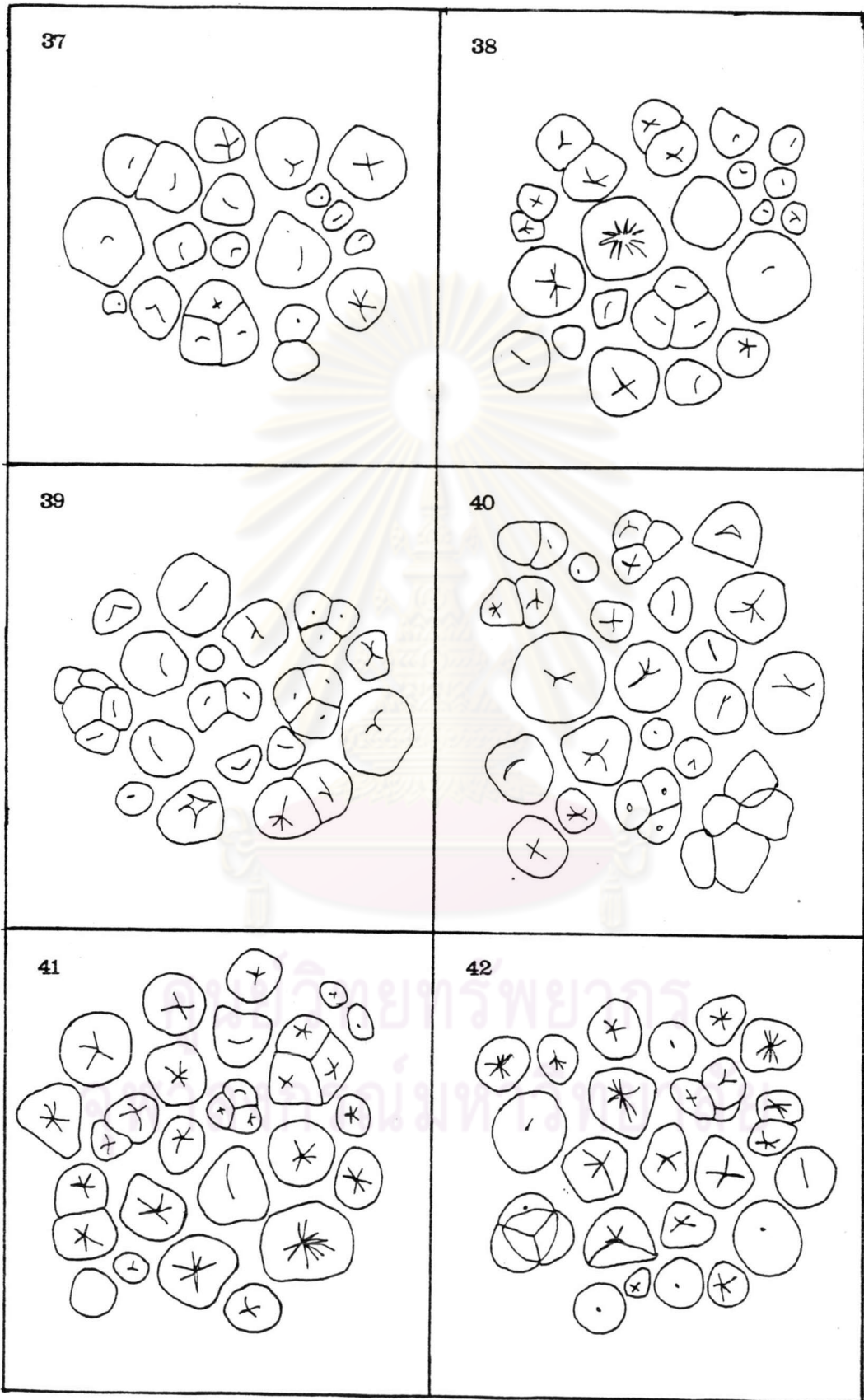
0.05 mm

Figure 18 continued



0.05 mm

Figure 18 continued



0.05 mm

Figure 18 continued



Table 8 Chemical Identification (Color Test) of Khaao-Yen-Wuea Khaao-Yen-Tai

Sample No.	Chemical test A amount of long lasting foam	Chemical test B + acetic anhydride and conc. H ₂ SO ₄ brownish red ring	Chemical test C + Fehling's TS. amount of red ppt.	Chemical Test D + Ferric chloride TS amount of green ppt.
1	++	upper layer orange, +++	+++	+++
2	++	upper layer orange, +++	+++	+++
3	+++	upper layer orange, +++	++	-
4	++	upper layer green, +++	+++	+
5	++	upper layer green, +++	+++	+
6	++	upper layer orange, ++	+++	-
7	++	upper layer orange, +++	+++	+++
8	++	upper layer orange, ++	+++	-
9	++	upper layer orange, +++	+++	+++
10	++	upper layer orange, +++	+++	+++
11	++	upper layer orange, +++	+++	+++
12	++	upper layer orange, +++	+++	+++
13	++	upper layer orange, +++	+++	+++
14	++	upper layer green, +++	+++	+
15	+++	upper layer orange, +++	++	-
16	++	upper layer orange, +++	+++	+++
17	++	upper layer orange, +++	+++	+++
18	++	upper layer orange, +++	+++	+++
19	++	upper layer orange, +++	+++	+++
20	++	upper layer green, +++	+++	+
21	++	upper layer orange, +++	+++	+++
22	++	upper layer orange, +++	+++	+++
23	++	upper layer orange, +++	+++	+++
24	++	upper layer orange, +++	+++	+++

Table 8 continued

Sample No.	Chemical test A amount of long lasting foam	Chemical test B + acetic anhydride and conc. H ₂ SO ₄ brownish red ring	Chemical test C + Fehling's TS. amount of red ppt.	Chemical Test D + Ferric chloride TS amount of green ppt.
25	+++	upper layer orange, +++	++	-
26	++	upper layer orange, +++	+++	+++
27	++	upper layer orange, +++	+++	+++
28	++	upper layer orange, +++	+++	+++
29	++	upper layer orange, +++	+++	+++
30	++	upper layer orange, +++	+++	+++
31	+++	upper layer orange, +++	++	-
32	++	upper layer orange, +++	+++	+++
33	++	upper layer orange, +++	+++	+++
34	++	upper layer orange, +++	+++	+++
35	++	upper layer orange, +++	+++	+++
36	++	upper layer orange, +++	+++	+++
37	++	upper layer orange, +++	+++	+++
38	++	upper layer orange, +++	+++	+++
39	++	upper layer orange, ++	+++	-
40	++	upper layer orange, +++	+++	+++
41	++	upper layer orange, +++	+++	+++
42	++	upper layer orange, +++	+++	+++
43	++	upper layer green, +++	+++	+
44	++	upper layer green, +++	+++	+

+++ = most ++ = medium + = least - = none ppt. = precipitate

Table 9 Chemical and Purity Evaluation of Khaao-Yen-Nuea Khaao-Yen-Tai

Sample No.	Commercial origin	Moisture content (%)	Total ash content (%)	Acid insoluble ash content (%)	Water extractive (%)	Ethanol extractive (%)
1	Mo Waeo	9.98	2.44	0.27	16.33	10.46
2	Doi Suthep	6.87	2.12	0.27	14.68	14.21
3	Chanthaburi Medicinal Plant Garden	9.32	5.62	1.53	9.63	12.42
4	Boon San Osot	9.24	2.53	0.38	13.96	13.92
5	Mo Wet-Suchada	9.38	4.35	0.34	10.64	9.25
6	Wetchaphong	12.11	1.24	0.16	7.06	16.07
7	Chao Krom Pua	11.12	1.59	0.31	10.68	7.22
8	Ngi-Tien-Ong	12.64	1.68	0.22	12.98	10.15
9	Wetchaphong	12.45	1.52	0.23	9.13	9.47
10	Wetchaphong	11.62	2.06	0.54	10.93	3.41
11	Ngaun-Heng-Chan	9.88	2.15	0.22	19.16	17.00
12	Ngaun-Heng-Chan	11.17	2.11	0.26	12.17	5.78
13	Wat Maha That	10.72	1.98	0.38	12.26	5.47
14	Wat Maha That	9.06	3.02	0.46	15.28	3.98
15	Suan Chattuchat	10.08	5.69	1.00	14.05	9.66
16	Pho Pradit	9.69	1.87	0.16	18.06	8.96
17	Ayuravet	9.03	2.45	0.31	17.29	12.89
18	Ayuravet	10.91	2.02	0.38	13.50	7.65
19	Va-Rin Osot	10.55	1.68	0.38	8.67	4.06
20	Va-Rin Osot	9.17	3.99	0.70	19.33	3.08
21	Mo Pud	10.80	3.90	0.25	12.81	4.83
22	Mo Pud	10.02	1.87	0.19	12.78	2.08
23	Ngi-Tien-Ong	10.72	1.90	0.22	15.59	8.75
24	Chanthaboon	10.11	1.33	0.25	9.24	7.18

