Recent Developments of Natural Product Chemistry in Taiwan

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Geographically Taiwan is located at a latitude between the tropical and sub-tropical zones. The island has more than four hundred mountains with an altitude higher than 2000 meters, hence it also has the arctic climate. Rainfall is heavy, the fourth highest in the world. Forest land is abundant, thus Taiwan is a treasure island of plants. Here in this island the study on the constituents of plants especially the medicinal plants of the folk medicine is very popular.

As for the past progress of the studies on the chemistry of natural proucts in Taiwan, one can refer to the book "Abstract of Chinese Herb Medicine in Taiwan (1905～1972)"[1], and the article "Studies on Natural Resources of Drugs in Taiwan"[2] reported by Dr. H. Y. Hsu in the 3rd Asian Congress of Pharmaceutical Sciences, FAPA, held in Korea in 1968, and also the topic "Recent Studies on Chinese Drugs in Taiwan"[3] reported by Dr. Hsu in the 5th Congress of FAPA, held in Taipei, Republic of China in 1974. Dr. H. Y. Hsu and I have already made a review titled "Studies on Chinese Drugs in Taiwan"[4] in which the major studies on the chemical constituents relating to 40 kinds of Chinese herb drugs, and the 41 new chemical constituents isolated therefrom during the period from 1968 to 1974 were included.

In the present review, an outline on the major researches about plant constituents as done by the scientists in Taiwan during the recent five years will be introduced. The names of plants, parts used in the study and components isolated and determined are summarized as follows. (Where * denotes the new compound first isolated from the natural world.)

(1) Six species of *Podocarpus* (family Podocarpaceae) grown in Taiwn were studied. The nor-and bisnor-diterpene lactones thus isolated from the trunks of these plants are shown below:

P. macrophyllus (Thunb.)D. Don: inumakilactone A, inumakilactone A glucoside* ($C_{24}H_{30}O_{13}$,mp. 296～300°), inumakilactone E*($C_{19}H_{24}O_7$,mp. 220～225°), nagilactone C

P. philippinensis Foxworthy: inumakilactone A, inumakilactone A glucoside, inumakilactone E, nagilactone A

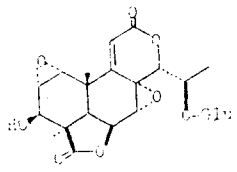
P. formosensis Dummer: nagilactone A

P. nagi (Thunb.) Zoll. et Makino: nagilactone A

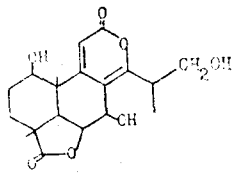
P. polystachyus R. Br.: inumakilactone B, hallactone B, nagilactone A

P. nankoensis Hayata: nagilactone C

Among the above-mentioned components, inumakilactone A, inumakilatone A glucoside and nagilactone C exhibited anti-inflammatory and antipyretic activity in rats[5]



Inumakilactone A glucoside



Inumakilacton E

(2) Alkaloidal constituents of the barks and the fruits of ***Cephalotaxus wilsoniana*** Hay., Ceph alotaxaceae were studied.

3-epi-schelhammericine, Base VI and 3-epi-wilsonine of homoerythrina alkaloids, and cephalotaxine, acetylcephalotaxine, isoharringtonine and Alkaloid G of the cephalotaxus alkaloids were isolated.[6].

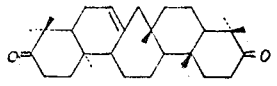
(3) From the wood of ***Keteleeria davidiana*** Beissner, Pinaceae, α-pinene, β-pinene, limonene, α-copaene, bornyl acetate, β-elemene, caryophyllene, caryophyllene oxide, α-selinene, β-selinene, selin-11-en-4α-ol, laevojunenol, α-cyperone, α-conidendrin, 15-hydroxydehydroabietic acid, hexacosanyl tetracosanoate, tetracosyltetracosanate, docosanyltetracosanoate, hexacosanol, tetracosanol, docosanol, β-sitosterol and stigmasterol were isolated.[7]

