Journal of Food and Drug Analysis
1993, 1(3) : 273-280

藥物食品分析
第一卷　第三期

血桐樹皮部單寧成分之研究

林　哲　輝

行政院衛生署藥物食品檢驗局

摘　要

血桐[*Macaranga tanarius* (L.) Muell. et Arg. (Euphorbiaceae)]樹皮以含水丙酮冷浸抽取，分離10種單寧成分，分別爲corilagin(1), mallotinic acid(2), geraniin(3), macarinin A(4), putranjivain B(5), putranjivain A(6), mallotunin(7), mallophilinin(8), repandusinic acid A(9) 及phyllanthusiin C(10).各化合物之構造係以其物理化學性質及核磁共振光譜等數據推定之，並與文獻記載數據或標準品直接比對而確認之。

前　言

大戟科(Euphorbiaceae)植物血桐[*Macaranga tanarius* (L.) Muell. et Arg.]爲民間藥，樹皮煎服治痢疾，樹皮及葉研爲末充作醱酵工業之防腐劑，根則爲發燒時之催吐劑，煎服治咳血。[1]

在植物單寧(Tannin)成分研究系列中，有關大戟科植物血桐及蘭嶼血桐[*M. sinensis* (Baill). Muell.-Arg.]之研究，曾提出由血桐葉部分離得23種單寧成分[2]，由蘭嶼血桐葉部分離得18種單寧成分[3]之報告，此次由血桐之樹皮部分離得10種單寧成分，本報告說明其成分分離及構造之決定。

材料與方法

一、材料

血桐樹皮(1987年2月採集自台北近郊)。

二、儀器

本實驗中融點測定使用Yanagimoto micro-melting point apparatus,融點未校正。旋光度以JASCO DIP-4旋光計測定。核磁共振(^{1}H-NMR)光譜儀使用JEOL FX100, JEOL GX270 spectrometer,以TMS爲內標準。Fast atom bombardment mass spectra(FAB-MS)以JEOL JMS-HX 100 mass spectrometer測定。

三、管柱層析使用之膠質

Sephadex LH-20 (25-100μ, Pharmacia Fine Chemical Co., LtD), MCI-gel CHP 20P (75-150μ, Mitsubishi Chemical Industris Co., Ltd), Fuji-gel ODS G3 (43-65μ, Fuji gel Hambai Co., Ltd), Bondapak C_{18}/Porasil B (37-75μ, Waters Associates, Inc.)。

四、抽取及分離

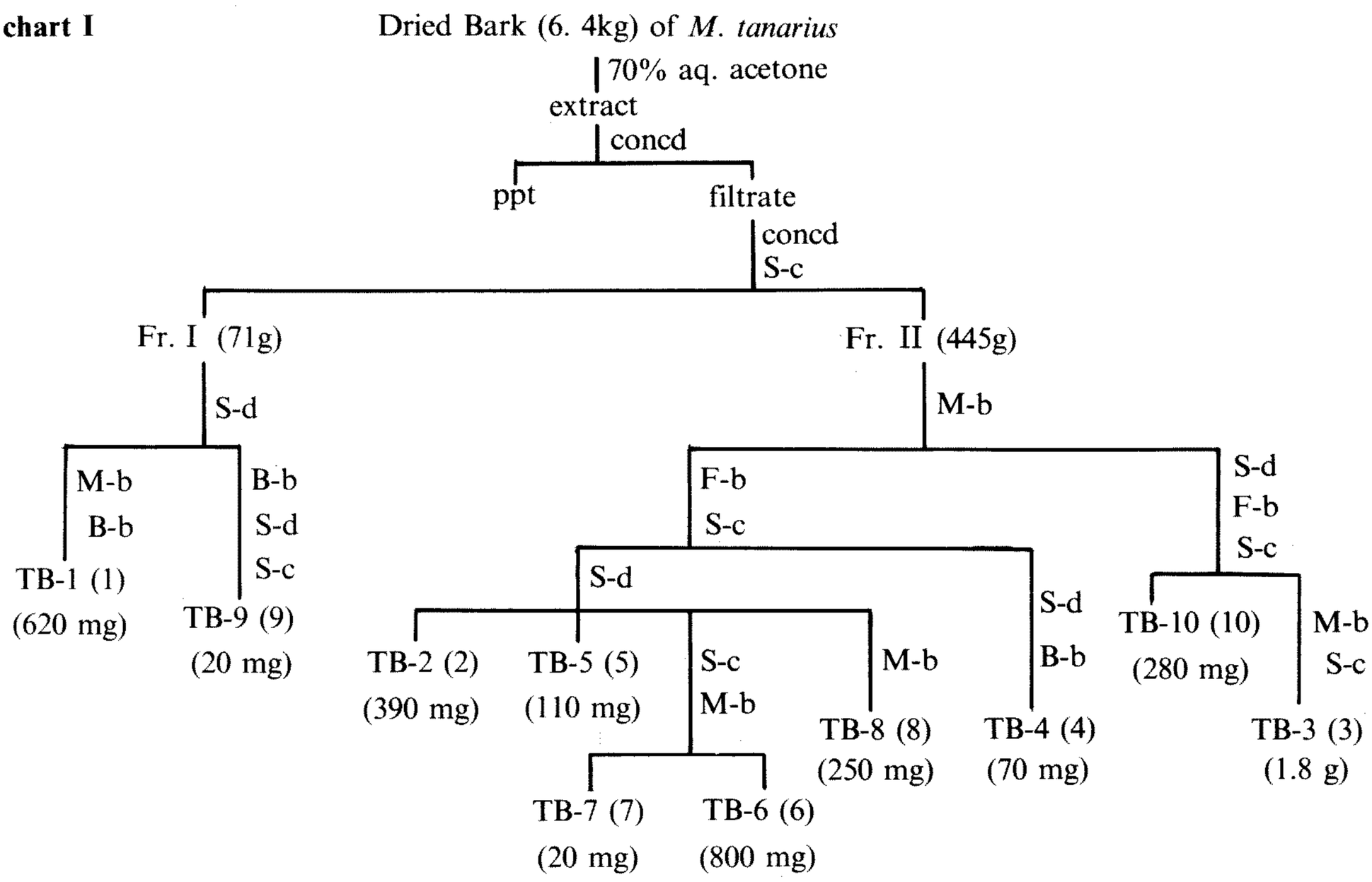
血桐樹皮(6.4Kg)，用70%丙酮室溫下浸泡抽取，抽出液於減壓下將丙酮除去，將析出之沈澱濾去後，濾液利用Sephadex LH-20管柱層析，以H_2O-MeOH-acetone沖提，劃分成Fr.I, Fr.II二部分，如Chart I所示，各部分利用各種管柱層析分離得10種化合物(TB-1～TB-10)。