Table 9 continued

Sample No.	Commercial origin	Moisture content (%)	Total ash content (%)	Acid insoluble ash content (%)	Water extractive (%)	Ethanol extractive (%)
25	Chanthaboon	8.96	6.98	0.23	11.17	8.52
26	Chai Langka	10.33	1.64	0.25	16.91	15.93
27	Chai Langka	12.33	1.71	0.22	19.21	13.58
28	Ae-di	11.59	1.59	0.25	14.11	11.44
29	Ae-di	11.33	1.95	0.27	13.68	6.45
30	Tang-Ngaun-Seng	9.93	1.87	0.32	17.86	15.20
31	Sai Ngan	9.03	7.01	0.25	20.43	9.36
32	Sai Ngan	11.07	2.03	0.27	17.16	11.97
33	Thai-An-Chan	9.43	1.67	0.23	19.96	20.20
34	Thai-An-Chan	10.98	2.06	0.28	13.76	7.32
35	Thai-Hua-Chan	10.25	1.74	0.66	13.51	8.63
36	Thai-Hua-Chan	12.63	1.07	0.14	6.61	3.06
37	Suan Chattuchat	10.68	2.22	0.56	15.83	12.17
38	Mo Wet-Suchada	11.93	2.10	0.40	21.16	8.26
39	Cha-Loen-Ket Pharmacy	12.89	1.28	0.19	7.01	3.43
40	Wang Nan Yen	10.43	2.03	0.25	9.29	4.39
41	Wang Nan Yen	9.93	2.29	0.27	20.00	17.25
42	Chi-An-Osot	10.75	2.53	0.22	11.92	2.09
43	Chi-An-Osot	10.30	4.88	0.30	16.36	4.25
44	Khao-Sup-Pra-du	9.75	3.63	0.59	16.55	1.58

Figure 20 Detection of "Khao-Yen-Nuea Khao-Yen-Tai" on TLC Plates under UV365

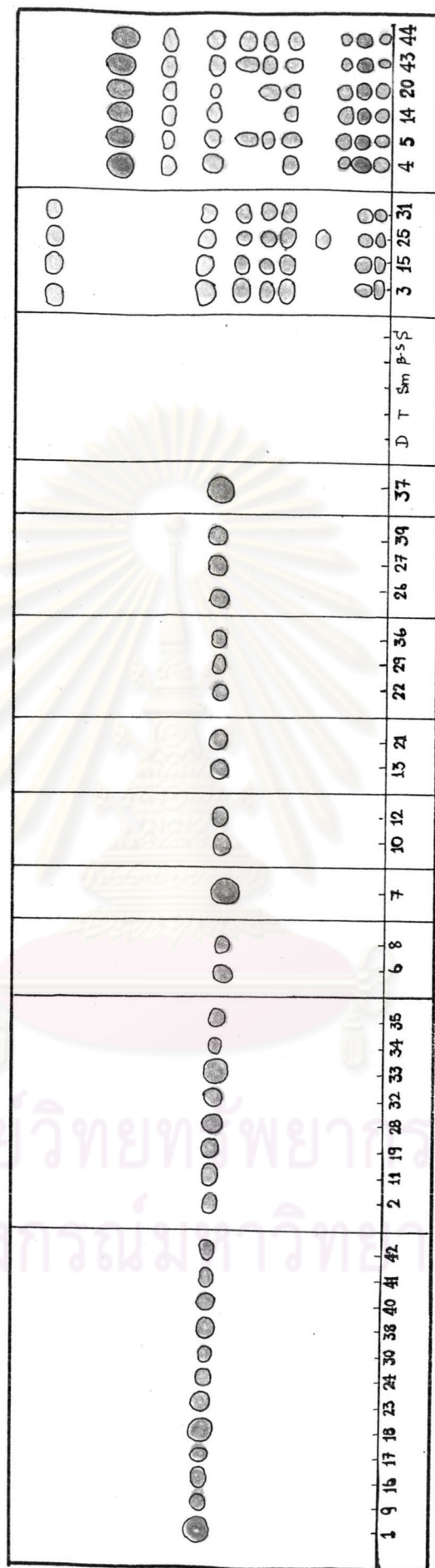
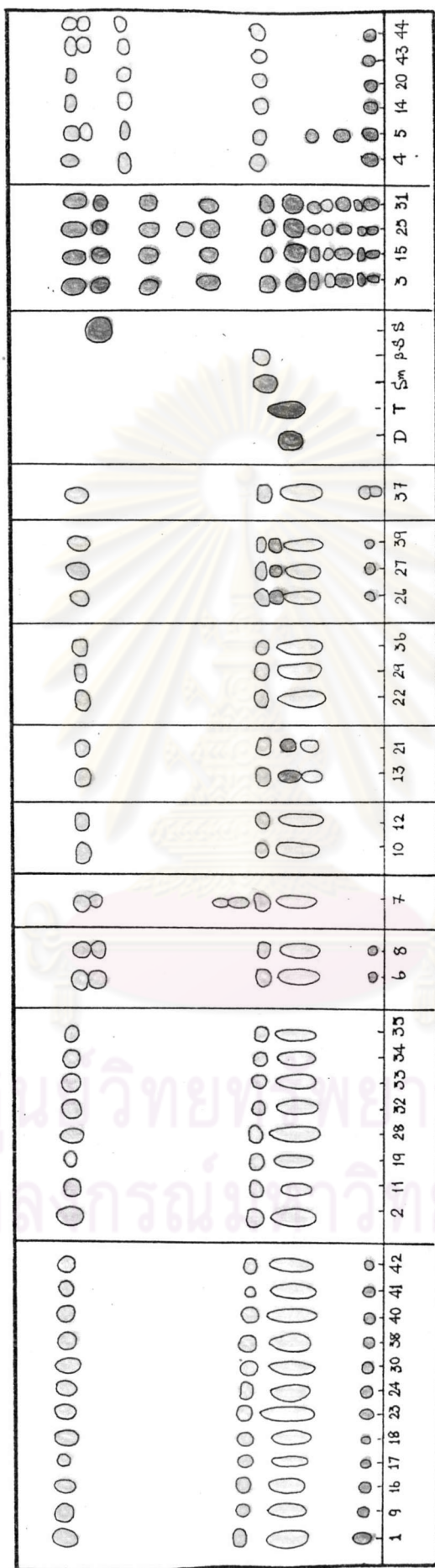


Figure 22 Detection of "Khaao-Yen-Nuea Khaao-Yen-Tai" on TLC Plates
with Orthophosphoric acid (visible)



D = Diosgenin

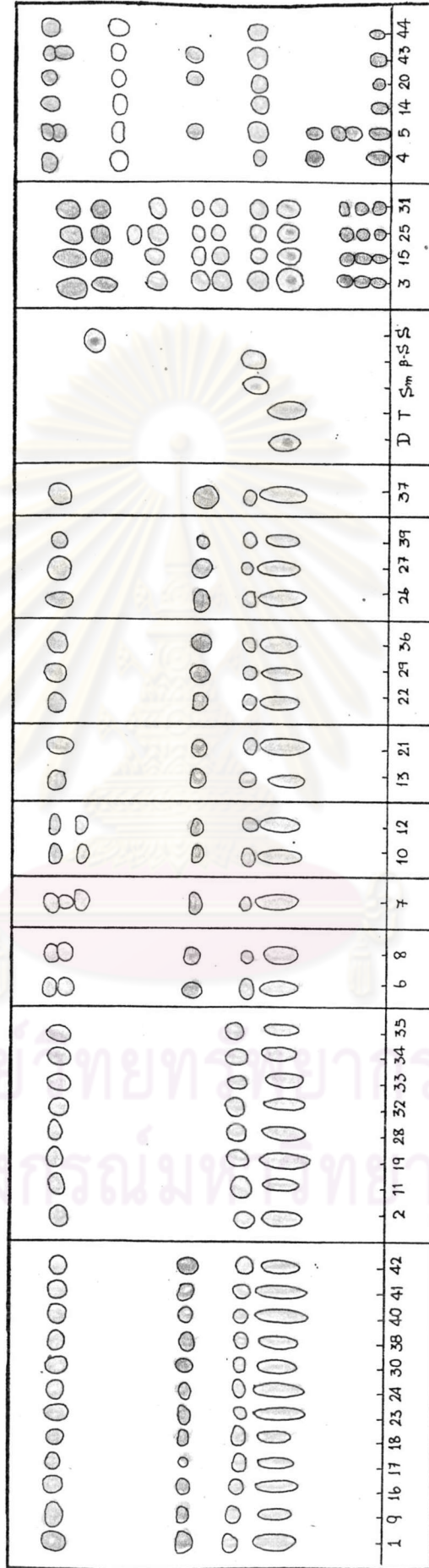
T = Tigogenin

Sm = Smilagenin

β-S = β-Sitosterol

S = Stigmasterol

Figure 23 Detection of "Khaao-Yen-Nuea Khaao-Yen-Tai" on TLC Plates
with Orthophosphoric acid (fluorescence UV₃₆₅)