(4) From the wood of ***Pinus luchuensis*** Mayer, Pinaceae, 3β-methoxyserrat-14-en-21-one, serrat-14-en-3, 21-dione,* 3β-hydroxyserrat-14-en-21-one, 3β, 21α-dimethoxyserrat-14-ene, 3β-methoxyserrat-14-en-21α-ol, methyl dehydroabietate, pinosylvin monomethylether, pimaric acid, dehydroabietic acid, α-pinene, β-pinene, camphene, camphor, 4-terpineol, α-terpineol, carvacrol, tetracosanol, hexacosanol, octacosanol, β-sitosterol and stigmasterol were isolated.[8]

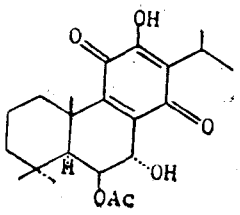
(5) A new derivative of royleanone, 6β-acetoxy-7α-hydroxyroyleanone*, $C_{22}H_{30}O_6$, mp. 182~183°, $[\alpha]_D$-52.5° (c=1.0, $CHCl_3$) besides 6,7-dehydroroyleanone were isolated from the barks of ***Taiwania cryptomerioides*** Hayata, Taxodiaceae.[9]

(6) A new phenolic diterpene, 6α-hydroxy-7-oxo-ferruginol*, $C_{20}H_{28}O_3$, mp. 207~208°, $[\alpha]_D^{20}$ +59.3° (c=1.0, EtOH) was isolated from the barks of ***Libocedrus formosana*** Florin, Cupressaceae.[10]

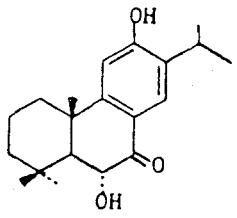
(7) Two novel neolignans, asatone*, $C_{24}H_{32}O_8$, mp. 101~102° $[\alpha]_D^{20}\pm0°$ (MeOH) and isoasatone*, $C_{24}H_{32}O_8$, mp. 157~158°, $[\alpha]_D^{20}\pm0°$, (MeOH), were isolated from the whole herb of ***Asarum taitonense*** Hayata, Aristolochiaceae, together with safrole, elemicin, esamin, borneol and β-sitosterol. From a biogenetic point of view, furthermore, thermal and photochemical reactions of these neolignans and their derivatives were carried out. In particular, asatone was photochemically converted into isoasatone.[11]



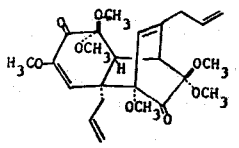
Serrat-14-en-3, 21-dione



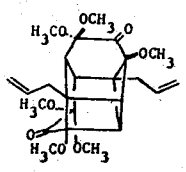
6β-Acetoxo-7α-hydroxoroyleanone



6α-Hydroxy-7-oxo-ferruginol



Asatone



Isoasatone

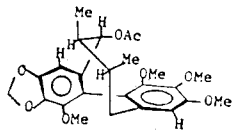
(8) Form the whole herb of ***Polycarpaea corymbosa*** Lam., Caryophyllaceae, camelliagenin A, A_1-barrigenol and stigmastanol were isolated.[12]

(9) From the whole herb of ***Thalictrum urbaini*** Hayata, Ranunculaceae, S-(+)-oconovine and S-(+)-isocorydine were isolated.[13]

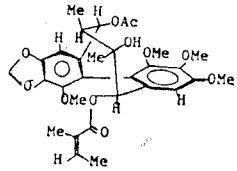
(10) From the roots of ***Tinospora dentata*** Diels, Menispermaceae, a diterpenoid, columbin and two alkaloids, palmatine and jatrorrhizine were isolated.[14]

(11) Two new schizandrin-type lignans, kadsurin*, $C_{25}H_{30}O_8$, mp. 157~158°, $[\alpha]_D^{25}$-39° (c=0.13, $CHCl_3$), kadsurarin*, $C_{30}H_{36}O_{11}$, mp.