結果與討論

一、結果

如Chart I所示，利用各種管柱層析分離得10種化合物(TB-1～TB-10)。各化合物之性質及光譜數據如下：

chart I



S: Sephadex LH-20
M: MCI-gel CHP 20P
F: Fuji-gel ODS G-3
B: Bondapak C_{18} / Porasil B

a: H_2O-MeOH-acetone
b: H_2O-MeOH
c: 80% MeOH
d: EtOH

TB-1: ***Corilagin*** *(1)*

白色無晶形粉末，$[\alpha]_D^{21}$-190.2° (c＝0.8, acetone). ^{1}H-NMR (acetone-d_6)δ: 4.01-4.20 (2H, m, H-2,6), 4.43-4.64(2H, m, H-4,5), 4.83-5.08 (2H, m, H-3,6), 6.38(1H, s, H-1), 6.69, 6.84 [each 1H, s, hexahydroxydiphenoyl (HHDP)-H], 7.12 (2H,s, galloyl H).

TB-2: ***Mallotinic acid*** *(2)*

淡褐色無晶形粉末，$[\alpha]_D^{23}$-75.7° (c＝0.9, MeOH). ^{1}H-NMR (acetone-d_6)δ: 3.99 (1H, broad [br] s, H-2), 4.08 (1H, dd, J＝7, 10Hz, H-6),4.42 (1H, brs, H-4), 4.49 (1H, br t, J＝ 10Hz, H-5), 4.71 (1H, t, J＝10Hz, H-6), 4.75 (1H, br s ,H-3), 6.33 (1H, d, J＝3Hz, H-1), 6.64, 6.72, 7.13 (each 1H, s, valoneayl H), 7.19 (2H, s, galloyl H).

TB-3: ***Geraniin*** *(3)*

黃色粉末(H_2O), mp 218-221°C (dec.), $[\alpha]_D^{22}$-147.8° (c＝0.9, MeOH). ^{1}H-NMR (acetone-d_6＋D_2O)δ: 4.28-4.50 (1H, m, H-6), 4.68-4.85 (2H in total, H-5,6), 4.89 [1/4H, br s, dehydrohexahydroxydiphenoyl (DHHDP) H-1], 5.15 (3/4H, s, DHHDP H-1), 5.35-5.46 (3H in total, H-2,3,4), 6.20 (1/4H, br s, DHHDP H-3), 6.48 (3/4H, s, DHHDP H-3), 6.55 (1H, s, H-1), 6.63, 7.05 (each 1H, s, HHDP H), 7.17 (2H,s, galloyl H), 7.23 (1 H, s, DHHDP H-3').

TB-4: ***Macarinin A*** *(4)*

淡黃色無晶形粉末，$[\alpha]_D^{15}$-42.0° (c＝1.1, MeOH). ^{1}H-NMR (acetone-d_6＋D_2O)δ: 4.25-4.50 (1H, m, H-6), 4.60-4.90 (2H, m, H-5,6), 4.94 (1/3 H, d, J＝2Hz, DHHDP H-1), 5.17 (2/3H, s, DHHDP H-1), 5.35-5.60 (3H, m, H-2,3,4), 6.25 (1/3H, d, J＝2Hz, DHHDP H-3),6.53 (2/3H, s, DHHDP H-3), 6.54 (1H, br s, H-1), 6.73, 7.01, 7.11,7.19,7.20,7.26 (4H in total, each s, aromatic H), 7.21 (2H,s, galloyl H).

TB-5: ***Putranjivain B*** *(5)*

白色粉末(H_2O), mp 229-230°C. $[\alpha]_D^{23}$-68.6°(c=1.0, acetone). ^{1}H-NMR (acetone-d_6)δ: 1.64 [1H, d, J=14Hz, putranjivainoyl (put.) H-3], 2.78 [1H, br d, J=14Hz, put. H-3], 4.29 (1H, s, put. H-3″), 4.61 (1H, m, H-3), 4.84 (1H, s-like, put. H-1), 4.98 (1H, m, H-4), 5.01 (1H, s, put. H-1″), 5.34 (1H, br d, J=3Hz, H-2), 6.37 (1H, d, J=3Hz, H-1), 7.21 (2H, s, galloyl H), 7.35 (1H, s, put. H-3').

TB-6: ***Putranjivain A*** *(6)*

無色板狀晶(H_2O), mp 252-253°C(dec.). $[\alpha]_D^{24}$-62.0° (c=1.0, MeOH). ^{1}H-NMR (270 MHz, acetone-d_6)δ: 1.64 (1H, d, J=14Hz, put. H-3), 2.72 (1H, dd, J=1.5,14Hz, put. H-3), 3.94(1H, m, put. H-5″), 4.17 (1H, s-like, put. H-4″), 4.19 (1H, m, put. H-5″), 4.25(1H, s, put. H-3″), 4.45 (1H, dd, J=8, 11Hz, H-6), 4.72 (1H, dd, J=9, 11Hz, H-6), 4.75 (1H, d, J=1.5Hz, put. H-1), 4.92 (1H, dd, J=8, 9Hz, H-5), 5.05 (1H, s, put. H-1″), 5.35 (1H, d, J=4Hz, H-3), 5.61 (1H, s, H-2), 5.66 (1H, d, J=4Hz, H-4), 6.53 (1H, s, H-1), 6.66, 7.08 (each 1H, s, HHDPlH), 7.19 (2H, s, galloyl H), 7.32 (1H, s, put. H-3').