D = Diosgenin

T = Tigogenin

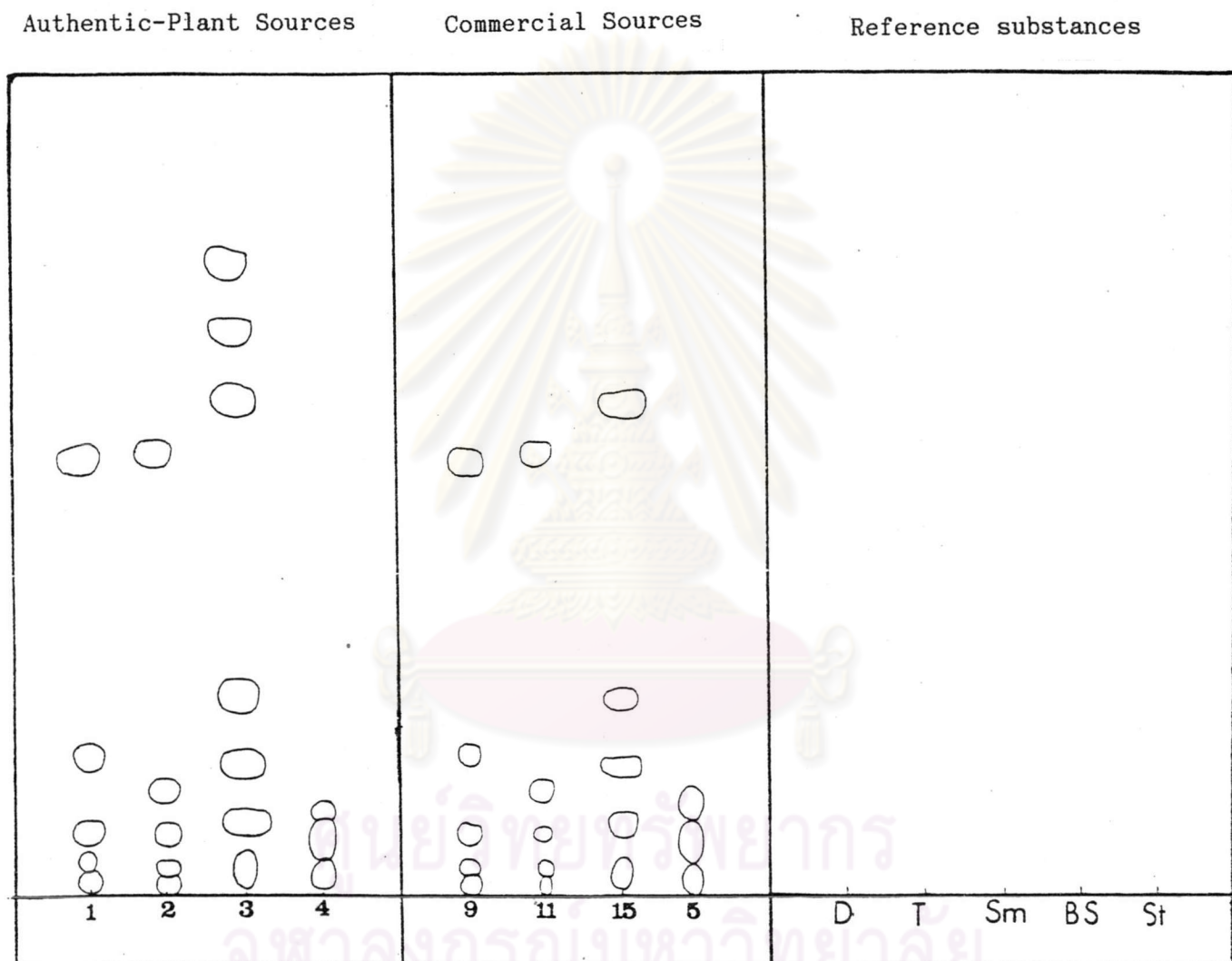
Sm = Smilagenin

β -S = β -Sitosterol

S = Stigmasterol

Figure 24 Comparison of TLC Pattern of Authentic-Plant Sources
and Commercial Sources

Detect under UV₂₅₄

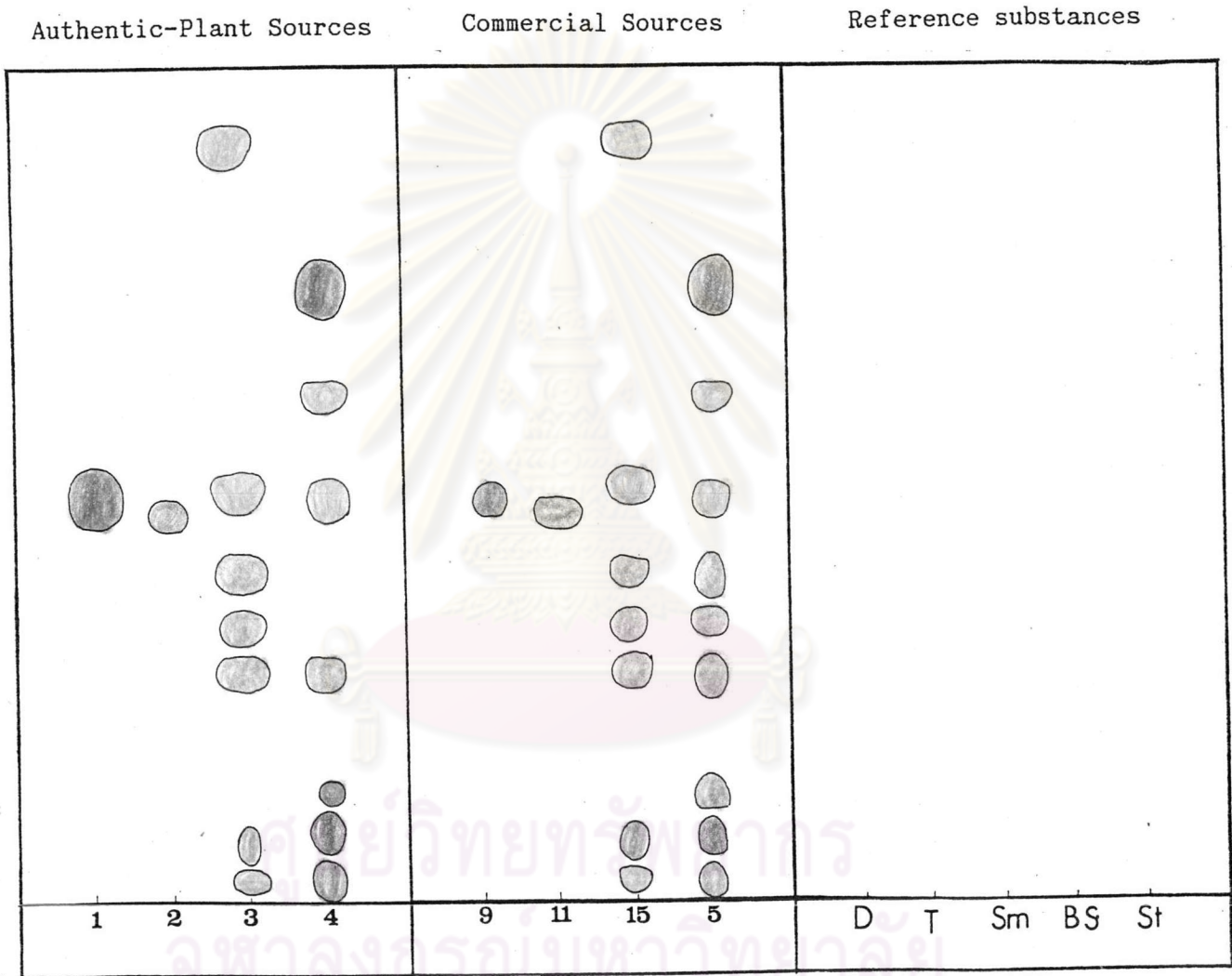


1. *Smilax glabra* Roxb.
2. *S. corbularia* Kunth
3. *Dioscorea birmanica* Prain et Burkill.
4. *Pygmaeopremna herbacea* (Roxb.) Mold.

D = Diosgenin
 T = Tigogenin
 Sm = Smilagenin
 β -S = β -Sitosterol
 S = Stigmasterol

Figure 25 Comparison of TLC Pattern of Authentic-Plant Sources
and Commercial Sources