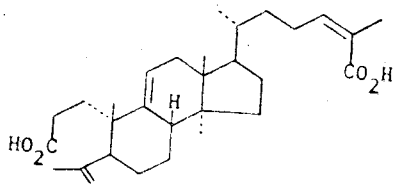
255～256°, $[\alpha]_D^{25}$-65° (c=0.10, $CHCl_3$), and a new A-secolanostane type triterpenoid, kadsuric acid*, $C_{30}H_{46}O_4$, mp. 185°, $[\alpha]_D^{20}$+77.3° (c=1.1, MeOH) were isolated from the stems of *Kadsura japonica* Dunal, Magnoliaceae.[15]



Kadsurin



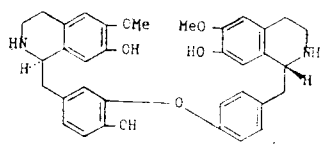
Kadsurarin



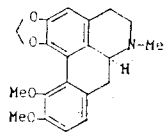
Kadsuric aid

(12) From the stem barks and leaves of *Anona montana* Macf., Anonaceae, five alkaloids were isolated. These include two major phenanthrene alkaloids, atherosperminine, argentinine and three minor bases, i.e. anonaine, oxoushinsunine and reticuline.[16]

(13) A new bisbenzylisoquinoline alkaloid, lindoldhamine*, $C_{34}H_{36}N_2O_6$, mp. 183～186°, $[\alpha]_D^{33}$+35° (c=1.0, EtOH), together with other seven alkaloids, namely, O-methylbulbocapnine* (O,N-dimetylnandigerine), $C_{20}H_{21}O_4N$, mp. 129～130°, $[\alpha]_D^{31}$+248° ($CHCl_3$), N-methylnandigerine (N-methylhernangerine), N-methylovigerine (N-methylhernovine), dicentrine, N-nordicentrine, dicentrinone and L-(+)-magnonocurarine were isolated from the trunks and leaves of *Lindera oldhamii* Hemsl, Lauraceae.[17]



Lindoldhamine



O-Methylbulbocapnine.

(14) Three species of *Neolitsea* (family Lauraceae) were studied. Following alkaloids were isolated.

N. aurata (Hay.) Koidz., wood: laurolitsine, litsericine, N-methyllitsericine, (+)-anonaine, (−)-roemerine[18]

N. buisanensis Yamamoto et Kamikoti, wood: laurolitsine, litsericine[18]

N. daibuensis Kamikoti, root wood and root barks: S-(+)-reticuline[19]

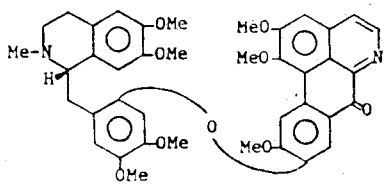
(15) From the leaves and the trunks of *Deh aasia triandra* Merr., Lauraceae, and aporphine alkaloid, isocorydine and a bisbenzylisoquinoline alkaloid, obaberine were isolated, respectively.[20]

(16) From the leaves and the stems of *Cinn amomum osmophloeum* Kanehira, Lauraceae, kaempferitrin, kaempferol-7-rhamnoside, coumarin and fumaric acid were isolated.[21]

(17) From the stems of *Illigera luzonensis* (Presl.) Merr., Hernandiaceae, an aporphine-type base, launobine was isolated.[22]

(18) From the root barks of *Hernandia ovigera* L., Hernandiaceae, six alkaloids, namely, oxothalicarpine*, $C_{40}H_{40}O_9N_2 \cdot 2H_2O$, mp. 219～220° (dec.), $[\alpha]_D^{25}$+115° (c=0.1, $CHCl_3$), thalicarpine, dehydrothalicarpine, ovigerine, hernangerine, hernandonine and a phenyl-tetralin type lignan, desoxypodophyllotoxin were isolated.[23]

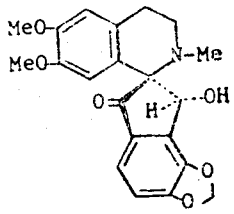
Desoxypodophyllotoxin and thalicarpine exhibited a distinctive cytotoxic activity against nasopharynx carcinoma was reported by S. M. Kupchan et. al.