TB-7: ***Mallotunin*** *(7)*

淡褐色無晶形粉末，$[\alpha]_D^{23}$-48.3° (c=0.5, MeOH).^{1}H-NMR (acetone-d_6+D_2O)δ: 1.62 (1H, d, J=14Hz, put. H-3), 2.72 (1H, br d, J=14Hz, put. H-3), 4.73 (1H, s-like, put. H-1), 5.03 (1H, s, put. H-1″), 5.33 (1H, br d, J=4Hz, H-3), 5.41(1H, br d, J=2Hz, H-2), 5.57 (1H, br, H-4), 6.46(1H, d, J=2Hz, H-1), 6.67, 6.85, 7.14 (each 1H, s, valoneaylH), 7.25 (2H, s,galloyl H), 7.26 (1H, s, put. H-3').

TB-8: ***Mallophilinin*** *(8)*

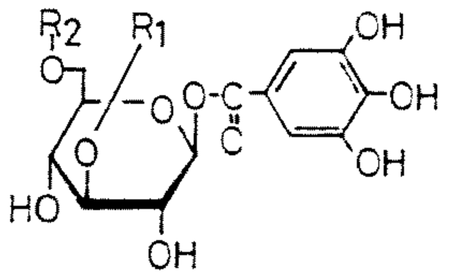
淡褐色無晶形粉末，$[\alpha]_D^{13}$-7.3° (c=1.0, MeOH). ^{1}H-NMR(270MHz, acetone-d_6+D_2O)δ: 1.63 (1H, d, J=14Hz, put. H-3), 2.74(1H, J=14Hz, put. H-3), 4.17(1H, s-like, put. H-4″), 4.23(1H, s, put. H-3″), 4.51 (1H, dd, J=8,10Hz, H-6), 4.74 (1H, s-like, put. H-1), 5.04 (1H, s, put. H-1″), 5.32 (1H, br d, J=4Hz, H-3), 5.62 (1H, br s, H-2), 5.71 (1H, br s, H-4), 6.54 (1H, s, H-1), 6.69, 6.85,7.01 (each 1H, s, tergalloyl H), 7.21 (2H, s, galloyl H), 7.32 (1H, s, put. H-3')

TB-9: ***Repandusinic acid A*** *(9)*

淡褐色無晶形粉末，$[\alpha]_D^{13}$-54.3° (c=0.9, MeOH). ^{1}H-NMR (270 MHz, acetone-d_6)δ: 4.23 (1H, d, J=4Hz, H-2), 4.29 (1H, dd, J=7, 10Hz, H-6), 4.60 (1H, t, J=7Hz, H-5), 4.69 (1H , dd, J=7, 10Hz, H-6), 4.88 (1H, d, J=4Hz, H-3), 5.31 [1H, d, J=2Hz, dehydrochebuloyl(DCHE) H-2), 5.56 (1H, d, J=2Hz, DCHE H-3), 5.60(1H, d, J=4Hz, H-4), 6.23 (1H, d, J=4Hz, H-1), 6.70, 6.85 (each 1H, s, HHDP H), 7.13 (2H, s, DCHE H-3',5), 7.15 (2H, s, galloyl H).

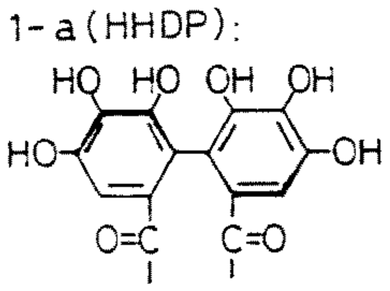
TB-10: ***Phyllanthusiin*** *C(10)*

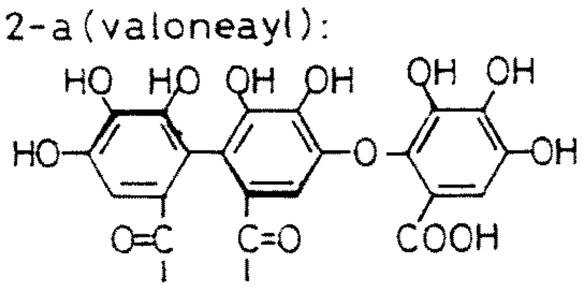
淡褐色無晶形粉末，$[\alpha]_D^{19}$-80.3° (c=0.8, MeOH). negative FAB-MS m/z: 633, 925[M-H]$^-$. ^{1}H-NMR (270 MHz, acetone-d_6)δ:2.24(1H, t, J=11Hz, 2,4-acyl H-3), 2.44 (1H, dd, J=7, 11Hz, 2,4-acyl H-3), 4.37 (1H, dd, J=12, 14Hz, H-6), 4.61 (1H, dd, J=7, 11Hz, 2,4-acyl H-4), 4.63 (1H, s, 2,4-acyl H-1), 4.84～4.93 (2H, m, H-5,6), 5.39 (1H, d, J=2Hz, H-4), 5.58 (2H, br s, H-2,3),