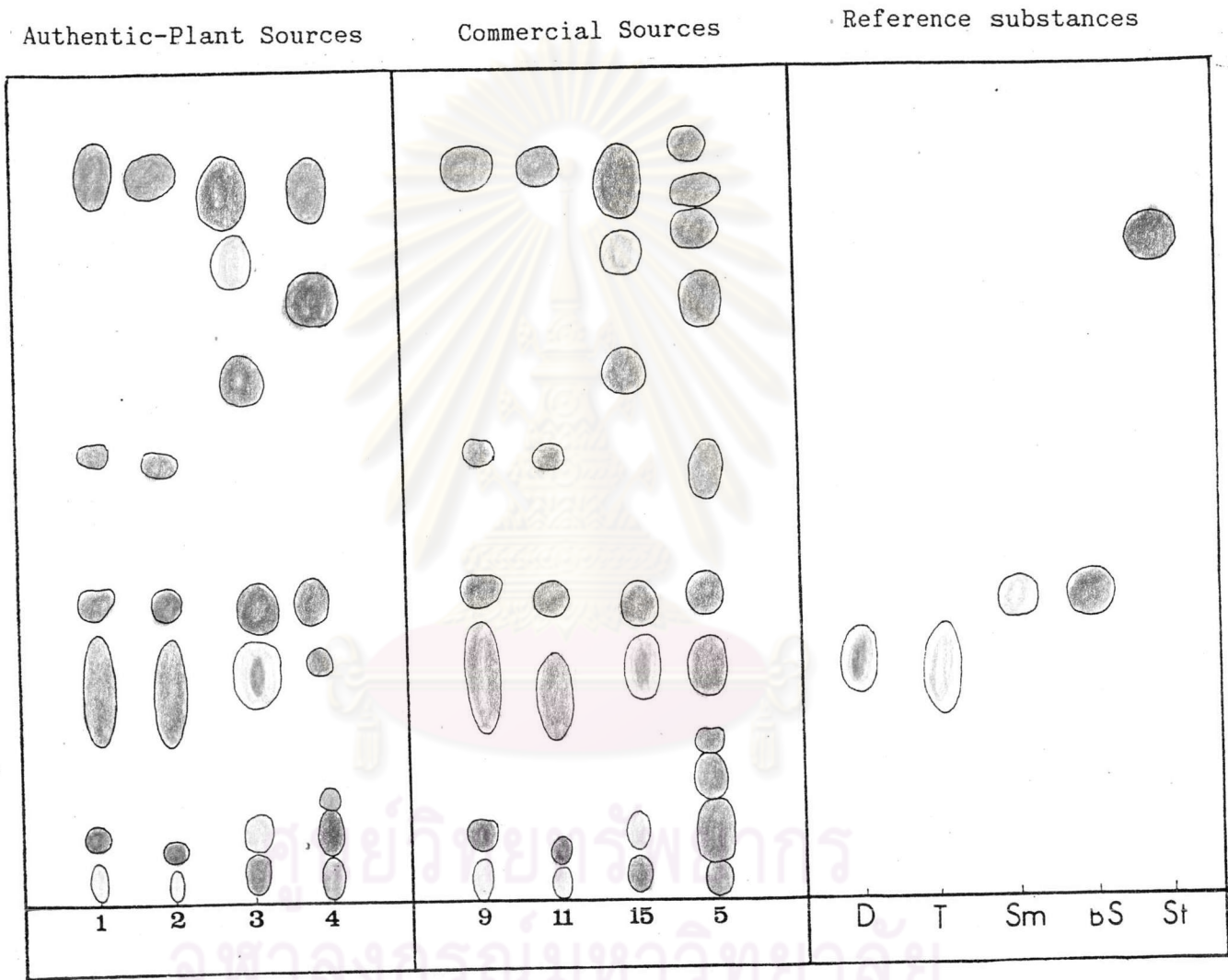
Detect under UV₃₆₅



- D = Diosgenin
- T = Tigogenin
- Sm = Smilagenin
- β -S = β -Sitosterol
- S = Stigmasterol

Figure 26 Comparison of TLC Pattern of Authentic-Plant Sources
and Commercial Sources

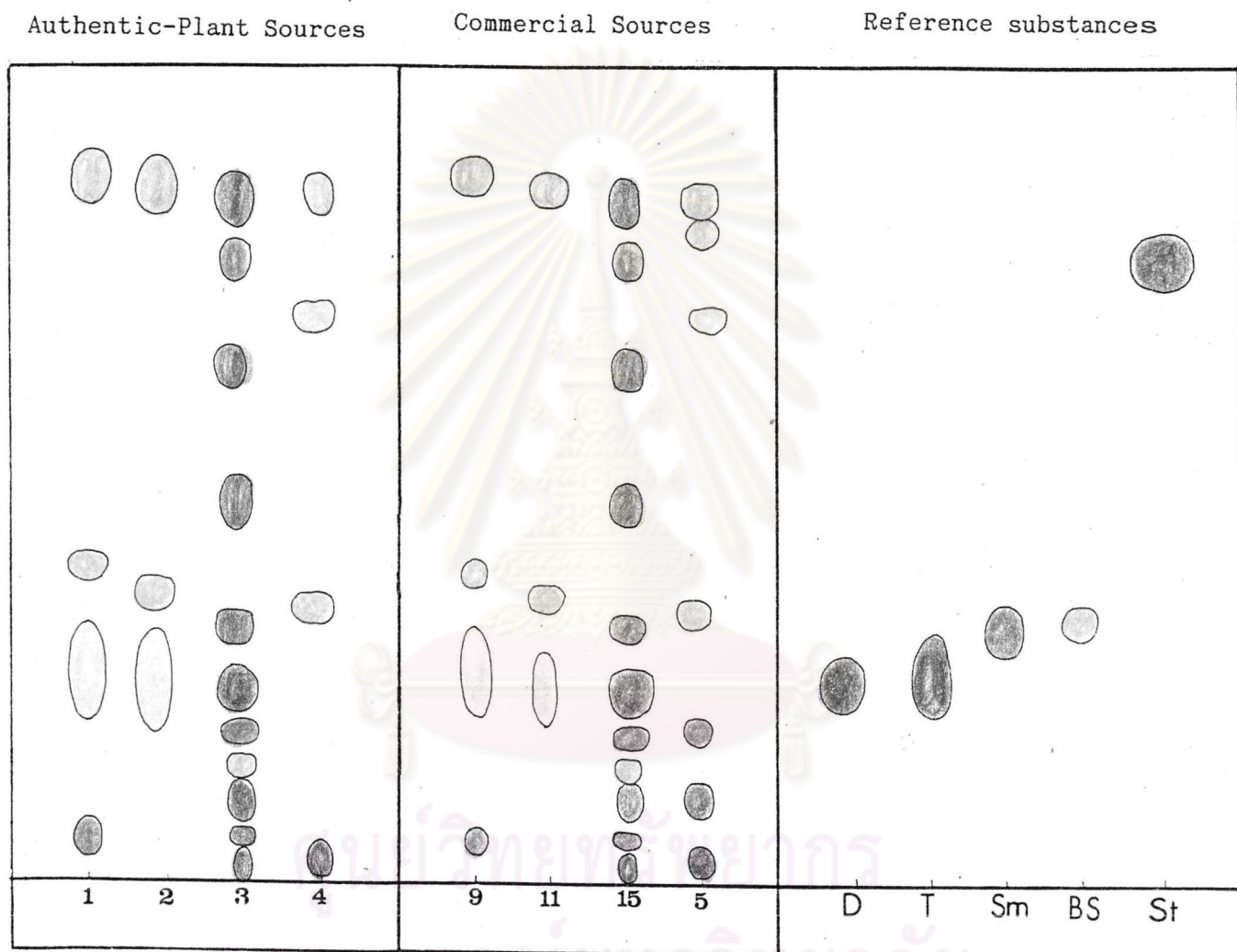
Detect with Anisaldehyde-Sulphuric acid



- D = Diosgenin
- T = Tigogenin
- Sm = Smilagenin
- β -S = β -Sitosterol
- S = Stigmasterol

Figure 27 Comparison of TLC Pattern of Authentic-Plant Sources
and Commercial Sources

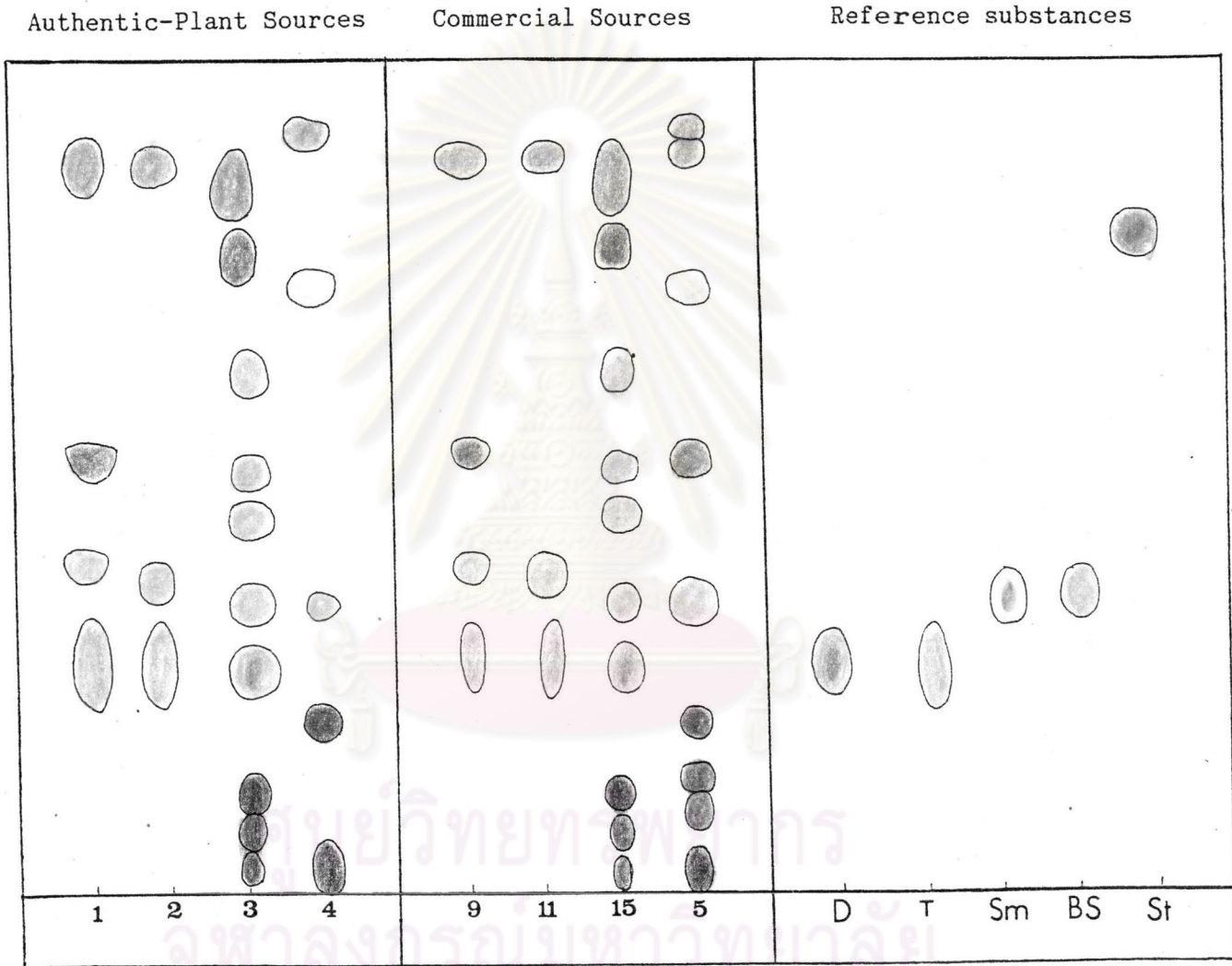
Detect with Orthophosphoric acid



- D = Diosgenin
T = Tigogenin
Sm = Smilagenin
 β -S = β -Sitosterol
S = Stigmasterol

Figure 28 Comparison of TLC Pattern of Authentic-Plant Sources and Commercial Sources

Detect with Orthophosphoric acid (fluorescence under UV 365)



- D = Diosgenin
- T = Tigogenin
- Sm = Smilagenin
- β -S = β -Sitosterol
- S = Stigmasterol

Figure 29 Detection of Sample No. 1, 9, 16, 17, 18, 23, 24, 30, 38, 40, 41, 42 on TLC Plates with UV light and Various Spray Reagents.