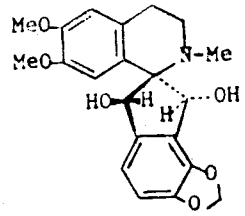
Oxothalicarpine

(19) The alkaloidal constituents of *Corydalis ochotensis* Turcz., Papaveraceae was studied,

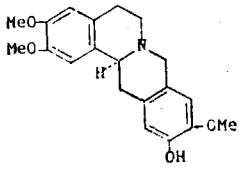
From the whole herb of this plant, two new spirobenzylisoquinoline akaloids, yenhusomine*, $C_{21}H_{23}NO_6$, mp. 127~128°, $[\alpha]_D^{19}$+48°(c=1.0, MeOH) and yenhusomidine*, $C_{21}H_{21}NO_6$, mp. 240~241°, $[\alpha]_D^{29}$0° (c=0.41, $CHCl_3$) and two tetrahydroprotoberberine alkaloids, corytenchine*, $C_{20}H_{23}NO_4$, mp. 257~258°, $[\alpha]_D^{30}$-268° (c=0.89, $CHCl_3$) and corytenchirine*, $C_{21}H_{25}NO_4$, mp. 246~247°, $[\alpha]_D^{24}$-299°(c=1.0, $CHCl_3$) together with four known alkaloids, ochotensimine, adlumidine, protopine and didehydroc heilantifoline were isolated.[24]



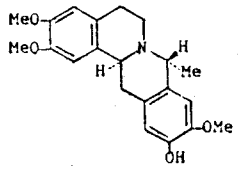
Yenhusomine



Yenhusomidine



Corytenchine

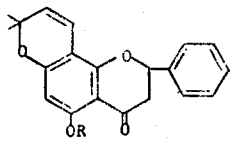


Corytenchirine

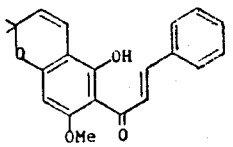
(20) From the stems of *Capparis formosana* Hemsl., Capparidaceae, scopoletin, scopolin, caffeic acid ethyl ester and a mixture of β-sitosterol, stigmasterol and campesterol were isolated.[25]

(21) From the stems of *Spiraea formosana* Hay., Rosaceae, friedelin, glutinol, β-amyrin, 10-nonacosanol and a mixture of β-sitosterol and campesterol were isolated.[26]

(22) Two species of *Tephrosia* (family Leguminosae) were studied. Three new flavonoids named obovatin*, $C_{20}H_{18}O_4$, mp. 123-124°, $[\alpha]_D$ -93.8° (c=3.74, $CHCl_3$), obovatin methyl ether*, $C_{21}H_{20}O_4$, mp. 163°, $[\alpha]_D$-50°(c=2.6, $CHCl_3$), and obovatachalcone*, $C_{21}H_{20}O_4$, mp. 105° were isolated from the whole herb of *T. obovata* Merr. These three components displayed moderate piscicidal activity against loach fish.[27] Obovatin methyl ether was also isolated from the whole plant of *T. candida* (Roxb.) DC.[28]

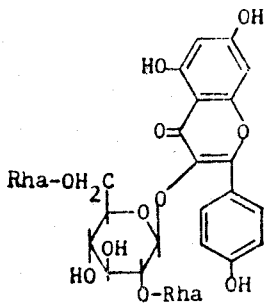


Obovatin R=H
Obovatin methyl ether R=Me



Obovatachalcone

(23) The flavonoids in the leaves of *Clitoria ternatea* L., Leguminosae was studied. Four kaempferol glycosides, namely, kaempferol-3-0-rhamnosyl-(1→2)-0-[rhamnosyl-(1→6)]-glucoside (named clitorin*), $C_{33}H_{40}O_{19}$, mp. 198°, kaempferol-3-glucoside (astragalin), kaempferol-3-rutinoside (nicotifolin) and kaempferol-3-neohesperidoside were isolated.[29]



