STUDIES ON CHINESE DRUGS IN TAIWAN

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The major studies on the chemical constituents relating to 28 kinds of Chinese herbs and 12 kinds of folk medicines used in Taiwan are collected in this review. From those plants, 41 new constituents were isolated and their structures were determined during the period from 1968 to 1974.

There are two ways of therapy which Chinese people are used to curing diseases, i.e., western and Chinese. In western medicine pure chemicals and synthetic products are generally used, while in Chinese medicine herbal preparations from natural resources are traditionally used. In Chinese ancient history, 52 kinds of herbs were recorded in the "SHAN-JING" (山經), BC 400, and the "HAE-JING" (海經), BC 120. Up to the Min Dynasty (明朝) 1878 kinds of drugs were recorded in the book of "PEN-TS'AO-KAN-MU" (本草綱目) by Si-Cheng Li (李時珍).

It is estimated that recent Chinese people generally use 520 kinds of Chinese herbs and 1000 kinds of folk medicines for curing diseases.

In order to promote better understanding of the Chinese herbal study, one of the authors has introduced it in the books namely, "The Progress on

Chinese Herbal Study", "The Studies of Chinese Herbal Medicine", Vols. I and II, respectively.[1,2,3]

During the recent years the scientists in Asia have made much progress in this field.

The subjects of studies include the following: (A) Studies of "PEN-TS'AO" (本草); (B) Pharmacognostical studies; (C) Chemical constituents; (D) Evaluation of the quality; (E) Studies on the preparation; (F) Pharmacological studies; (G) Cultivation; (H) Clinical studies, etc.

As to the progress of the study of Chinese herbal medicine in Taiwan, one can refer to the book "Abstract of Chinese herbal Medicine in Taiwan"[4] and the article "Recent Studies on Chinese Drugs in Taiwan" reported by one of the authors in the recent special symposium in plenary session of the 5th Asian Congress of Pharmaceutical Sciences, FAPA. In the present review, we wish to make a brief introduction of the major studies on the chemical constituents relating to the Chinese herbs and folk medicines which have been investigated by some scientists in Taiwan.

(1) HUNG-LIEN (黃連) —— Berberine, coptisine, jatrorrhizine, columbamine and magnoflorine were identified from the rhizoma of Formosan Coptis quinquefolia Miq., Ranunculaceae. The alkaloids presented in some different species of Coptis were also compared as following:

	C. quinquefolia	C. teeta	C. japonica	C. trifolia
Berberine	+	+	+	+
Palmatine	-	+	+	-
Coptisine	+	+	+	-
Worenine	-	+	+	-

	C. quinquefolia	C. teeta	C. japonica	C. trifolia
Jatrorrhizine	+	+	+	-
Columbamine	+	-	-	-
Magnoflorine	+	-	+	-

It is interesting that columbamine was the first example found in Coptis genus.[5]

(2) MUH-MIAN-SHUH (木棉樹) —— Lupeol and KNO_3 were isolated from the root barks of Bombax malabarica DC. (B. ceiba L.), Bombacaceae.[6]

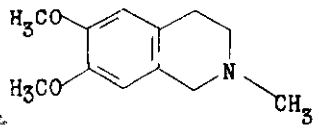
(3) SHUU-YUH (薯蕷) —— From the methanolic extract of the tubers of Formosan Dioscorea colletii Hook. f., Dioscoreaceae, dimethyl terephthalate was isolated.[7]

(4) LIEN-FANG (蓮房) —— From Formosan lotus receptacle (seed pod of Nelumbo nucifera Gaertn., Nymphaeaceae), four alkaloids: nuciferine, N-nornuciferine, oxoushinsunine and N-norarmepavine were isolated.

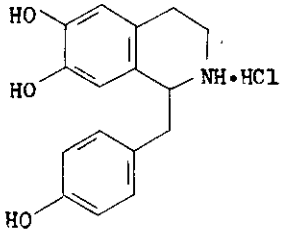
The comparison of the alkaloidal distribution in each part of Formosan lotus was also shown as below:[8]

	leaf	petiole	embryo	receptacle
nuciferine	+	+		+
roemerine	+			
O-nornuciferine	+			
isoliensinine			+	
neferine			+	
lotusine			+	
methylcorypalline			+	
N-nornuciferine				+
oxoushinsunine				+
N-norarmepavine				+