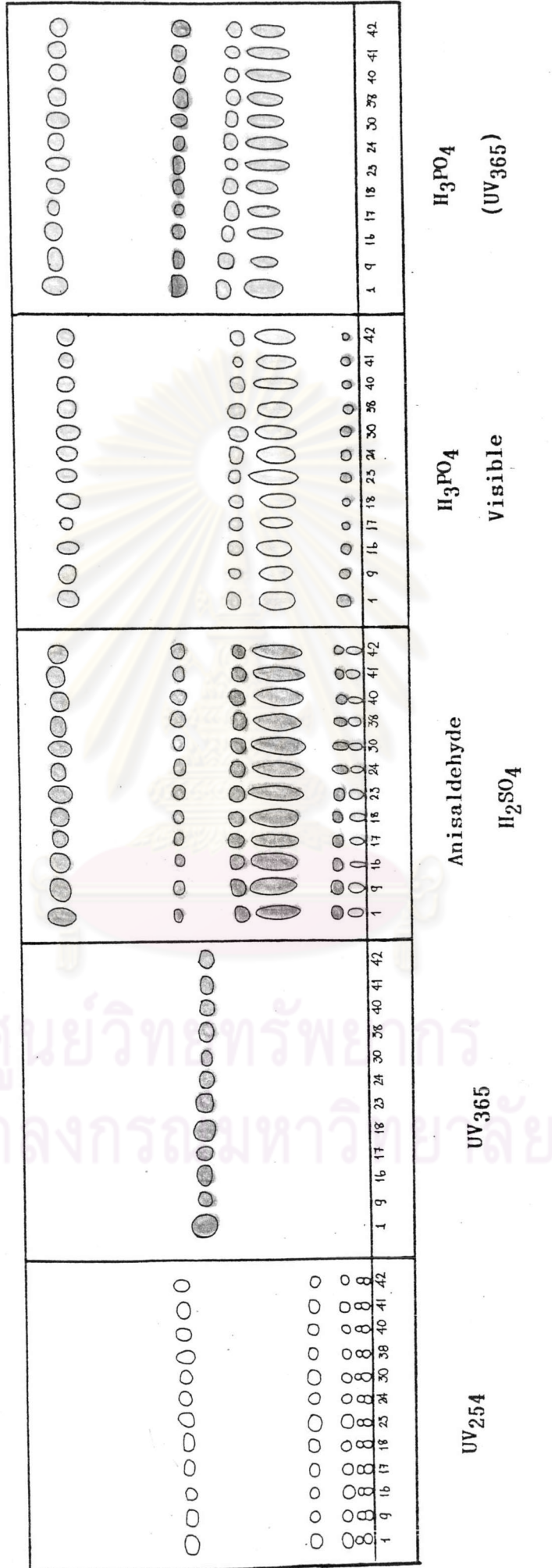
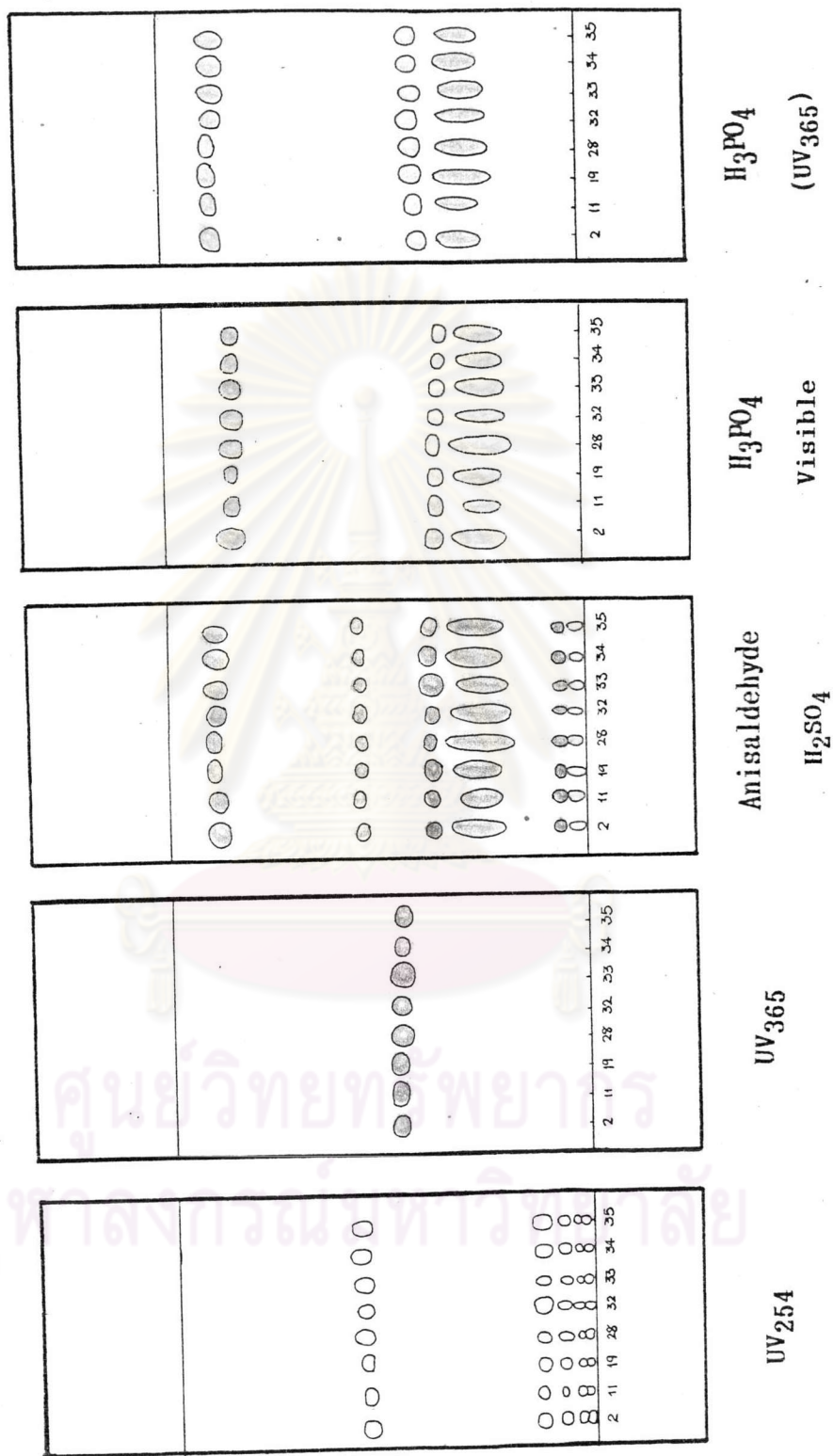


Figure 30 Detection of Sample No. 2, 11, 19, 28, 32, 33, 34, 35 on TLC Plates with UV light and Various Spray Reagents.



UV254

UV365

Anisaldehyde

H₂SO₄

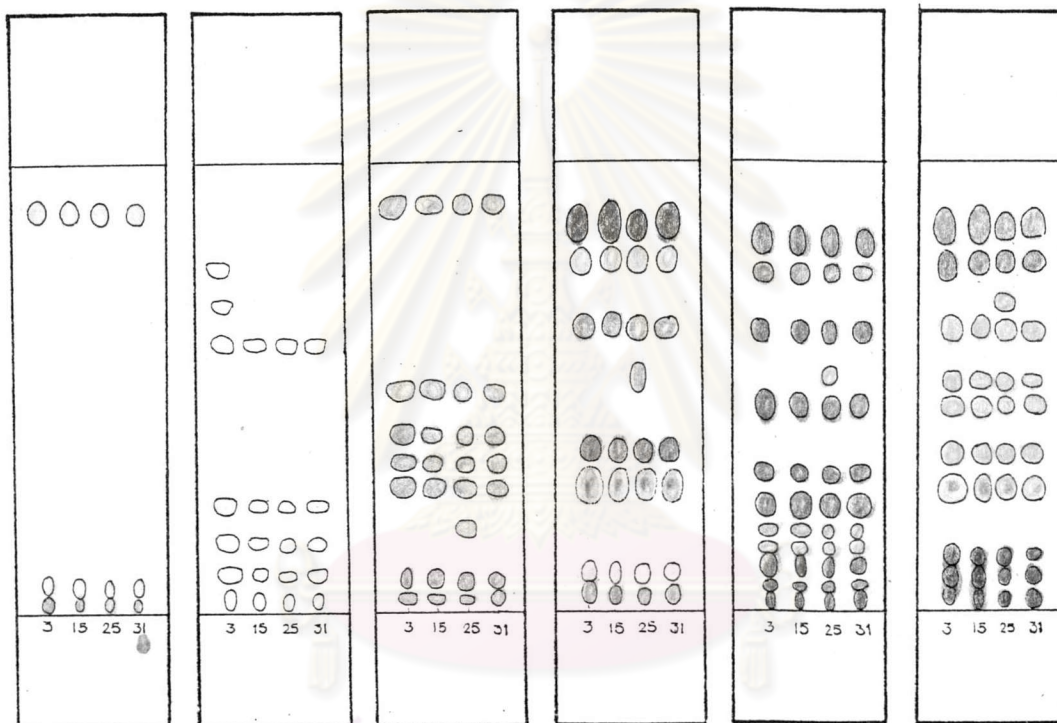
H₃PO₄

Visible

H₃PO₄

(UV365)

Figure 31 Detection of Sample No. 3, 15, 25, 31 on TLC Plates with UV light and Various Spray Reagents.