Clitorin cuspidiol

(24) From the leaves of *Uraria crinita* Desv., Leguminosae, six C-glycosylflavones, namely, vitexin, vitexin 7-0-glucoside, orientin, orientin 7-0-glucoside, saponaretin 4′-0-glucoside and vicenin II were isolated.[30]

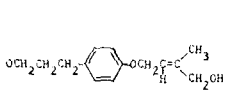
(25) Five flavonol glycosides, kaempferol-3-arabinoside, kaempferol-3-xyloside, quercetin) and quercetin-3-galactoside were isolated from the leaves of *Leucaena glauca* (L.) Benth., Leguminosae.[31]

(26) From the leaves of *Cassia fistula* L., Leguminosae, three kaempferol glycosides, kaem

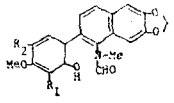
pferol-3-glucoside (astragalin), kaempferol-3-neohesperidoside and kaempferol-3-0-rhamnosyl-(1→2)-0-[rhamonosyl-(1→6)-glucoside (clitorin) were isolated.[31]

(27) Kaempferol-3-rhamnoside (afzelin) and quercitrin were isolated from the leaves of *Pithecolobium dulce* Benth., Leguminosae.[31] Vicenin II, quercetin-3-xyloside (reynoutrin), quercetin-3-rhamnoglucoside (rutin), myricetin-3-rhamnoside (myricitrin) and kaempferol-3-robinoside-7-rhamnoside (robinin) were obtained from the leaves of *Albizzia lebbeck Benth.*, *Aeschynomene indica* L., *Canavalia lineata* D.C., *Flemingia congesta* Roxb.,and *Vigna marginata* Benth., Leguminosae, respectively.[31]

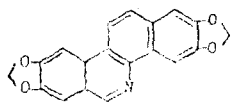
(28) The constituents of *Xanthoxylum cuspidatum* Champ. (*Fagara cuspidata* Engl.), Rutaceae, was investigated. From the wood a new phenylpropanoid, cuspidiol*, $C_{14}H_{20}O_3$, mp. 65-67°, and β-sitosterol, besides six alkaloids, i.e. nitidine chloride, dictamine, γ-fagarine, skimmianine, robustine and haplopine were isolated.[32] From the bark three new alkaloids, arnottianamide*, $C_{21}H_{19}O_6N$, mp. 264-267°, isoarnottianamide*, $C_{21}H_{19}O_6N$, mp. 254-257°, and des-N-methylavicine*, $C_{19}H_{11}O_4N$, mp. 290-295°, together with eight known alkaloids, des-N-methylchelerythrine, decarine, liriodenine, oxynitidine 4-methoxy-1-methyl-2-quinolone, nitidine chloride, γ-fagarine and skimmianine were obtained. Dihydro-p-coumaryl alcohol, cuspidiol and β-sitosterol were also isolated from the bark of this plant.[32] A new amide, integriamide*, mp. 302-304°, was isolated from the root-xylem of *Xanthoxylum integrifoliolum* Merr.[33]



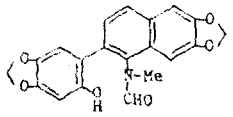
Cuspidiol



Arnottianamide R_1=OMe, R_2=H
Isoarnottianamide R_1=H, R_2=OMe



Des-N-methylavicine



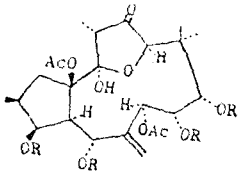
Integriamide

(29) From the peels of *Citrus reticulata* Blanco, Rutaceae, nobiletin, 5-demethylnobiletin, ponkanetin, 5, 7, 8, 4′-tetramethoxyflavone, 6, 7-dimethylesculetin, limonin, cholesterol, campesterol, stigmasterol and β-sitosterol were obtained.[34] From the roots of *Citrus maximus* form *hounyu*, xanthyletin, stigmasterol and β-sitosterol were obtained.