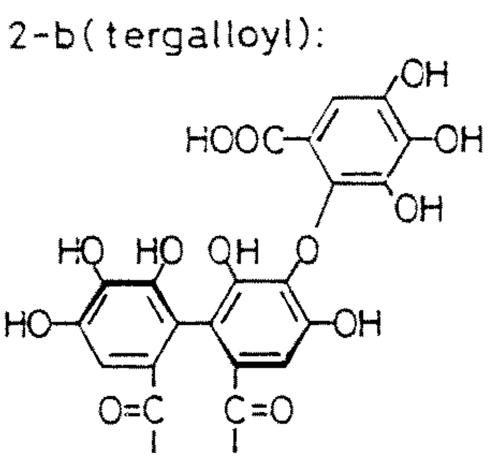


1. R_1,R_2= 1-a

2. R_1,R_2= 2-a







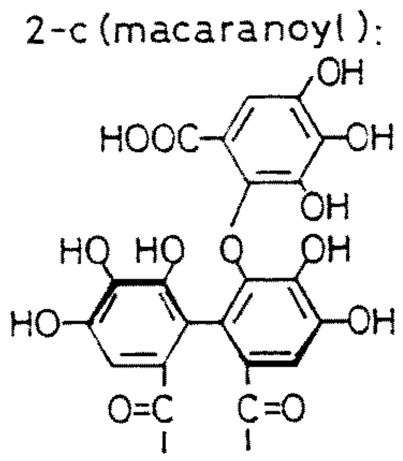


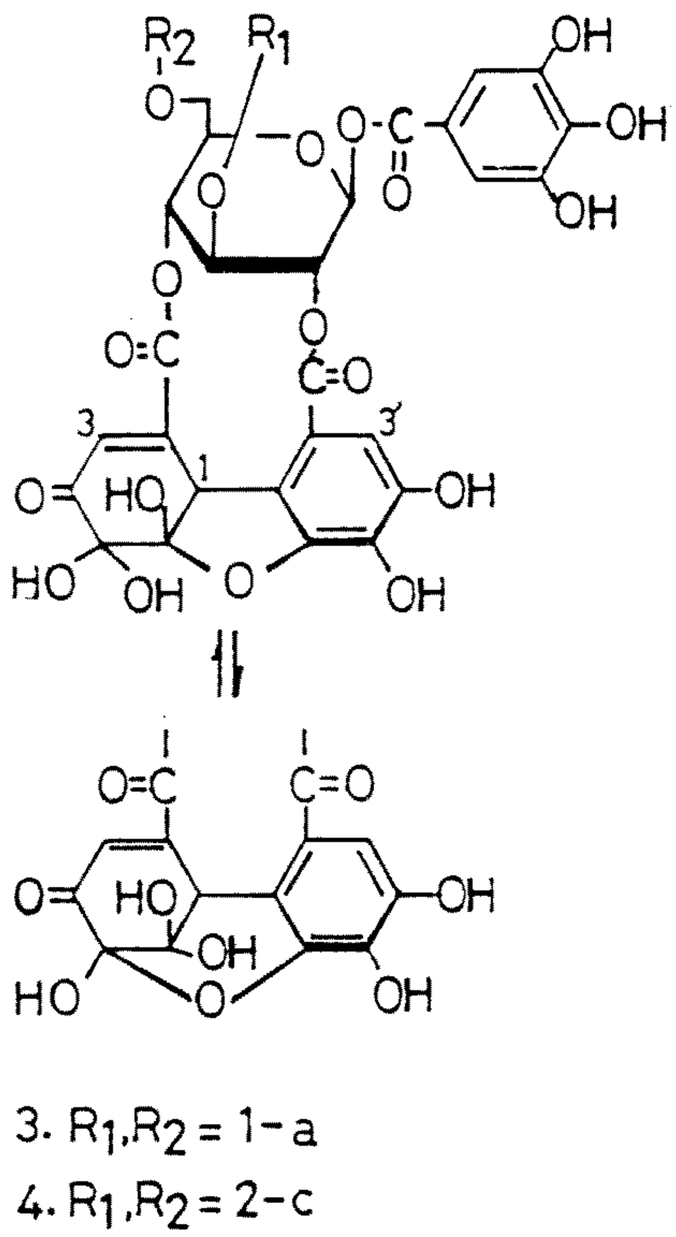
Figure 1. Structures of 1, 2 and 1a, 2a, 2b, 2c

6.40 (1H, s, H-1), 6.68, 7.05 (each 1H, s, HHDP H), 7.10 (2、4-acyl H-3'), 7.15 (2H, s, galloyl H). ^{13}C-NMR(acetone-d_6 + D_2O)δ: 46.3 (t), 65.8 (glc C-4), 63.2(d), 62.5(glc C-3), 63.9 (glc C-6), 68.1 (glc C-2), 72.8 (glc C-5), 74.8(d), 78.3 (s), 92.0(glc C-1), 107.6 (HHDP C-3,3'), 110.6(galloyl C-2, 6), 116.9, 117.2 (HHDP C-1, 1'), 119.9(galloyl C-1), 124.3, 125.4 (HHDP C-2,2'), 136.4, 137.8 (HHDP C-5,5'), 140.0 (galloyl C-4), 144.7, 144.9, 145.2, 145.5 (HHDP C-4,4',6,6'), 145.9 (galloyl C-3,5'), 119.2(2,4-acyl C-1'), 115.4 (2,4-acyl C-2'), 111.3 (2,4-acyl C-3'), 147.0(2,4-acyl C-4'), 135.8 (2,4-acyl C-5'), 149.7 (2,4-acyl C-6'), 164.8, 165.3, 166.5, 168.9, 173.6 (-COO-).

二、討論

如實驗部分所述，由血桐之樹皮部分離得到之10種單寧類化合物(TB-1～TB-10)，其構造之決定如下：

TB-1爲白色無晶形粉末，$[\alpha]_D$ −190.2°，其^{1}H-NMR光譜顯示之galloyl基[δ 7.12 (2H, s)]，HHDP基[δ 6.69, 6.84 (each 1H, s)]及糖[δ 6.38 (1H, s), anomeric H]之吸收峰與corilagin (1)標準品比較均一致，故而確認TB-1爲corilagin.[2]