(5) LIEN-TZE-HSIN (蓮子芯) ——— From the Formosan seed embryo of Nelumbo nucifera, Nymphaeaceae, a new minor base —— methylcorypalline, $C_{12}H_{17}ON \cdot \frac{1}{2}H_2O$, m.p. 58-59°C, $(\alpha)_D^{20}$ 0° ($CHCl_3$), which is the first instance occurring in nature having coronary dilator action[9] —— and another new alkaloid —— 1-(p-hydroxybenzyl)-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline which is the first tetrahydroisoquinoline alkaloid with a secondary base obtained from this crude drug and it has the pharmacological activity of smooth muscle and uterine relaxation[10] —— were isolated.



Methylcorypalline



1-(p-Hydroxybenzyl)-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline

(6) SHAN-ZHU-YU (山茱萸) ——— Ursolic acid was obtained from the fructus of Cornus officinalis. The yield was 0.22%.[11]

(7) JU-TZY-TS'AO (珠仔草) ——— From the whole herbs of Formosan Hedyotis diffusa Willd., Rubiaceae, β-sitosterol and ursolic acid were isolated.[12]

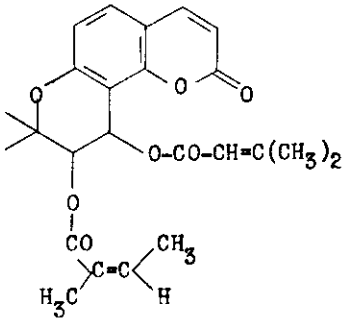
(8) FORMOSAN-BAI-ZHI (台灣白芷) ——— Besides 6 kinds of coumarin derivatives (i.e. oxypeucedanin hydrate, isoimperatorin, imperatorin, bergapten, phellopterin and oxypeucedanin), byak-angelicin was also isolated from the ether extract of the dried ripe fruits of Angelica dahurica Benth. et Hook. var. formosana (Boiss.) Yen.[13]

(9) JAPANESE-TANG-KUEI (日本當歸) ——— Xanthotoxin and iso-pimpinellin were isolated from the roots and fruits of Angelica acutiloba Kitagawa

besides bergapten from its roots.[14]

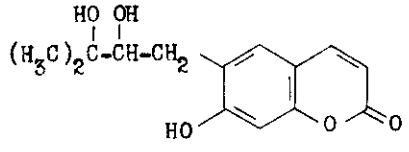
(10) MA-TOU-LING (馬兜鈴) ——— Allantoin and aristolochic acid were isolated from the roots of Formosan Aristolochia shimadai Hayata.[15]

(11) FORMOSAN-CHIAN-HU (台灣前胡) ——— A new coumarin derivative, peuformosin, $C_{24}H_{26}O_7$, m.p. 155-156°C, $(\alpha)_D^{27}$ +67.3°, was isolated from ether extract of the roots of Peucedanum formosanum Hayata, Umbelliferae.[16]

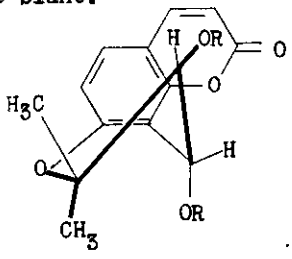


Peuformosin

(12) FARNG-KWEI (防葵)——— A new coumarin derivative, peucedanol, $C_{14}H_{16}O_5$, m.p. 174-175°C, $(\alpha)_D^{20}$ +31.2°, was obtained from ether extract of the roots of Peucedanum japonicum Thunb., Umbelliferae.[16] On the other hand, two new khellactone esters —— 3'(S),4'(S)-diisovalerylkhellactone, $C_{24}H_{30}O_7$, m.p. 88-89°C, $(\alpha)_D$-38.8°(c=0.1 $CHCl_3$), and 3'(S),4'(S)-disenecioylkhellactone, $C_{24}H_{26}O_7$, m.p. 112-113°C, $(\alpha)_D$-47.7°(c=0.1 $CHCl_3$) —— were isolated from the n-hexane extract of the whole herbs of this plant.[17]



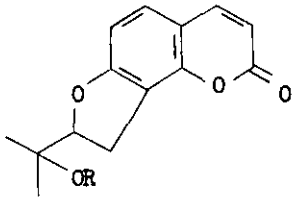
Peucedanol



3'(S),4'(S)-Diisovalerylkhellactone R=isovaleryl

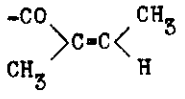
3'(S),4'(S)-Disenecioylkhellactone R=senecioyl