Visible

UV₂₅₄UV₃₆₅

Anisaldehyde

H₂SO₄H₃PO₄

Visible

H₃PO₄(UV₃₆₅)

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Figure 32 Detection of Sample No. 4, 5, 14, 20, 43, 44 on TLC Plates with UV Light and Various Spray Reagents.

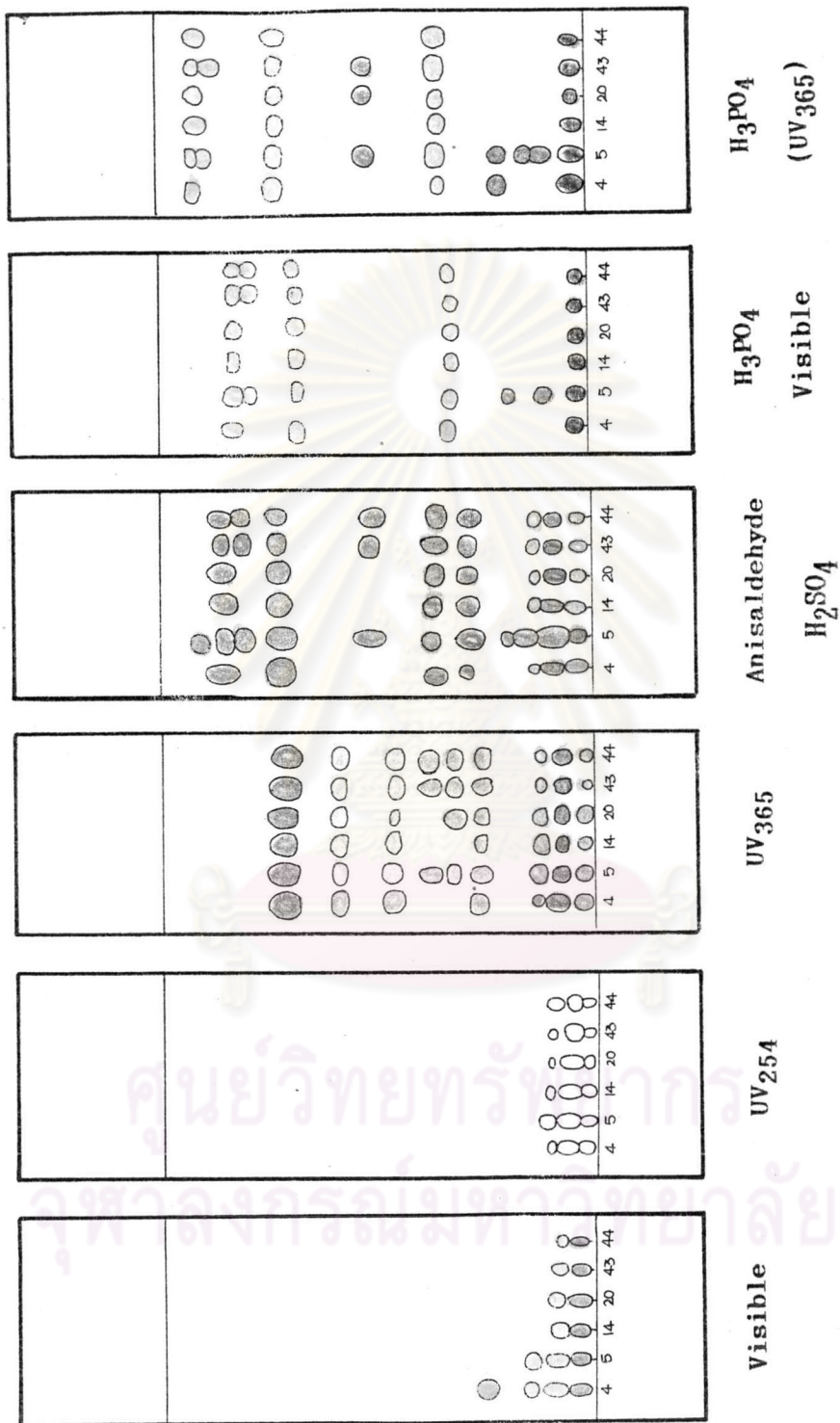


Figure 33 Detection of Sample No. 6, 8, 7, 10, 12, 13, 21 on TLC Plates with UV Light and Various Spray Reagents.

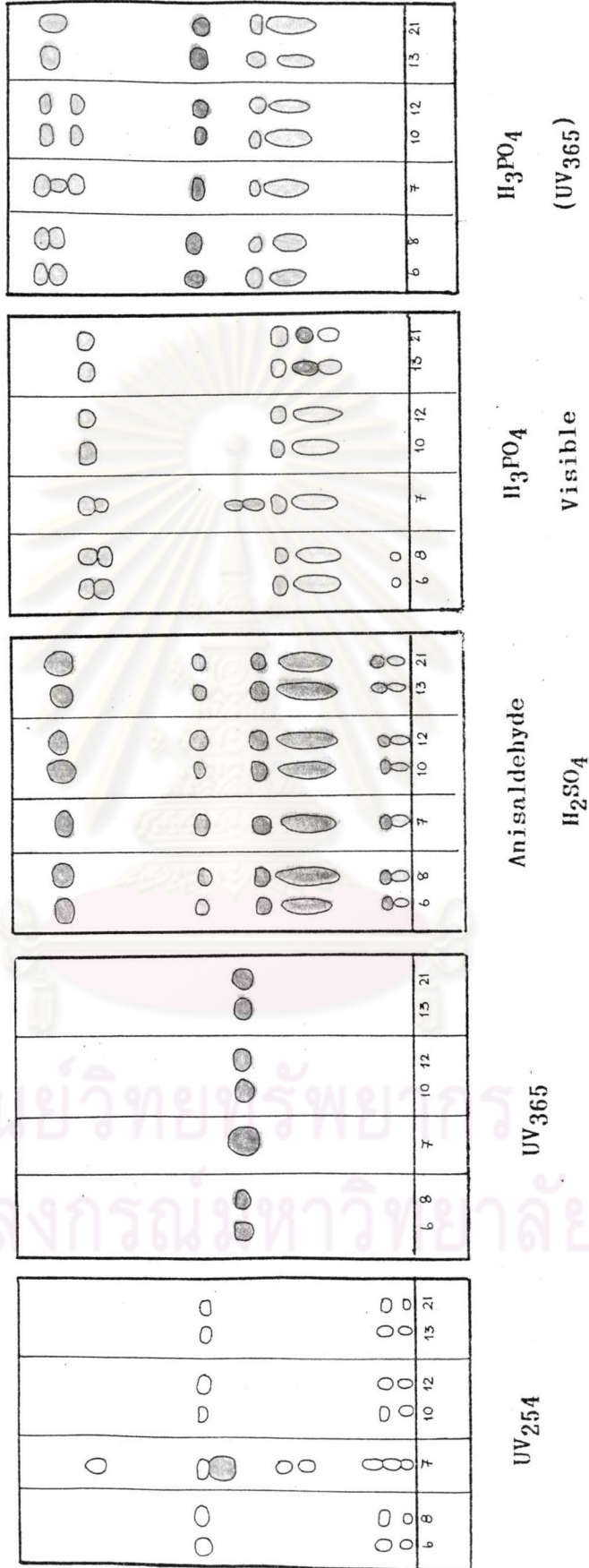


Figure 34 Detection of Sample No. 22, 29, 36, 26, 27, 39, 37 on TLC Plates with UV light and Various Spray Reagents.