3. R_1,R_2 = 1-a
4. R_1,R_2 = 2-c

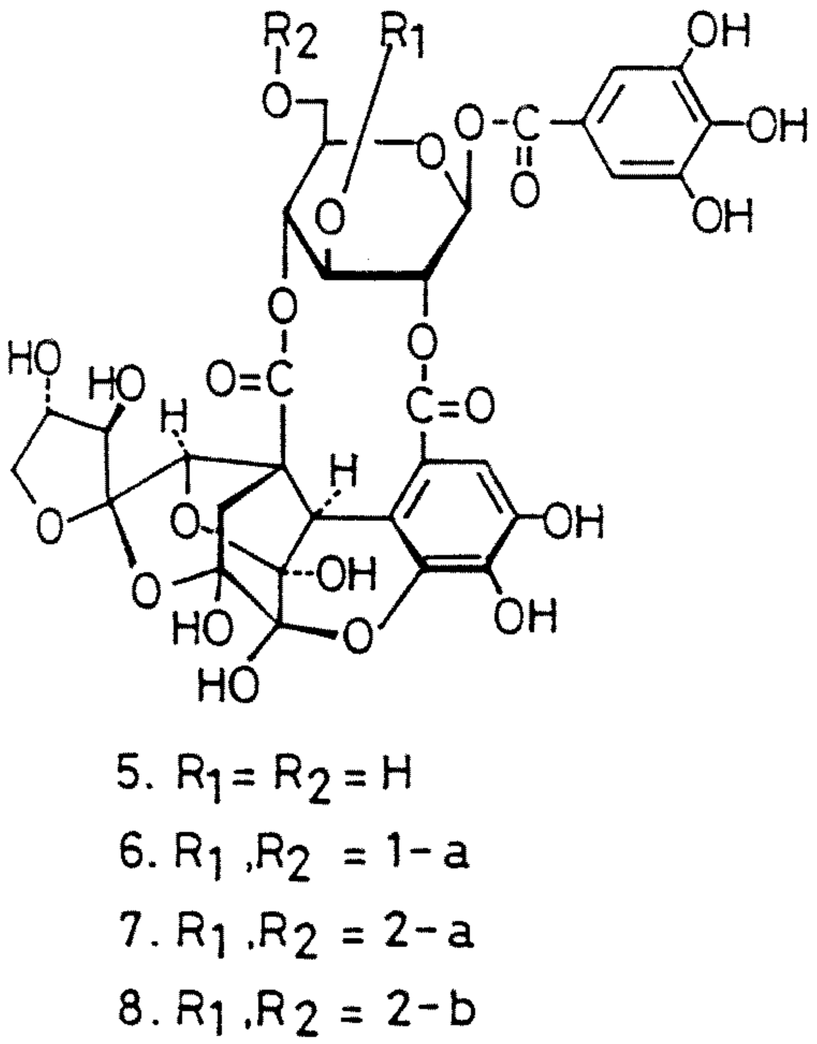
Figure 2. Structures of 3 and 4

TB-2爲淡褐色無晶形粉末，$[\alpha]_D$ −75.7°，其^{1}H-NMR光譜顯示糖之吸收峰與corilagin相類似，亦即glucose之1,3,6位之OH基均醯基化，且在3,6位爲架橋之醯基。在aromatic領域中則呈現1個2H之singlet[δ 7.19 (2H, s)]及3個1H之singlet[δ 6.64, 6.72, 7.13 (each 1H,s)]。因此推測TB-2爲1位接galloyl基，3,6位則可能爲接valoneayl基(2-a)(即mallotinic acid)[4]，tergalloyl基(2-b)(即mallorepanin)[3]或macaranoyl基(2-c)(即macarinin C)[3]之單寧類化合物。經與各化合物直接比較其^{1}H-NMR等而確認TB-2構造爲，3,6位接valoneayl基之mallotinic acid(2)（如圖一）。

TB-3爲黃色結晶性粉末，$[\alpha]_D$ −147。8°，其^{1}H-NMR光譜上呈現DHHDP基之5員環及6員環平衡狀態之特有吸收峰[δ4.89 (1/4H, br s), 5.15 (3/4H, s), 6.20 (1/4H, br s), 6.48 (3/4H,s)]及糖之anomeric H[δ 6.59 (1H, s)]之吸收峰。在aromatic領域，TB-3呈現galloyl基[δ 7.17 (2H,s)]，DHHDP基H-3[δ 7.23 (1H, s)]之吸收峰外，還有在δ 6.63, 7.05 (each 1H, s)之吸收，爲HHDP基之吸收峰，以上之數據顯示TB-3爲1-0-galloyl-2,4-(R)-DHHDP-3,6-(R)-HHDP-β-D-glucopyranose(geraniin)(3) (如圖二)，經與geraniin標準品直接比對而確認之。[2]

TB-4爲黃色無晶形粉末，$[\alpha]_D$ −42.0°，其^{1}H-NMR光譜中aliphatic領域及anomeric H[δ 6.54 (1H, s)]之吸收及DHHDP基平衡狀態之吸收特徵[δ 4.94 (1/3H, d, J＝2Hz), 5.17 (2/3H,s), 6.25 (1/3H, d, J＝2Hz), 6.53 (2/3H, s)]均與TB-3極爲類似，而在aromatic領域之吸收除galloyl基[δ 7.21 (2H, s)]之吸收外，尚有δ 6.73, 7.01, 7.11, 7.19, 7.20, 7.26 (4H in total, each s)共4個aromatic H之吸收，顯示TB-4與TB-3之glucose母核具有相同之conformaton, 爲在1位接有galloyl基，2,4位接有DHHDP基，而3,6位接有galloyl substituted之HHDP基，此可能爲valoneayl基(2-a), tergalloyl基(2-b)或mcaranoyl基(2-c)，經與三者之^{1}H-NMR光譜比對，與3,6位接tergalloyl基之macarinin A(4)[3](如圖二)完全一致，並與標準品直接比較而確認其構造如4。

TB-5爲白色粉末，$[\alpha]_D$ −68.6°，其^{1}H-NMR光譜在δ 1.64, 2.78 (each 1H, d, J＝14Hz)呈現geminal proton之吸收峰，以及在δ 4.29, 4.84, 5.01及7.35 (each 1H,s)之吸收峰與putranjivainoyl基之吸收甚爲類似。在圖譜上又呈現anomeric H之吸收峰[δ 6.37 (1H, d, J＝3Hz)]及galloyl基之吸收峰[δ 7.21 (2H,s)]，由以上數據推定TB-5爲putra-