(13) DU-HUO (獨活) ——— Xanthotoxin and byak-angelicin were isolated from the roots of Angelica tarokoensis Hayata, Umbelliferae (TAROKO-DU-HUO 太魯閣獨活).[18] The ether extract of the dried roots of Angelica laxiflora Diels. (CHUAN-DU-HUO 川獨活) afforded bergapten, umbelliferone, angelol, as well as three compounds: columbianetin, $C_{14}H_{14}O_4$, m.p. 162-163°C; columbianetin acetate, $C_{16}H_{16}O_5$, m.p. 130-131°C; columbianadin, $C_{19}H_{20}O_5$, m.p. 116-117°C.[19]



Columbianetin R= -H

Columbianetin acetate R= $-COCH_3$

Columbianadin R= 

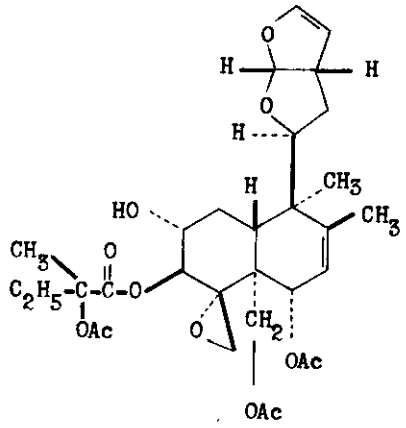
(14) HUAH-SHYR-TS'AO (化石草) ——— A new diterpene compound, 3-epicaryoptine, $C_{26}H_{36}O_9$, m.p. 171-172°C, (α)D-70° ($CHCl_3$), was isolated from the air dried leaves of Clerodendron calamitosum L., Verbenaceae.[20,21]

(15) DAH-CHING (大青) ——— Clerodendrin A was isolated from Clerodendron cyrtophyllum Turcz., Verbenaceae. Both of 3-epicaryoptine and clerodendrin A are effective antifeeding substances.[20,21]

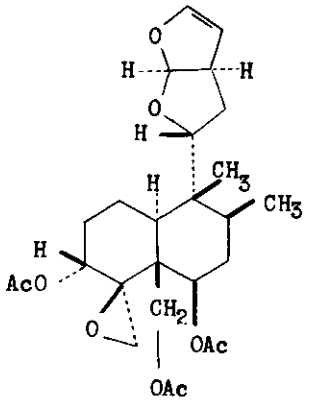
(16) U-TZY-TS'AO (烏仔草) ——— Justicidin A and B which are fish killing lignans and have same activity as rotenone of Taiwan grown derris root with insecticide activity were obtained from Justicia hayatai var. decumbens, Acanthaceae.[22]

(17) SHU-UWEI-HONG (鼠尾紅) ——— Justicidin A and B as well as

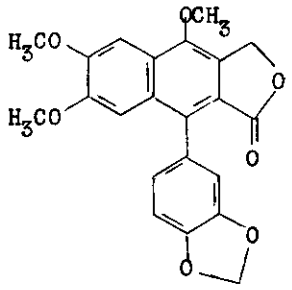
justicidin C and D were obtained from Justicia procumbens L., Acanthaceae. 22,23,24,25