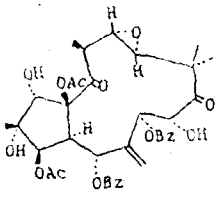
(30) From the leaves of *Phelloedndron wilsonii* Hayata et Kanehira, Rutaceae, phellamurin and amurensin were isolated and it was confirmed that the latter coincided with 8-isopentenylkaempferol-7-glucoside, i.e. epimedoside C.[36]

(31) From the flowers and the fruits of *Murraya paniculata* (L.) Jack, Rutanceae, scopolin, scopoletin and glucose were obtained.[37]

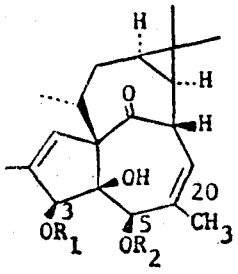
(32) From the toxic fractions of the dried roots of *Euphorbia kansni* Liou., Euphorbiaceae, six new diterpene derivatives were isolated. They were kansuinine A*, $C_{37}H_{46}O_{15}$, mp. 218-220° $[\alpha]_D^{23}$+28° (c=0.25, MeOH), kansuinine B*, $C_{38}H_{42}O_{14}$, mp. 160-162° $[\alpha]_D^{23}$+37.0° (c=0.27, MeOH), 20-deoxyingenol-3-benzoate*, 20-deoxyingenol-5-benzoate*, ingenol-3-(2, 4-decadienoate)-20-acetate*, and 13-oxyingenol-13-dodecanoate, 20-hexanoate* $C_{38}H_{60}O_8$. Among them, kansuinine A and kansuinine B exhibited a strong anagesic and anti-writhing activity in mice.[38]



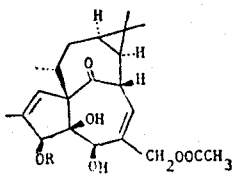
R=Benzoyl×1, Acetyl, ×3 Kansuinine A



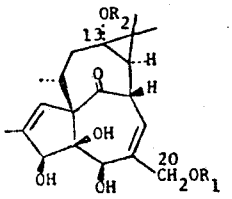
Kansuinine B



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

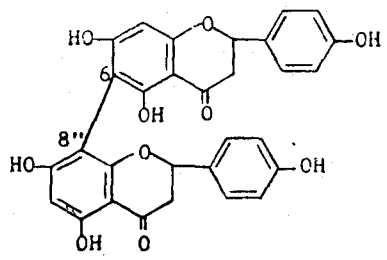


R=CO(CH=CH)$_2$(CH$_2$)$_4$CH$_3$
Ingenol-3-(2,4-decadienoate)-20-acetate

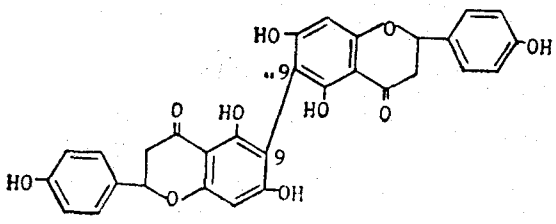


R_1=CO(CH$_2$)$_4$CH$_3$
R_2=Dodecanoyl
13-Oxyingenol-13-dodecanoate-20-hexanoate

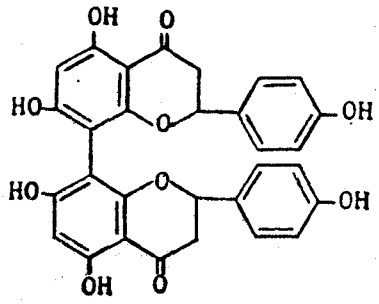
(33) The pigments in the seed-kernels of wax-tree, ***Rhus succedanea*** L., Anacardiaceae were investigated. Three new biflavanones, i.e. rhusflavanone* (6,8″-binaringenin), $C_{30}H_{22}O_{10}\cdot 1.5H_2O$, mp. 204-206°, $[\alpha]_D^{20}$ −29° (c=1.8, MeOH), succedaneaflavanone*(6,6″-binaringenin), $C_{30}H_{22}O_{10}$, mp. 318-322° (dec.), $[\alpha]_D^{20}$ −13° (c=2.15, C_5H_5N), neorhusflavanone*(8,8″-binaringenin), $C_{30}H_{22}O_{10}$, mp. 274-280°, $[\alpha]_D^{28}$ −357° (c=0.2, MeOH), and a new flavanoflavone, i.e. rhusflavone* (6,8″-naringeninylapigenin), $C_{30}H_{20}O_{10}$, mp. 236-238°, $[\alpha]_D^{25}$ −163° (c=0.39, EtOH) besides other four biflavones, agathisflavone, robustaflavone, amentoflavone and hinokiflavone were isolated.[39]