5. $R_1 = R_2 = H$
6. R_1, R_2 = 1-a
7. R_1, R_2 = 2-a
8. R_1, R_2 = 2-b

Figure 3. Structures of 5,6,7 and 8

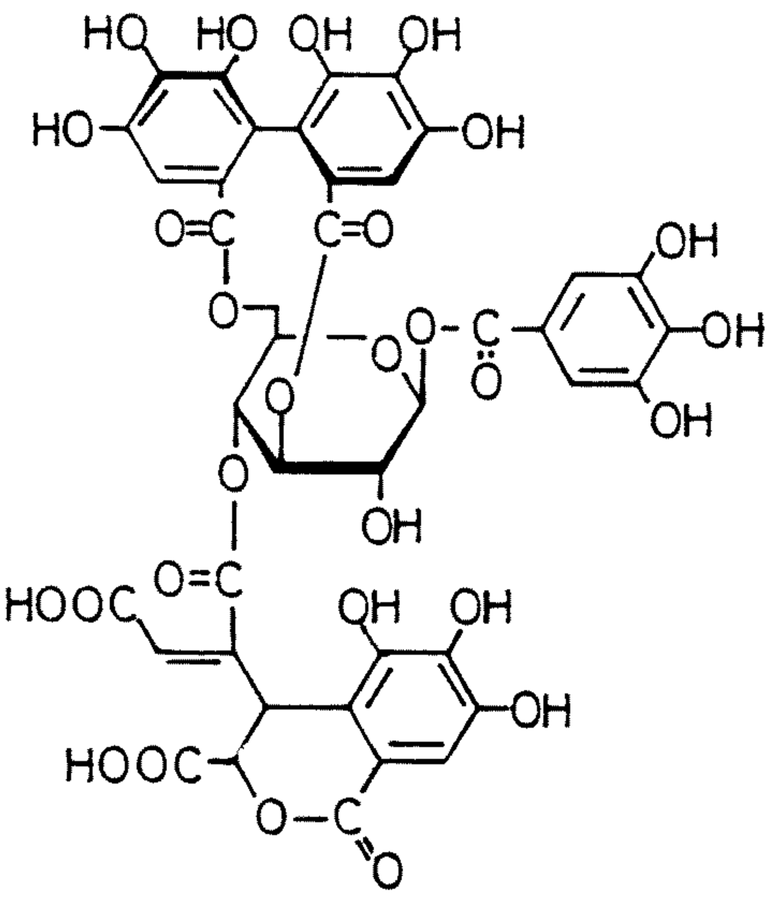


Figure 4. Structures of 9

njivain B(5)[5] 如圖三，經比對其^{1}H-NMR光譜及諸物理數據而確認之。

TB-6爲無色板狀晶，$[\alpha]_D$-62.0°；TB-7爲淡褐色無晶形粉末，$[\alpha]_D$-48.3°；TB-8爲淡褐色無晶形粉末，$[\alpha]_D$-7.3°。三者之^{1}H-NMR光譜如實驗部分所述，均具有由putranjivainoyl基而來之吸收峰及glucose之吸收峰，且glucose之OH基均被醯基化。三者在aromatic領域之吸收則各有不同：在TB-6而言，除galloyl基之吸收及putranjivainoyl基之H-3之吸收外，尚有在δ 6.66, 7.08 (each 1H,s)歸屬爲HHDP基之吸收峰。以上數據經與putranjivain A比較均一致而確認TB-6爲putranjivain A(6).[4]TB-7及TB-8則除galloyl基及putranjivainoyl基之H-3之吸收外，尚有三個1H之singlet吸收[TB-7: δ 6.67, 6.85, 7.14 (each 1H, s); TB-8: δ 6.69, 6.85, 7.01 (each 1H, s)]，顯示TB-7及TB-8均爲glucose之1位接galloyl基，2,4位接有putranjivainoyl基，而3,6位則接有valoneayl基(2-a)，tergalloyl基(2-b)或macaranoyl基(2-c)之單寧類化合物，經直接與mallotunin(7)[6]及mallophilinin(8)[7]比較^{1}H-NMR光譜及諸物理性質而確認TB-7爲3,6位接valoneayl基之mallotunin; TB-8爲3,6位接tergalloyl基之mallophilinin（如圖三）。

TB-9爲淡褐色粉末，$[\alpha]_D$-54.3°，其^{1}H-NMR光譜與neochebulagic acid比較，glucose之pattern極爲類似[δ 6.23 (1H, d, J=4Hz, H-1), 5.60 (1H, d, J=4Hz, H-4), 4.88 (1H, J=4HZ, H-3), 4.69 (1H, dd, J=7, 10Hz, H-6), 4.60 (1H, t, J=7Hz, H-5), 4.29 (1H, dd, J=7,10Hz, H-6), 4.27 (1H, d, J=4Hz, H-2)]，顯示glucose之1,3,4,6位之OH基均被醯基化，此外^{1}H-NMR光譜亦呈現有galloyl基[δ 7.15 (2H, s)]及HHDP基[δ 6.70 6.85 (each 1H, s)]，故可能爲1-0-galloyl-3,6-HHDP-4-acyl-glucopyranose。由於neochebulagic acid之chebuloyl基之吸收在TB-9均未呈現，代之於δ 7.13[2H, s, dehydrochebuloyl(DCHE) H-3, 5], 5.56, 5.31 (each 1H, d, J=2Hz, DCHE H-2,3)呈現吸收峰，因此推測爲glucose之4位爲接4-dehydrochebuloyl基之repandusinic acid A,[8]經直接比對其諸物理數據及^{1}H-NMR光譜均完全一致而確認TB-9爲repandusinic acid A(9)（如圖四）。