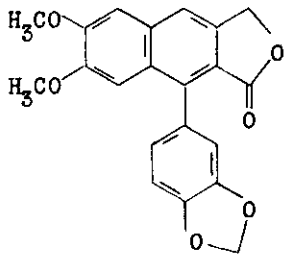
Clerodendrin A



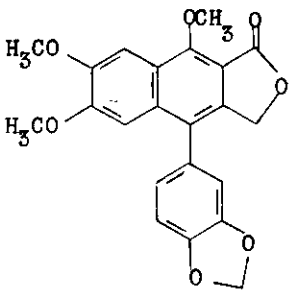
3-Epicaryoptine



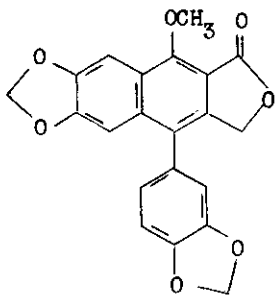
Justicidin A



Justicidin B

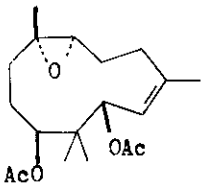


Justicidin C

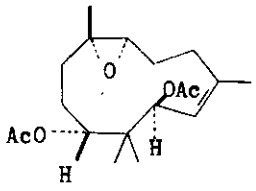


Justicidin D

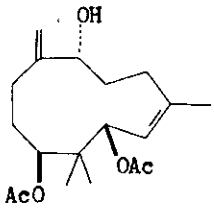
(18) SHEAU-CHIEH-I (小蘪衣) —— Caucalol diacetate, $C_{19}H_{30}O_5$, as well as minor constituents: epicaucalol diacetate, $C_{19}H_{30}O_5$ and caucalol M, $C_{19}H_{30}O_5$, were isolated from the seeds of Torillis scabra DC. which are used as substitutes for the seeds of Cnidium monnieri Cusson (蛇床子) in Japan. The stereochemistry of each of them were also determined.[26]



Caucalol diacetate

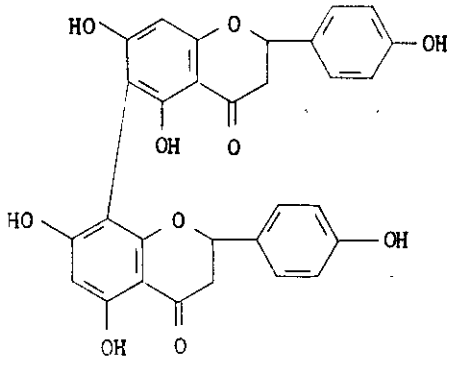


Epicaucalol diacetate

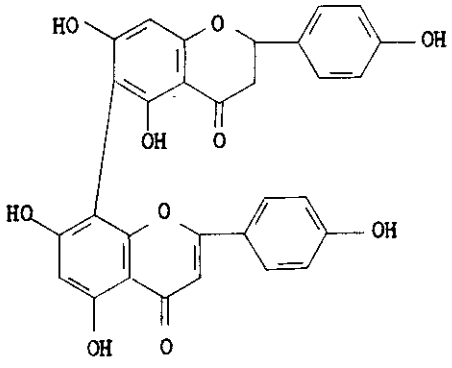


Caucalol M

(19) SHAN-CHI (山漆) —— A new biflavanone —— rhusflavanone, $C_{30}H_{22}O_{10}$, m.p. 204-206°C[27], and a new flavanoflavone —— rhusflavone, $C_{30}H_{20}O_{10}$, m.p. 236-238°C, $(\alpha)_D^{25}$ -1.63°(c=0.39, EtOH)[28] besides hinokiflavone, amentoflavone, agathisflavone[29] and robustaflavone[30] were isolated from the seed-kernels of Rhus succedanea, Anacardiaceae.



Rhusflavanone



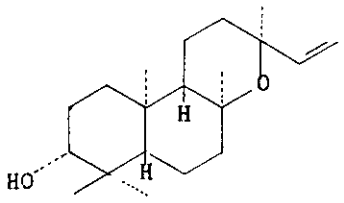
Rhusflavone

(20) LANG-YU (榔榆) —— 7-Hydroxycadalenal, 3-methoxy-7-hydroxycadalenal, mansonone C, sitosterol, and mansonone G were isolated from the dried and ground Chinese elm wood —— Ulmus parvifolia Jacq, Ulmaceae.[31]

(21) BAI-XIAN-PI (白鮮皮) ——— Four components, dictamnine, limonin, obacunone and fraxinellone were isolated from the root barks of Dictamnus dasycarpus Turcz., Rutaceae.[32] The activities of four materials (i.e. silica gel, alumina, polyamide, and polyamide-silica gel mixture) used as adsorbents in TLC to separate these four components were compared.[33]

(22) REEN-DONG-TENG (忍冬藤) ——— During the study of the component of Lonicera japonica Thunb. var. sempervillose, Caprifoliaceae, a new diterpene which was 3α-hydroxy-(-)-manoyl oxide, $C_{20}H_{34}O_2$ was obtained.[34]

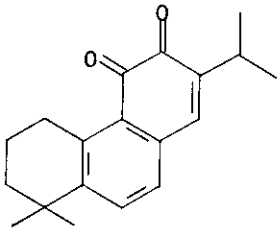
(23) YIN-CHEN-HAU (茵陳蒿) ———
From the chloroform extract of the buds of Artemisia capillaris, Compositae, scopoletin was isolated.[35]



