天然产物研究与开发 Nat Prod Res Dev 2007,19:423-426

文章编号:1001-6880(2007)03-0423-04

蜡菊花的化学成分研究

刘海洋[1],何红平[1],杨献文[1],陈慕玮[2],郝小江[1]*

[1]中国科学院昆明植物研究所 植物化学与西部植物资源利用国家重点实验室,昆明 650204;

[2]贵阳中医学院,贵阳 550002

摘 要:从菊科植物蜡菊(*Helichrysum bracteatum* Vent)花的乙醇提取物中分离出11个化合物,经波谱分析鉴定为subscandenin(**1**),江户樱花苷(**2**),圣草素5-*O*-β-D-葡萄吡喃糖苷(**3**),pyracanthoside(**4**),槲皮素(**5**),木犀草素(**6**),柯伊利素(**7**),异荭草素(**8**),咖啡酸(**9**),piperitol(**10**),4-hydroxymethyl-1-methoxycarbonylazulene(**11**)。这些化合物均为首次从该植物中分离得到。

关键词:化学成分;腊菊;菊科;波谱分析

中图分类号:R282.1;Q946.91 **文献标识码**:A

Chemical Constituents of the Flowers of *Helichrysum bracteatum*

LIU Hai-yang[1], HE Hong-ping[1], YANG Xian-wen[1], CHEN Mu-wei[2], HAO Xiao-jiang[1]*

[1]*The State Key Laboratory of Phytochemistry and Plant Resources in West China, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650204, China;*

[2]*Guyang College of Traditional Chinese Medicine, Guiyang 550002, China*

Abstract: Eleven known compounds were isolated from the ethanol extract of the flowers of *Helichrysum bracteatum* Vent (Compositae), and their structures were elucidated by spectroscopic methods as subscandenin(**1**), prunin(**2**), eriodictyol 5-*O*-β-D-glucopyranoside(**3**), pyracanthoside(**4**), quercetin(**5**), luteolin(**6**), chrysoeriol(**7**), isoorientin(**8**), caffeic acid(**9**), piperitol(**10**) and 4-hydroxymethyl-1-methoxycarbonylazulene(**11**). All of them were isolated from the genus for the first time.

Key words: chemical constituents; *Helichrysum bracteatum*; Compositae; spectroscopic methods

Introduction

Helichrysum bracteatum Vent, a kind of ornamental plants, belongs to the family of Compositae, which originally distributed in Australia and now is widely planted in China[1]. In order to investigate the chemical constituents of the genus, the flowers purchased from the Shanyi flowers market in Kunming were extracted with 95% EtOH. The ethanol extract was partitioned between chloroform and water. After evaporated, the chloroform and aqueous portions were applied to column chromatography over polyamide resin, silica gel, Rp-18 gel and Sephadex LH-20 to afforded eleven compounds (Fig. 1): subscandenin (**1**)[2], prunin (**2**)[3], eriodictyol 5-*O*-β-*D*-glucopyranoside (**3**)[4], pyracanthoside (**4**)[5], quercetin (**5**)[6], luteolin (**6**)[7], chrysoeriol (**7**)[7], isoorientin (**8**)[8], caffeic acid (**9**)[9], piperitol (**10**)[10] and 4-hydroxymethyl-1-methoxycarbonylazulene (**11**)[11]. Prunin exhibited a significant hypocholesterolemic effect[12]. Quercetin was an antitumor agent[13], hosphatidylinositol protein kinase inhibitor and lipid peroxidation inhibitor. Luteolin showed a high inhibitory activity against both thromboxane and leukotriene synthesis[14], and was a DNA topoisomerase I inhibitor and possessed antimicrobial activity. Chrysoeriol showed antioxidant and anti-inflammatory activities[15]. Isoorientin exhibited significant hepatoprotective effect[16], also showed to possess significant anti-nociceptive and anti-inflammatory activities[17], antioxidative activity[18]. Cafferic acid was an arachidonare 5-lipoxygenase inhibitor. Compound **11** has been used as an anti- inflammatory, anti-spasmodic, and anti-microbial agent.