TB-10爲淡褐色無晶形粉末，$[\alpha]_D$-80.3°，^{1}H-NMR光譜呈現galloyl基[δ 7.15 (2H, s)]，HHDP基[δ 6.68, 7.05 (each 1H, s)]及由糖而來之訊號；由糖而來之訊號皆於δ 4.37-6.40間，較低磁場位置呈現，顯示糖之OH基均被醯基化。此外在δ 2.24(1H, t, J=11Hz), 2.44 (1H, dd, J=7,11Hz)及δ 4.61 (1H, dd, J=7,11Hz)呈現ABX型吸收峰，在δ4.83 (1H, s)呈現一個benzylmethine H之singlet；在δ7.10 (1H, s)則呈現一個aromatic H之singlet吸收。

TB-10之negative FAB-MS圖譜在m/z 925顯示$[M-H]^-$之尖峰，又在m/z 633出現相當於corilagin (1)之$[M-H]^-$之尖峰。

就TB-10之^{13}C-NMR光譜檢討，除了galloyl基，HHDP基及glucose之吸收訊號外，在δ46.3(t)呈現methylene;在δ63.2(d)及74.8(d)爲methine;在δ78

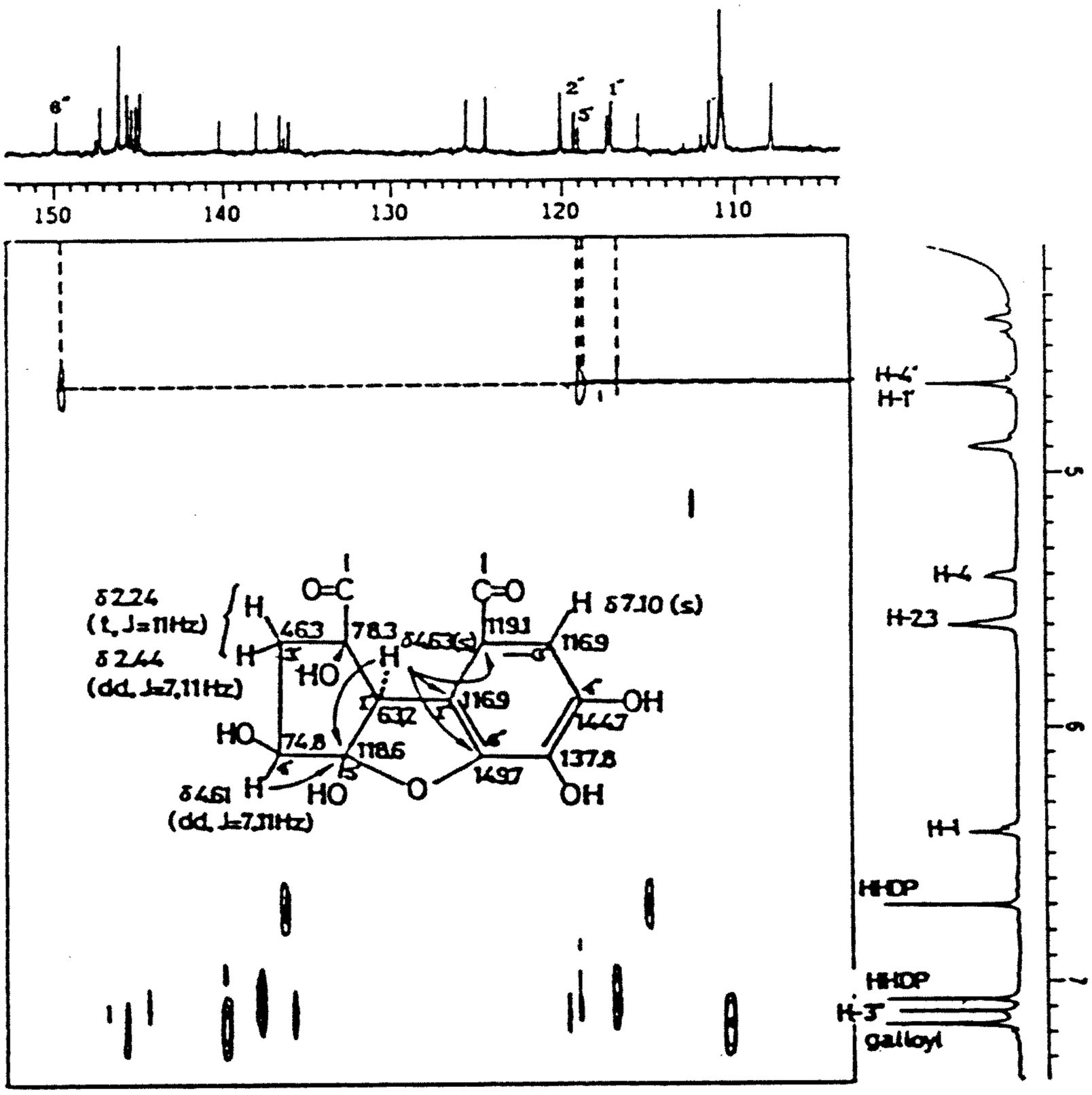


Figure 5. ^{1}H-^{13}C Long-Range COSY Specturm of 10 (in acetone-d_6, Jch=8Hz)