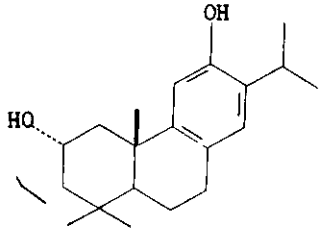
3α-Hydroxy-(-)-manoyl oxide

(24) SHAN-SHEN-ZI (山參仔) ———
From the n-hexane extract of the whole plant of Glossogyne tenuifolia, Compositae, oleanolic acid was obtained as the main component.[36]

(25) DAN-SHEN (丹參) ——— From the roots of Salvia miltiorrhiza Bunge, a new red crystalline pigment, named miltirone, $C_{19}H_{22}O_2$, m.p. 100°C, and a new diterpenoid phenol named salviol, $C_{20}H_{30}O_2$, m.p. 108°C, were isolated.[37,38]



Miltirone

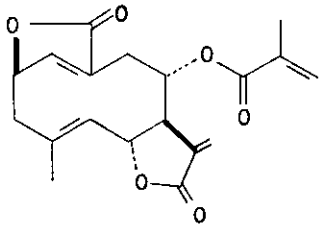


Salviol

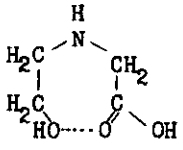
(26) DENG-SHU-U (登聲杉) ——— From the chloroform extract of the whole

plants of Elephantopus scaber, Compositae, two compounds were isolated. They were lupeol and deoxoelephantopin, $C_{19}H_{20}O_6$, m.p. 198-200°C.[39]

(27) HAE-DAY (海帶) ——— A new amino acid, named petalonine, m.p. 182-184°C (decomp.), $C_4H_9O_3N$, was isolated from Formosan seaweed, Petalonia fascia (Muller) Kuntze, Scytosiphonaceae, besides laminine and pipecolic acid.[40]

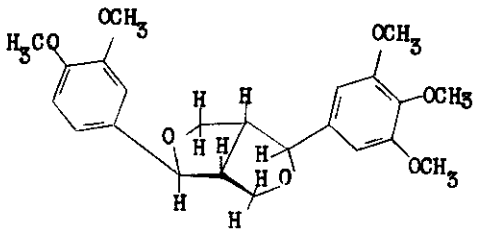


Deoxoelephantopin

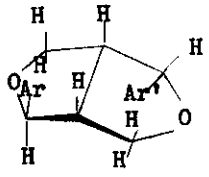


Petalonine

(28) XIN-YI (辛夷) ——— Four lignans were isolated from the flower buds of Magnolia fargesii Cheng, two of which were known lignans, pinoresinol dimethyl ether and lirioresinol-B dimethyl ether; the other two were new lignans, named magnolin and fargesin.[41]



Magnolin

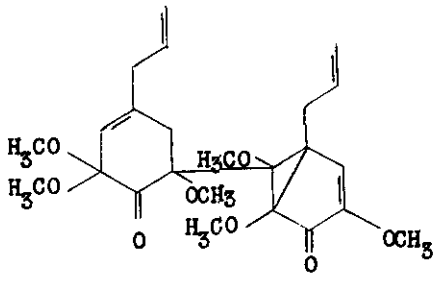


Ar,Ar'=3,4-dimethoxy phenyl,
3,4-methylenedioxy phenyl

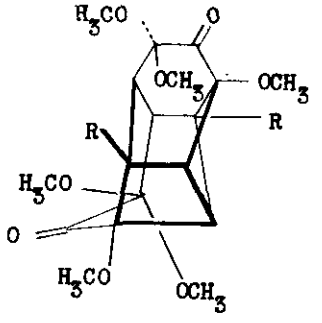
Fargesin

(29) FORMOSAN-SHIH-SHIN (台灣細辛) ——— Two new compounds were isolated from the n-hexane extract of the whole herb of Formosan Asarum taitonense

Hayata, Aristolochiaceae. They were asatone, $C_{24}H_{32}O_8$, m.p. 101-102°C, $[\alpha]_D^{20}$ ±0°(MeOH), and isoasatone, $C_{24}H_{32}O_8$, m.p. 156.5-158°C, $[\alpha]_D^{20}$ ±0° (MeOH).[42,43,44]