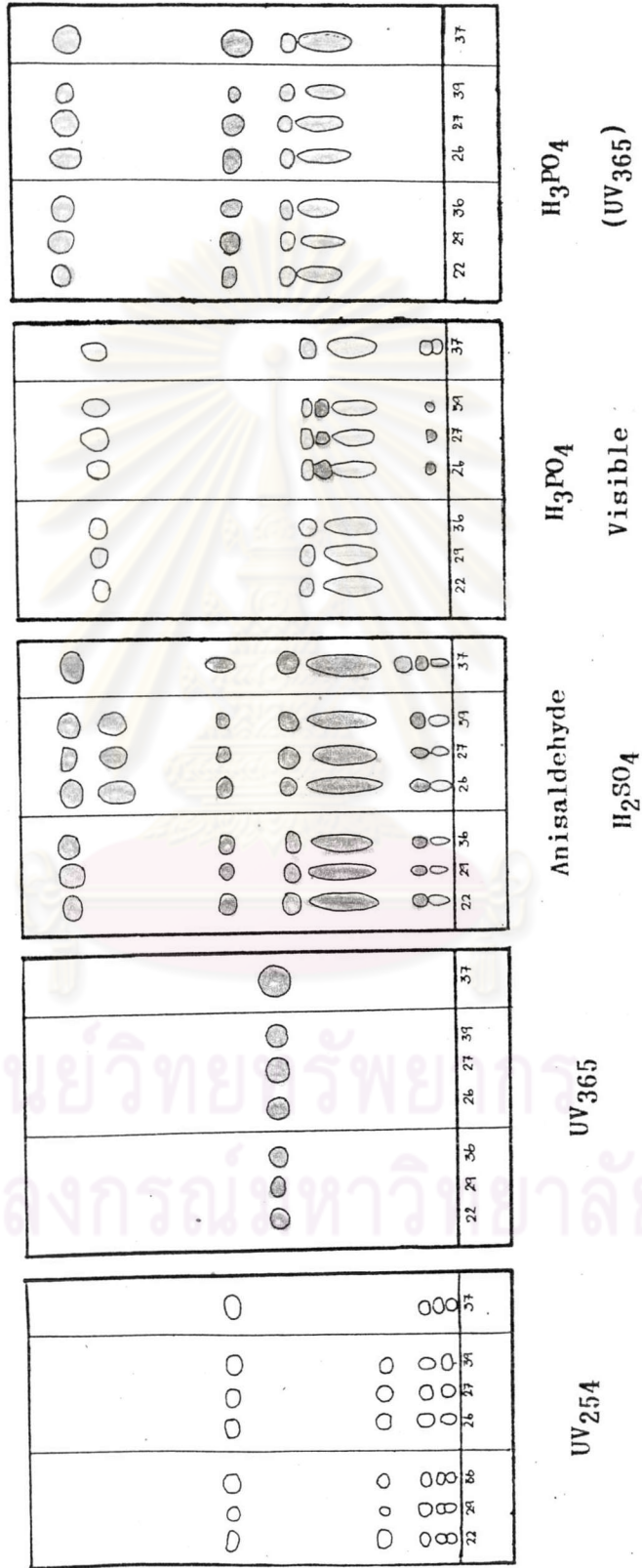


Table 12 continued

Spots	Rf value	Color Detection with					Sample No.																			
		UV ₂₅₄	UV ₃₆₅	Anisaldehyde	H ₃ PO ₄ visible	H ₃ PO ₄ UV ₃₆₅	6	8	7	10	12	13	21	22	29	36	26	27	39	37						
25	50-54.5	dark	—	—	—	—	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
26	50-57	—	—	green	—	—	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
27	53-60	—	—	—	—	blue	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
28	73.5-82	—	—	gray	—	—														/	/	/				
29	74.5-77.5	—	—	—	yellow	—	/	/	/																	
30	77-82	dark	—	—	—	—		/																		
31	77.5-84	—	—	—	yellow	—	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
32	80-83.5	—	—	—	—	blue	/	/	/																	
33	83.5-91.5	—	—	—	—	orange	/																			
34	84-91	—	—	red violet	—	—	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
35	88-92	—	—	—	—	orange	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/

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Table 13 TLC Analysis of Sample No. 3, 15, 25, 31

Spots	Rf value	Color Detection with						Sample No.			
		Visible without spray	UV ₂₅₄	UV ₃₆₅	Anisaldehyde	H ₃ PO ₄ visible	H ₃ PO ₄ UV ₃₆₅	3	15	25	31
1	0.5-4.5	—	—	—	—	black	—	/	/	/	/
2	0.5-5	—	—	—	—	—	dark gray	/	/	/	/
3	1-4.5	yellow-brown	—	—	—	—	—	/	/	/	/
4	1-6	—	dark	—	—	—	—	/	/	/	/
5	1.5-4.5	—	—	orange	—	—	—	/	/	/	/
6	1.5-6	—	—	—	yellow-brown	—	—	/	/	/	/
7	3.5-8.5	yellow	—	—	—	—	—	/	/	/	/
8	4.5-7	—	—	—	—	dark violet	—	/	/	/	/
9	5-9.5	—	—	green	—	—	—	/	/	/	/
9	5-9.5	—	—	—	—	—	dark gray	/	/	/	/
10	6.5-10.5	—	—	—	yellow	—	—	/	/	/	/
11	7.5-10.5	—	dark	—	—	—	—	/	/	/	/
12	7.5-12	—	—	—	—	brown	—	/	/	/	/
13	10-14.5	—	—	—	—	—	dark gray	/	/	/	/
14	12-15	—	—	—	—	light violet	—	/	/	/	/
15	14.5-18	—	dark	—	—	—	—	/	/	/	/
16	16-19	—	—	—	—	yellow-brown	—	/	/	/	/
17	16-20	—	—	bright green	—	—	—	/	/	/	/
18	20-25	—	—	—	—	black-green	—	/	/	/	/
19	22-26	—	dark	—	—	—	—	/	/	/	/
20	23.5-30	—	—	—	—	—	blue	/	/	/	/
21	23.5-31	—	—	—	bright yellow	—	—	/	/	/	/
22	25-29.5	—	—	blue	—	—	—	/	/	/	/
23	27.5-32	—	—	—	—	violet	—	/	/	/	/

Table 13 continued

Spots	hRf value	Color Detection with						Sample No.			
		Visible without spray	UV ₂₅₄	UV ₃₆₅	Anisaldehyde	H ₃ PO ₄ visible	H ₃ PO ₄ UV ₃₆₅	3	15	25	31
24	30-34.5	—	—	blue	—	—	—	/	/	/	/
25	32-37	—	—	—	—	—	orange-pink	/	/	/	/
26	32-38	—	—	—	violet	—	—	/	/	/	/
27	37-41.5	—	—	blue	—	—	—	/	/	/	/
28	42-47	—	—	—	—	—	orange-pink	/	/	/	/
29	42-48.5	—	—	—	—	violet	—	/	/	/	/
30	46-51	—	—	bright blue	—	—	—	/	/	/	/
31	47.5-52.5	—	—	—	—	—	orange-pink	/	/	/	/
32	47.5-54.5	—	—	—	green	—	—	/			
33	49.5-53.5	—	—	—	—	orange	—	/			
34	58-61.5	—	dark	—	—	—	—	/	/	/	/
35	58.5-63.5	—	—	—	—	violet	—	/	/	/	/
36	59.5-65	—	—	—	—	—	orange-pink	/	/	/	/
37	60-65	—	—	—	green	—	—	/	/	/	/
38	65.8-80	—	—	—	—	—	blue	/			
39	66-69.5	—	dark	—	—	—	—	/			
40	72-77	—	—	—	—	green	—	/	/	/	/
41	73.5-80	—	—	—	lemon green	—	—	/	/	/	/
42	74-79.5	—	—	—	—	—	blue	/	/	/	/
43	74.5-77.5	—	dark	—	—	—	—	/			
44	78-85	—	—	—	—	violet	—	/	/	/	/
45	80.5-89.5	—	—	—	purple	—	—	/	/	/	/
46	80.5-90	—	—	—	—	—	pink	/	/	/	/
47	86-91.5	dark yellow	—	—	—	—	—	/	/	/	/
48	87-92	—	—	bright blue	—	—	—	/	/	/	/

Table 14 TLC Analysis of Sample No. 4, 5, 14, 20, 43, 44

Spots	R _f value	Color Detection with						Sample No.					
		Visible without spray	UV ₂₅₄	UV ₃₆₅	Anisaldehyde	H ₃ PO ₄ visible	H ₃ PO ₄ UV ₃₆₅	4	5	14	20	43	44
1	0-4.6	—	—	green	—	—	—	/	/	/	/	/	/
2	0-6	—	—	—	—	—	dark gray	/	/	/	/	/	/
3	0.1-5	—	—	—	yellow-brown	—	—	/					
4	0.5-4.5	—	dark	—	—	—	—	/	/	/	/	/	/
5	0.5-5	—	—	—	—	dark gray	—	/	/	/	/	/	/
6	0.5-5.5	—	—	—	green	—	—	/	/	/	/	/	/
7	1.5-6	yellow-brown	—	—	—	—	—	/	/	/	/	/	/
8	4.5-9.5	—	dark	—	—	—	—	/	/	/	/	/	/
9	5-12	—	—	—	olive green	—	—	/					
10	5.5-11	—	—	—	brown	—	—	/	/	/	/	/	/
11	5.8-11	—	—	brown	—	—	—	/	/	/	/	/	/
12	6-12	yellow	—	—	—	—	—	/	/	/	/	/	/
13	7.5-12	—	—	—	—	brown	—	/					
13	7.5-12	—	—	—	—	—	brown	/					
14	9.5-13.5	—	dark	—	—	—	—	/	/	/	/	/	/
15	11-15	—	—	green	—	—	—	/	/	/	/	/	/
16	12-16	—	—	—	—	—	brown	/					
17	12-17	—	—	—	green	—	—	/	/	/	/	/	/
18	12.5-16	yellow	—	—	—	—	—	/	/				
19	16-19	—	—	—	—	yellow-brown	—	/					
20	17-19	—	—	—	blue	—	—	/	/				
21	18.5-22.5	—	—	—	—	—	—	/	/				
22	23-27	orange-yellow	—	—	—	—	—	/					
23	23.5-28.5	—	—	blue	—	—	—	/	/	/	/	/	/