Experimental

General

The ^{1}H NMR and ^{13}C NMR spectra were recorded on

Received October 10, 2005; Accepted March 10, 2006

* Corresponding author Tel: 86-871-5223263; E-mail: haoxj@mail.kib.ac.cn

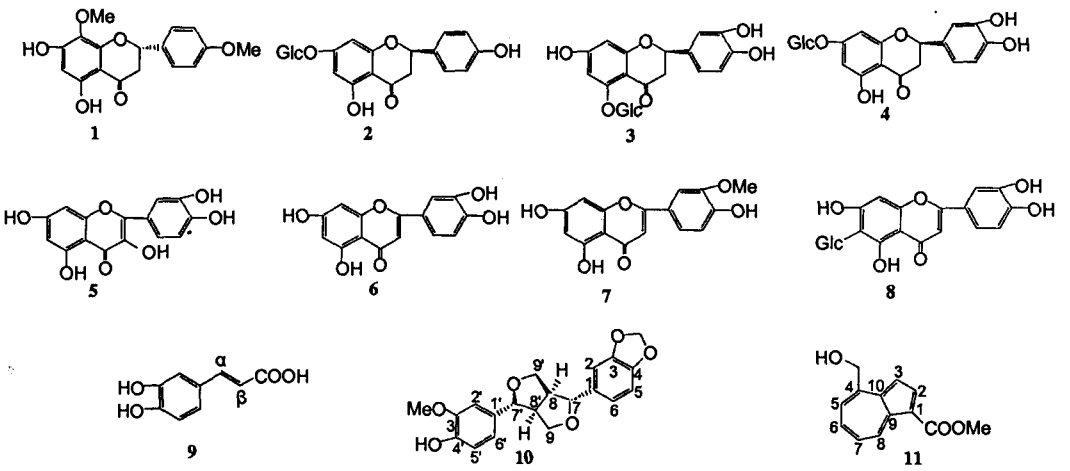

Fig. 1 Structures of compounds 1-11

Bruker AM-400 spectrometers with TMS as internal standard. MS data were taken on a VG Autospec-3000 spectrometer. Column chromatographies were performed on polyamide resin(90-180 mesh), silica gel(200-300 mesh, Qingdao Marine Chemical Inc.), reversed-phase silica gel(Lichroprep Rp-18, 40-63 μm, Merk, Germany), and Sephadex LH-20 (25-100 μm, Pharmcia). Fractions were monitored by TLC, and spots were visualized by heating silica gel plates sprayed with 10% H_2SO_4 in EtOH.

Plant material

The flowers of *Helichrysum bracteatum* Vent were purchased from the Shanyi flowers market in Kunming, Yunnan. The plant was identified by Dr. Xiang Jianying, Kunming Insitute of Botany, Chinese Academy of Sciences.

Extract and isolation

The fresh flowers(5 kg) of *H. bracteatum* were extracted with 95% EtOH three times under reflux for 3 h each time. After the removal of solvents *in vacuo*, the resulting residue (150 g) was portioned successively between H_2O and $CHCl_3$. The $CHCl_3$ extract(40 g) was subjected to MPLC over silica gel eluting with gradient petroleum ether-AcOEt to give two fractions. Fraction 2 further purified by silica gel eluting with petroleum ether-AcOEt and Sephadex LH-20 eluting with MeOH to obtain compound **1** (65 mg), **10** (38 mg) and **11** (10 mg), respectively. A part(50 g) of the aqueous portion was applied to column chromatography over polyamide resin eluting with MeOH-H_2O (1:1, 2:1, 3:1), then MeOH to give four fractions. Fraction 1 was subjected to repeated column chromatography over Sephadex LH-20 eluting with MeOH to obtain compound **9**(40 mg). Fraction 2 was repeatedly chromatographed over Sephadex LH-20 to yield compound **8** (43 mg). Fraction 3 was repeatedly purified over Sephadex LH-20 to yield compound **5**(32 mg), **6**(100 mg), **7**(82 mg). Fraction 4 was repeatedly subjected to column chromatography on Rp-18 gel and Sephadex LH-20 to get compound **2** (120 mg), **3**(18 mg) and **4**(30 mg).

Results and Discussion

Compound 1 $C_{17}H_{16}O_6$, yellow needles ($CHCl_3$-MeOH), EI-MS *m/z*(%): 316(M^+, 100), 301(15), 216(59), 196(86), 181(84), 167(24), 153(38), 128(24), 120(27), 107(4), 91(7), 69(11); ^1H NMR(400 MHz, DMSO-d_6) δ: 2.82(1H, d, J = 3.0 Hz, H-3α), 3.07(1H, d, J = 12.3 Hz, H-3β), 3.76 (3H, s, 7-OMe), 3.85(3H, s, 4′-OMe), 5.37(1H, dd, J = 3.0, 12.3 Hz, H-2), 6.09(1H, s, H-6), 6.82 (2H, dd, J = 2.0, 8.4 Hz, H-3′, 5′), 7.25(2H, dd, J = 2.0, 8.4 Hz, H-2′, 6′). ^{13}C NMR(100 MHz, DMSO-d_6) data see Table 1.

Compound 2 $C_{21}H_{22}O_{10}$, yellow powder, Negative FAB-MS *m/z*: 433(M-H), 271(M-H-Glc); ^1H NMR (400 MHz, DMSO-d_6) δ: 2.61(1H, d, J = 2.9 Hz, H-3α), 3.04(1H, d, J = 12.7 Hz, H-3β), 4.69(1H, d, J = 7.0 Hz, Glc-1), 5.35(1H, dd, J = 2.9, 12.7 Hz, H-2), 6.38(1H, d, J = 1.9 Hz, H-6), 6.76(1H, d, J = 1.9 Hz, H-8), 6.77(2H, dd, J = 2.0, 8.4 Hz, H-3′, 5′), 7.29(2H, dd, J = 2.0, 8.4 Hz, H-2′, 6′). ^{13}C NMR(100 MHz, DMSO-d_6) data see Table 1.