Asatone

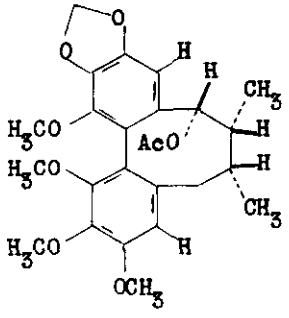


R= $-CH_2CH=CH_2$

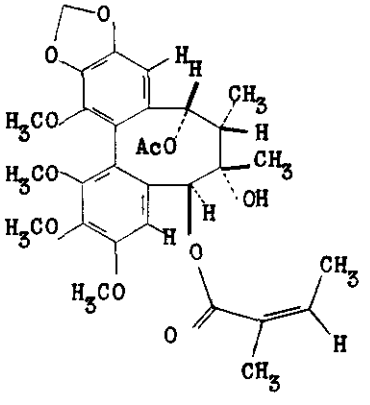
Isoasatone

(30) DAO-DIAW-JIN-JONG (倒吊金鐘) —— A bitter substance, columbin, was isolated from Formosan Melothria maderospatana Cogn. DC., Cucurbitaceae.[45]

(31) HORNG-GUU-SHER (紅骨蛇) —— Two new lignans, kadsurin, $C_{25}H_{30}O_8$, m.p. 157-158°C, $[\alpha]_D^{25}$ -39°(c=0.13 in $CHCl_3$), and kadsurarin, $C_{30}H_{36}O_{11}$, m.p. 255-256°C, $[\alpha]_D^{25}$ -65°(c=0.10 in $CHCl_3$) were isolated from the stems of Kadsura japonica Dunal (Magnoliaceae).[46]

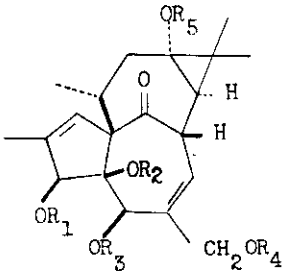


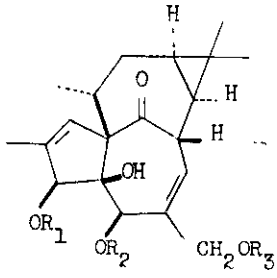
Kadsurin



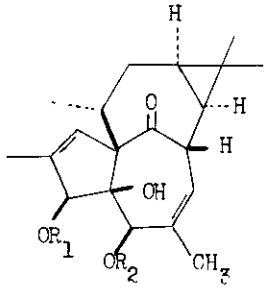
Kadsurarin

(32) KAN-SUI (甘遂) ——— **From the toxic fractions (the ethanol extract) of the dried roots of Euphorbia kansui Liou, Euphorbiaceae, four new diterpene derivatives were obtained. They were 20-deoxyingenol-3-benzoate, 20-deoxyingenol-5-benzoate, ingenol-3-(2,4-decadienoate)-20-acetate and 13-oxyingenol-13-dodecanoate-20-hexanoate.**[47]



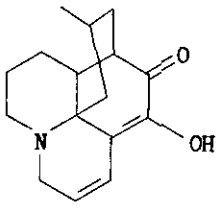


13-Oxyingenol	$R_1=R_2=R_3=R_4=R_5=H$
13-Oxyingenol-13-dodecanoate-20-hexanoate	$R_1=R_2=R_3=H$ $R_4=CO(CH_2)_4CH_3$ R_5=dodecanoyl
Ingenol	$R_1=R_2=R_3=H$
Ingenol-3-(2,4-decadienoate)-20-acetate	$R_1=CO(CH=CH)_2(CH_2)_4CH_3$ $R_2=H$ $R_3=COCH_3$

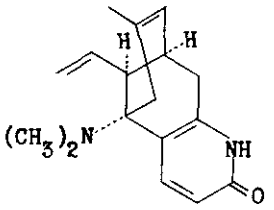


20-Deoxyingenol	$R_1=R_2=H$
20-Deoxyingenol-3-benzoate	$R_1=COPh$, $R_2=H$
20-Deoxyingenol-5-benzoate	$R_1=H$, $R_2=COPh$