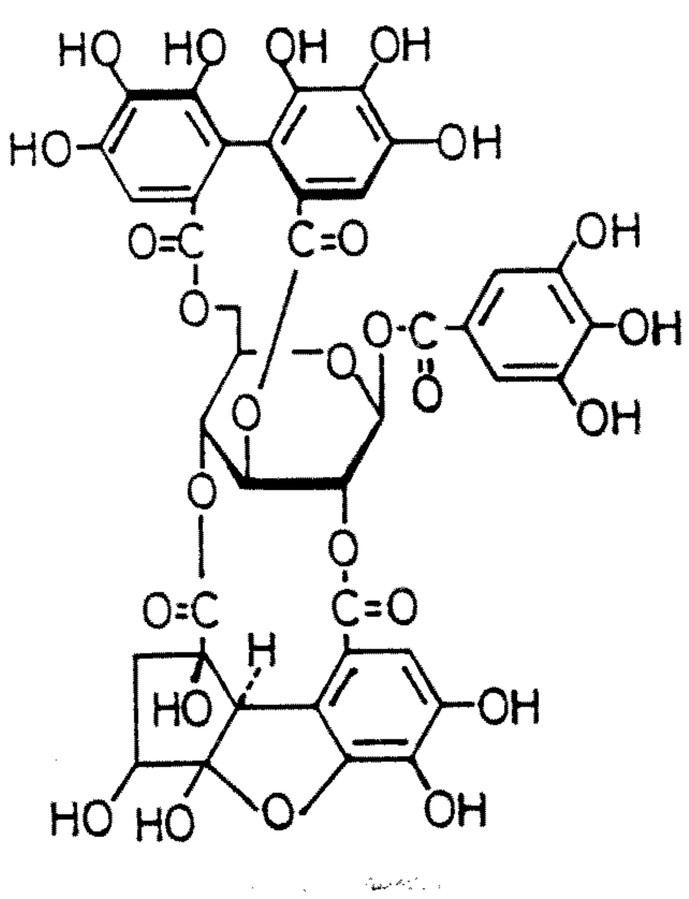


Figure 6. Structures of 10

.3(s)則爲四級碳之吸收訊號；此外，在δ116.9(s, C-1″), 119.2 (s, C-2″), 116.9 (d, C-3″), 144.9 (s, C-4″), 135.8 (s, C-5″), 149.7 (s, C-6″)之訊號與DHHDP基之5員環hemiacetal構造之芳香環部分之訊號極爲類似。δ118.6之訊號依^{1}H-^{13}C long-range COSY光譜(如圖五)所示，與δ4.61,及4.63之methine H具cross peak,可知爲四級碳。綜合以上^{1}H-NMR圖譜，^{13}C-NMR圖譜及negative FAB-MS推測TB-10之構造如10。經查文獻記載phyllanthusiin C之數據，[9]兩者完全一致，故而確認其爲phyllanthusiin C(10)(如圖六)。

血桐樹皮部所含單寧成分與葉部同樣以geraniin(3)爲主成分；樹皮部所分離出之單寧皆以glucose爲母核之加水分解型單寧，且glucose之conformation皆爲$^{1}C_4$-(或skew boat)型，而2,4位及3,6位結合多樣之醯基(valoneayl基, tergalloyl基, DHHDP基及putranjivainoyl基)爲其特徵。再者，葉部含有之多種gallotannin在樹皮部均未被分離

得到。顯示同植物之不同部位所含之成分仍有極大之差異。

謝　誌

本研究承日本九州大學藥學部生藥學教授西岡五夫博士、副教授　野中源一郎博士及助教田中　隆博士指導，光譜測定承同學部儀器中心田中彬嗣、添田恭子、磯部隆一先生惠助，謹申謝忱。

考參文獻

1. 甘偉松.1965.臺灣藥用植物誌.第三卷.p.433.國立中國醫藥研究所.台北縣.
2. Lin, J. H., Nonaka, G., Nishioka, I. 1990. Tannins and Related Compounds. XCIV. Isolation and Characterization of Seven New Hydrolyzable Tannins from the Leaves of *Macaranga tanarius* (L.) Muell. et Arg. Chem. Pharm. Bull . 38 : 1218.
3. Lin, J. H., Ishimatsu, M., Tanaka, T., Nonaka , G., Nishioka, I.1990. Tannins and Related Compounds. XCVI. Structures of Macaranins, New Hydrolyzable Tannins Possessing Macaranoyl and Tergalloyl Ester Groups, from the Leaves of *Macaranga sinensis* (Baill.) Muell. Arg. Chem. Pharm. Bull. 38 : 1844.
4. Saijo, R., Nonaka, G. and Nishioka, I.1989. Tannins and Related Compounds. LXXXIV. Isolation and Characterization of Five New Hydrolyzable Tannins from the Bark of *Mallotus japonicus*. Chem. Pharm. Bull. 37 : 2624.
5. 石松眞，野中源一郎，西岡五夫.1989.大戟科，連香樹科及苦木科植物中新奇加水分解型單寧putranjivain A及B之構造.日本生藥學會第36回年會(熊本)演講要旨.p.172.
6. 西條玲子，野中源一郎，西岡五夫.1988. *Mallotus*屬植物之單寧及相關化合物(3)—*Mallotus japonicus*樹皮部之研究，日本藥學會第108回年會(廣島)演講要旨.p.277.
7. 西條玲子，野中源一郎，西岡五夫.1989. *Mallotus*屬植物之單寧及相關化合物(5)--4種新加水分解型單寧之構造.日本藥學會第109回年會(名古屋)演講要旨III.p.156.
8. Saijo, R., Nonaka, G. and Nishioka, I.1989. Tannins and Related Compounds. LXXXVII. Isolation and Characterization of Four New Hydrolyzable Tannins from the Leaves of *Mallotus repandus*. Chem. Pharm. Bull. 37 : 2624.
9. Yoshida, T., Itoh, H., Matsunaga, S., Tanaka, R. and Okuda, T.1992. Tannins and Related Polyphenols of Euphorbiaceas IX. Hydrolyzable Tannins with C Glucose Core from *Phyllanthus flexuosus* Muell. Arg. Chem. Pharm. Bull. 40 : 53.

Correspondence to : Jer-Huei Lin

Accepted for Publication : July. 8. 1993

Journal of Food and Drug Analysis, 1993. 1(3)

Studies on Tannins of the Bark of *Macaranga tanarius* (L.) Muell. et Arg.

JER-HUEI LIN

National Laboratories of Foods and Drugs, Department of Health, Executive Yuan

ABSTRACT

Chemical examination of the bark of *Macaranga tanarius* (L.) Muell. et Arg. (Euphorbiaceae) has led to the isolation of 10 known tannins(1-10). These tannins are corilagin (1), mallotinic acid(2), geraniin(3), marcarinin A (4), putranjivain B(5), putranjivain A(6), mallotunin(7), mallophilinin (8), repandusinic acid A(9) and phyllanthusiin C(10). These structures were identified on the basis of their physical properties and spectroscopic evidences.

Key words : *Macaranga tanarius*, Euphorbiaceae, Hydrolyzable tannin.