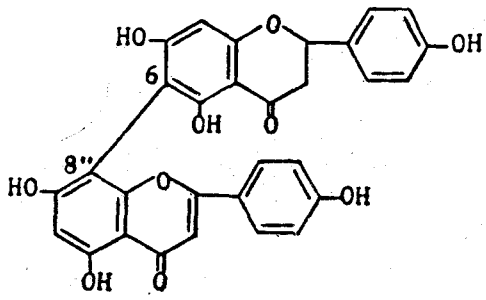
Rhusflavanone



Succedaneaflavanone

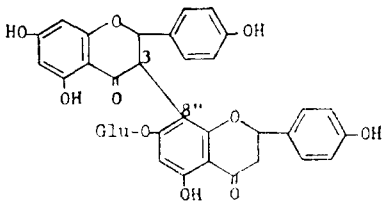


Neorhusflavanone



Rhusflavone

(34) The constituents of the heartwood of *Garcinia multiflora* Champ, Guttiferae was studied. A new biflavanone glucoside, GB-1a-7″-O-β-glucoside* (3,8″-binaringenin-7″-O-β-glucoside), mp. 218-221°, $[\alpha]_D^{20}$ −31.68° (c=2.5, EtOH) was isolated together with three known biflavanoid glucosides, spicataside, fukugiside, xanthochymuside, and seven phenolic compounds, i.e. apigenin, 1,3,6,7-tetrahydroxyxanthone, (−)-GB-1a, (+)-GB-2a, (+)-volkensiflavone, (+)-morelloflavone [i.e. (+)-fukugetin], and (±)-morelloflavone.[40]



GB-la-7″-O-β-glucoside

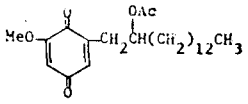
(35) From the leaves of *Garcinia spicata* Hook, friedelin was isolated.[41]

(36) From the roots of *Elaeagnus oldhami* Maxim., Elaeagnaceae, maslinic acid (crataegolic acid), arjunolic acid, sitosteryl glucopyranoside and β-sitosterol were obtained.[42]

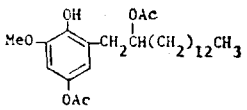
(37) From the roots of *Glehnia littoralis* Fr. Schmidt, Umbelliferae, xanthotoxin and bergapten were isolated.[43]

(38) Bergapten was isolated from the roots of *Peucedanum formosanum* Hay., Umbelliferae.[41]

(39) A new quinone, ardisianone*, $C_{24}H_{38}O_5$, mp. 49-54°, and a new phenol, ardisianol*, $C_{26}H_{42}O_6 \cdot 1/3H_2O$, mp. 82-84 were isolated from the stems and the leaves of *Ardisia quinquegona* Blume, Myrsinaceae.[44]



Ardisianone



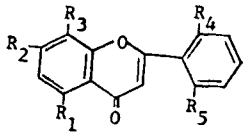
Ardisianol

(40) From the fruits of *Diospyros discolor* Willd, Ebenaceae, betulinic acid, nonacosane, hentriacontane and tritriacontane were obtained.[45]

(41) The constituents of Formosan gentianaceous plants were studied. Mangiferin from the aerial portion of *Tripterospermum taiwanense* Stake, and oleanolic acid from the whole herb of *Gentiana arisanensis* Hayata were isolated, respectively. From the whole herb of *Swertia randaiensis* Hayata, gentianine and oleanolic acid were obtained.[46]