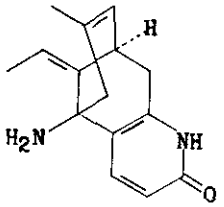
(33) JIN-BUH-HUANN (金不換) —— From the chloroform layer of the Formosan Lycopodium serratum var. longepetiolatus, Lycopodiaceae, three new constituents named kimpukan-A, -B and -C were isolated. Kimpukan-A and -B showed strong analgesic activity in mouse hot plate method, while kimpukan-C no analgesic activity.[48]



Kimpukan-A



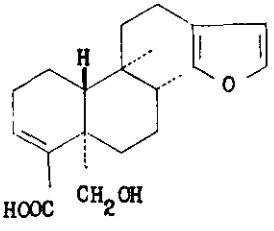
Kimpukan-B



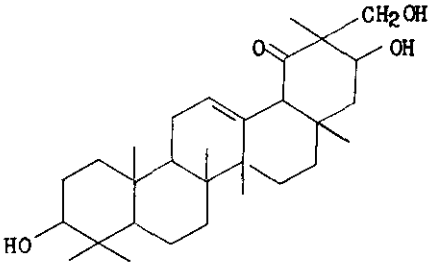
Kimpukan-C

(34) CHE-SANG-TZY (車桑仔) —— Hautriwaic acid was isolated from the leaves of Dodonea viscosa, Sapindaceae. Its structure was determined by chemical and spectroscopic studies.[49]

(35) FORMOSAN-TZAW-JYA (臺灣皂莢) —— A new sapogenin was isolated from the root barks of Gleditsia formosana Hay., Leguminosae. It was named gledi-formgenin which showed antitumor activity to the Walker 256 carcinosarcoma and was proved to be $\Delta^{12,13}$-3,21,30-trioxy-19-oxo-oleanen.[50]



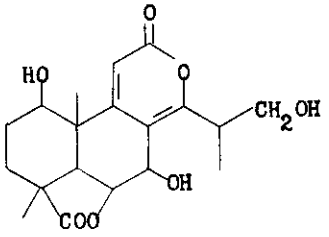
Hautriwaic acid



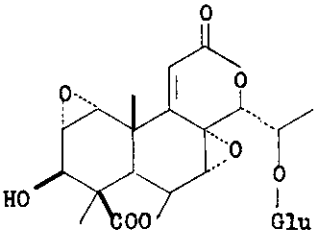
$\Delta^{12,13}$-3,21,30-Trioxy-19-oxo-oleanen

(36) BAE-RYH-CHING (百日青) —— Four insect moulting hormones —— ponasterone A,B,C,D were extracted from the Formosan Podocarpus nakaii Hayata, Podocarpaceae, with activity on calliphoric test similar to that reported by Hoffmeister et al.[51]

(37) LUO-HANN-SONG (羅漢松) —— Two further norditerpenoids of Podocarpus macrophyllus D. Don, Podocarpaceae, were isolated together with inumakilactone A, nagilactone C and nagilactone F. They were inumakilactone E, $C_{19}H_{24}O_7$, m.p. 220-225°C and inumakilactone A 15β-glucoside, $C_{24}H_{30}O_{13}$, m.p. 296-300°C, which was shown to be a potent inhibitor of the expansion and division of plant cells.[52]



Inumakilactone E



Inumakilactone A
15β-glucoside

(38) LON-YEN-FU (龍眼菰) —— Ganoderma applanatum is a fungal herb used widely as a diuretic in Taiwan. From the n-hexane extract of this fungus, coenzyme Q_9, orange-red crystal, $C_{54}H_{82}O_4$, m.p. 44°C, was obtained. It is interesting that coenzyme Q_9, playing an important role in respiratory chain, exists in this fungus.[53]

(39) PU-CHAN-KUAN (埔姜癀) —— Phellinus yucatensis Murr. is a fungal herb used widely as an anti-inflammatory agent in Taiwan. From the n-hexane soluble part of the methanolic extract of this fungus, 1,4-dimethoxy-2,3,5,6-tetrachlorobenzene, $C_8H_6O_2Cl_4$, m.p. 164-165°C, was obtained. It is interesting that such a polyhalogene compound exists in nature, especially in this

herb.[54]

(40) RUAE-UAN (蕊丸) ——— Omphalia lapidescens Schr. is a fungal herb used widely as an anthelmintic in China. A mixture of henicosanoic acid, docosanoic acid, tricosanoic acid, tetracosanoic acid and pentacosanoic acid was obtained from the ether soluble part of the methanolic extract of this fungus.[55]

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