Table 14 continued

Spots	hRf value	Color Detection with						Sample No.					
		Visible without spray	UV ₂₅₄	UV ₃₆₅	Anisaldehyde	H ₃ PO ₄ visible	H ₃ PO ₄ UV ₃₆₅	4	5	14	20	43	44
24	24.5-31.5	—	—	—	blue	—	—	/	/	/	/	/	/
25	29.5-35	—	—	blue	—	—	—	/	/	/	/	/	/
26	30-33.5	—	—	—	—	orange-pink	—	/	/	/	/	/	/
27	32-37.5	—	—	—	—	—	orange-pink	/	/	/	/	/	/
28	34.5-39.5	—	—	—	violet	—	—	/	/	/	/	/	/
29	35-42	—	—	blue	—	—	—	/	/	/	/	/	/
30	44.5-50	—	—	bright blue	—	—	—	/	/	/	/	/	/
31	47.5-55	—	—	—	violet	—	—	/	/	/	/	/	/
32	49.5-54.5	—	—	—	—	—	dark violet	/	/	/	/	/	/
33	57.5-61.5	—	—	bright blue	—	—	—	/	/	/	/	/	/
34	65-69.5	—	—	—	—	yellow	—	/	/	/	/	/	/
35	67.5-75	—	—	—	light green	—	—	/	/	/	/	/	/
36	68.5-76	—	—	light green	—	—	—	/	/	/	/	/	/
37	70-74.5	—	—	—	—	—	yellow	/	/	/	/	/	/
38	76-79.5	—	—	—	—	yellow	—	/	/	/	/	/	/
39	77.5-82	—	—	—	green	—	—	/	/	/	/	/	/
40	79.5-84.5	—	—	—	—	yellow	—	/	/	/	/	/	/
41	82.5-87	—	—	—	violet	—	—	/	/	/	/	/	/
42	84.5-89.5	—	—	—	—	—	orange	/	/	/	/	/	/
43	87.5-92	—	—	—	green	—	—	/	/	/	/	/	/
44	87.5-93	—	—	—	—	—	orange	/	/	/	/	/	/

Table 15 TLC Analysis of Reference Standards.

Spots	hRf value	Color Detection with			Diosgenin	Tigogenin	Smilagenin	β -Sitosterol	Stigmasterol
		Anisaldehyde	H ₃ PO ₄ visible	H ₃ PO ₄ UV ₃₆₅					
1	22-32	—	—	orange-pink	/				
2	22-32.5	—	purple	—	/				
3	22-33	yellow-green	—	—	/				
4	23.5-31.5	—	—	blue (center brown)	/				
5	24.5-32	—	black green	—	/				
5	24.5-32	yellow-green (center brown)	—	—	/				
6	32-38	—	—	yellow (center brown)		/			
7	32-38.5	—	—	orange-pink			/		
8	32.5-37.5	—	yellow-brown	—		/			
9	33-38	yellow-green	—	—		/			
10	33-39	—	orange-pink	—			/		
10	33-39	violet	—	—			/		
11	75-81	—	dark brown	—				/	
11	75-81	purple	—	—				/	
12	75.5-81	—	—	orange pink				/	

Remarks No spot of standard substance is detected under UV₂₅₄ and UV₃₆₅

Table 16 Identification of Investigated Sample Drugs

Sample No.	Traditional Drug Store/Place	Province	Identified Plants
1	Mo Waeo (หมอล้าว)	Loei (เลย)	<i>Smilax glabra</i> Roxb.
2	Doi Suthep (ดอยสุเทพ)	Chiang Mai (เชียงใหม่)	<i>S. corbularia</i> Kunth
3	Chanthaburi Medicinal Plant Garden (สวนสมุนไพรจังหวัดจันทบุรี)	Chanthaburi (จันทบุรี)	<i>Dioscorea birmanica</i> Prain et Burkill
4	Bunsan Osot (บุนสันทอส)	Ubon Ratchathani (อุบลราชธานี)	<i>Pygmaeoprenna herbacea</i> (Roxb.) Mold.
5	Mo Wet-Suchada (หมอเวทสุชาติดา)	Ubon Ratchathani (อุบลราชธานี)	<i>P. herbacea</i> (Roxb.) Mold.
6	Wetchaphong (เวทพงษ์)	Bangkok (กรุงเทพฯ)	<i>Smilax</i> sp.
7	Chao Kron Pua (เจ้ากรมเปื้อ)	Bangkok (กรุงเทพฯ)	<i>Smilax</i> sp.
8	Ngai-Tien-Ong (เง็กเทียนอุ้ง)	Songkla (สงขลา)	<i>Smilax</i> sp.
9	Wetchaphong (เวทพงษ์)	Bangkok (กรุงเทพฯ)	<i>S. glabra</i> Roxb.
10	Wetchaphong (เวทพงษ์)	Bangkok (กรุงเทพฯ)	<i>Smilax</i> sp.
11	Ngaun-Heng-Chan (ง่วนเฮงจัน)	Bangkok (กรุงเทพฯ)	<i>S. corbularia</i> Kunth
12	Ngaun-Heng-Chan (ง่วนเฮงจัน)	Bangkok (กรุงเทพฯ)	<i>Smilax</i> sp.
13	Wat Mahatthai (วัดมหาธาตุ)	Bangkok (กรุงเทพฯ)	<i>Smilax</i> sp.
14	Wat Mahatthai (วัดมหาธาตุ)	Bangkok (กรุงเทพฯ)	<i>P. herbacea</i> (Roxb.) Mold.
15	Suan Chatuchat (สวนจตุจักร)	Bangkok (กรุงเทพฯ)	<i>D. birmanica</i> Prain et Burkill
16	Pho Pra-dit (โพธิ์ประติศรั)	Bangkok (กรุงเทพฯ)	<i>S. glabra</i> Roxb.
17	Ayuravet (อายุรเวท)	Bangkok (กรุงเทพฯ)	<i>S. glabra</i> Roxb.
18	Ayuravet (อายุรเวท)	Bangkok (กรุงเทพฯ)	<i>S. glabra</i> Roxb.
19	Va-Rin Osot (วารินทอส)	Phichit (พิจิตร)	<i>S. corbularia</i> Kunth
20	Va-Rin Osot (วารินทอส)	Phichit (พิจิตร)	<i>P. herbacea</i> (Roxb.) Mold.
21	Mo Pud (หมอลุด)	Songkla (สงขลา)	<i>Smilax</i> sp.
22	Mo Pud (หมอลุด)	Songkla (สงขลา)	<i>Smilax</i> sp.
23	Ngai-Tien-Ong (เง็กเทียนอุ้ง)	Songkla (สงขลา)	<i>S. glabra</i> Roxb.
24	Chanthaboon (จันทบูรณ์)	Chanthaburi (จันทบุรี)	<i>S. glabra</i> Roxb.
25	Chanthaboon (จันทบูรณ์)	Chanthaburi (จันทบุรี)	<i>D. birmanica</i> Prain et Burkill

Table 16 continued

Sample No.	Traditional Drug Store/Place	Province	Identified Plants
26	Chai Langka (ชัชลังกา)	Chiang Mai (เชียงใหม่)	<i>Smilax</i> sp.
27	Chai Langka (ชัชลังกา)	Chiang Mai (เชียงใหม่)	<i>Smilax</i> sp.
28	Ae-di (เอ็ดดี)	Chiang Mai (เชียงใหม่)	<i>S. corbularia</i> Kunth
29	Ae-di (เอ็ดดี)	Chiang Mai (เชียงใหม่)	<i>Smilax</i> sp.
30	Tang-Nguan-Seng (ตั้งวงวั้น)	Bangkok (กรุงเทพฯ)	<i>S. glabra</i> Roxb.
31	Sai Ngam (ทรายงาม)	Chanthaburi (จันทบุรี)	<i>D. birmanica</i> Prain et Burkill
32	Sai Ngam (ทรายงาม)	Chanthaburi (จันทบุรี)	<i>S. corbularia</i> Kunth
33	Thai-An-Chan (ไถอันจัน)	Bangkok (กรุงเทพฯ)	<i>S. corbularia</i> Kunth
34	Thai-An-Chan (ไถอันจัน)	Bangkok (กรุงเทพฯ)	<i>S. corbularia</i> Kunth
35	Thai-Hua-Chan (ไถฮัวจัน)	Bangkok (กรุงเทพฯ)	<i>S. corbularia</i> Kunth
36	Thai-Hua-Chan (ไถฮัวจัน)	Bangkok (กรุงเทพฯ)	<i>Smilax</i> sp.
37	Suan Chatuchat (สวนจตุจักร)	Bangkok (กรุงเทพฯ)	<i>Smilax</i> sp.
38	Mo Wet Suchada (หมอเวทสุชาติ)	Ubon Ratchathani (อุบลราชธานี)	<i>S. glabra</i> Roxb.
39	Cha-Loem-Khet Pharmacy (เฉลิมเขตตำบ่อ)	Bangkok (กรุงเทพฯ)	<i>Smilax</i> sp.
40	Wang Nam Yen (วังน้ำเย็น)	Prachinburi (ปราจีนบุรี)	<i>S. glabra</i> Roxb.
41	Wang Nam Yen (วังน้ำเย็น)	Prachinburi (ปราจีนบุรี)	<i>S. glabra</i> Roxb.
42	Chi-An Osot (ฉิมโอสถ)	Cha-Choeng-Sao (ฉะเชิงเทรา)	<i>S. glabra</i> Roxb.
43	Chi-An Osot (ฉิมโอสถ)	Cha-Choeng-Sao (ฉะเชิงเทรา)	<i>P. herbacea</i> (Roxb.) Mold.
44	Khao Sup Pradu (เขาวังประดู่)	Nakhon Ratchasima (นครราชสีมา)	<i>P. herbacea</i> (Roxb.) Mold.