(42) Two flavones have been isolated from the seeds of *Vitex rotundifolia* Linn. f., Verbe naceae, and identified to be 5-hydroxy-3, 6, 7, 3′, 4′-pentamethoxyflavone (artemetin) and 5, 3′-dihydroxy-3, 6, 7, 4′-tetramethoxyflavone (casticin).[47]

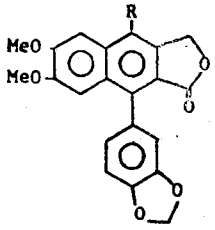
(43) The roots of *Scutellaria rivularis* Wall, Labiatae, yielded three flavonoids. They were characterized as 2′,5-dihydroxy-6′, 7, 8-trimethoxyflavone, named rivularin*, $C_{18}H_{16}O_7$, mp. 257-259°, 5-hydroxy-7, 8-dimethoxyflavone (7-O-methylwogonin*), mp. 180-182°, and 5, 7-dihydroxy-8-methoxyflavone (wogonin).[48]



Rivularin R_1=R_4=OH, R_2=R_3=R_5=OMe
7-O-Methylwogonin R_1=OH, R_2=R_3=OMe, R_4=R_5=H

(44) The crystalline component obtained from the essential oil of the whole plant of *Pogostemon formosanus* Oliv., Labiatae, was identified as a 10-membered ring sesquiterpene ketone, germacrone. On the basis of the spectroscopic evidence and of the orbital symmetry rule, *trans, trans* configuration was assigned to germacrone.[49]

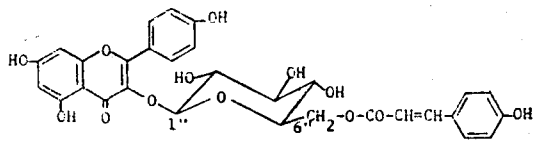
(45) The piscicidal constituents of the whole herb of *Justicia hayatai* var. *decumbens* Yamamoto, Acanthaceae, was investigated. The six fish poison constituents were identified to be lignans, justicidin A*, $C_{22}H_{18}O_7$, mp. 262°, justicidin B*, $C_{21}H_{16}O_6$, mp. 240°, justicidin



Justicidin A R=OMe, Justicidin B R=H

C (neojusticin B) justicidin D (neojusticin A), diphyllin and chinensinaphthol methyl ether. Four non-active constituents, stearic acid, β-sitosterol, KCl and KNO_3 were also isolated.[50]

(46) A new flavonoide, glycoside kaempferol-3-β-D-(6″-O-p-coumaroyl) monoacetyl glucoside (tiliroside monoacetate*), $C_{32}H_{28}O_4 \cdot 2.5H_2O$, mp. 178-182°, was isolated together with kaempferol-3-β-D-(6″-O-p-coumaroyl) glucoside (i.e. tiliroside), quercetin, apigenin and kaempferol, from the flowers of *Anaphalis contorta* Hooker, Compositae.[51]



Tiliroside

(47) From the whole herb of *Siegesbeckia orientalis* L., Compositatae, 3,7-dimethylquercetin and potassium nitrate were isolated.[52]

(48) From the whole herb of *Glossogyne tenuifolia* (Labill.) Cass., Compositae, luteolin-7-0-β-D-glucoside and luteolin were obtained.[53]

(49) The constituents of the Formosan *Cirsium* species, Compositae were investigated. From the leaves of *C. arisanense* Kitamura, linarin, pectolinarin and fumaric acid were isolated.[54,55]

Pectolinarin and fumaric acid from the leaves of *C.ferum* Kitamura[55], luteolin-7-glucoside from the aerial portion of *C.kawakami* Hayata[56], and fumaric aci from the aerial portion of *C. wallichii* DC.[56] were obtained.

(50) From the tops of *Eupatorium fortunei* Turcz, Compositae, taraxasteryl palmitate, taraxasteryl acetate, taraxasterol, β-amyrin palmitate, β-amyrin acetate, stigmasterol,β-sitosterol, octacosanol and palmitic acid were isolated.[57]

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