Compound 3 $C_{21}H_{22}O_{11}$, yellow powder, Negative FAB-MS *m/z*: 449(M-H), 287(M-H-Glc); ^1H NMR (400 MHz, DMSO-d_6) δ: 2.62(1H, d, J = 6.0 Hz, H-3α), 2.97(1H, d, J = 2.6 Hz, H-3β), 4.71(1H, d, J = 6.4 Hz, Glc-1), 5.32(1H, dd, J = 2.6, 6.0 Hz, H-2), 6.12(1H, brs, H-6), 6.38(1H, brs, H-8), 6.86 (1H, d, J = 9.3 Hz, H-5′), 7.48(1H, dd, J = 1.8, 9.3

Table 1 The ^{13}C NMR data of compound 1-8 (100 MHz, in DMSO-d_6)

C	1	2	3	4	5	6	7	8
2	79.1	78.2	78.3	78.4	46.8	164.0	164.2	163.7
3	43.1	44.5	44.8	44.8	135.7	103.0	103.3	102.8
4	196.4	190.1	189.7	190.3	175.8	181.8	181.9	181.9
5	160.0	164.4	160.2	165.7	156.1	157.4	157.4	156.2
6	130.2	98.5	98.9	99.3	98.2	99.0	98.9	108.9
7	161.5	164.9	165.1	160.9	164.0	164.2	164.2	163.3
8	93.0	97.7	98.0	98.1	93.3	94.0	94.1	93.5
9	153.7	164.2	163.9	164.2	160.7	161.6	161.5	160.7
10	102.9	103.4	105.4	105.5	102.9	103.8	103.8	103.4
1′	129.5	129.2	129.9	130.0	121.9	121.6	121.6	121.4
2′	127.9	128.3	114.4	114.7	115.0	113.4	110.2	113.3
3′	115.6	115.2	145.7	145.4	145.0	145.8	150.8	145.7
4′	156.3	128.3	145.8	145.8	147.7	149.8	148.1	149.7
5′	115.6	115.2	115.6	115.6	115.6	116.1	115.8	116.1
6′	127.9	129.0	118.1	118.2	120.0	119.1	120.4	119.0
1″	–	102.2	102.3	103.6	–	–	–	78.9
2″	–	73.5	73.6	73.6	–	–	–	73.1
3″	–	76.1	76.3	76.3	–	–	–	70.6
4″	–	69.7	69.8	69.9	–	–	–	70.2
5″	–	77.5	77.3	77.7	–	–	–	81.5
6″	–	60.7	61.0	61.0	–	–	–	61.5
OMe	56.2 61.3	–	–	–	–	–	56.0	–

Hz, H-6′), 7.52 (1H, d, J = 1.8 Hz, H-2′). ^{13}C NMR (100 MHz, DMSO-d_6) see Table 1.

Compound 4 $C_{21}H_{22}O_1$, yellow powder, Negative FAB-MS m/z: 449 (M-H), 287 (M-H-Glc); ^1H NMR (400 MHz, DMSO-d_6) δ: 2.62 (1H, d, J = 5.8 Hz, H-3α), 2.96 (1H, d, J = 2.6 Hz, H-3β), 4.75 (1H, d, J = 6.4 Hz, H-1″), 5.32 (1H, dd, J = 2.6, 5.8 Hz, H-2), 6.11 (1H, d, J = 2.0 Hz, H-6), 6.38 (1H, brs, H-8), 6.85 (1H, d, J = 9.4 Hz, H-5′), 7.46 (1H, dd, J = 1.8, 9.4 Hz, H-6′), 7.50 (1H, d, J = 1.8 Hz, H-2′). ^{13}C NMR (100 MHz, DMSO-d_6) see Table 1.

Compound 6 $C_{15}H_{10}O_6$, yellow powder, Negative FAB-MS m/z: 285 (M-H); ^1H NMR (400 MHz, DMSO-d_6) δ: 6.17 (1H, d, J = 1.4 Hz, H-6), 6.43 (1H, d, J = 1.4 Hz, H-8), 6.64 (1H, s, H-3), 6.88 (1H, d, J = 8.4 Hz, H-5′), 7.38 (1H, brs, H-2′), 7.40 (1H, brs, H-6′). ^{13}C NMR (100 MHz, DMSO-d_6) see Table 1.

Compound 7 $C_{16}H_{12}O_6$, yellow powder, EI-MS m/z (%): 300 (M^+, 100), 272 (8), 257 (16), 229 (17), 153 (23), 133 (11), 124 (6), 114 (10), 105 (8); ^1H NMR (400 MHz, DMSO-d_6) δ: 3.88 (3H, s, 3′-OMe), 6.18 (1H, d, J = 2.0 Hz, H-6), 6.49 (1H, d, J = 2.0 Hz, H-8), 6.88 (1H, s, H-3), 6.92 (1H, d, J = 8.7 Hz, H-5′), 7.50 (1H, d, J = 1.8 Hz, H-2′), 7.54 (1H, dd, J = 1.8, 8.7 Hz, H-6′). ^{13}C NMR (100 MHz, DMSO-d_6) see Table 1.

Compound 8 $C_{16}H_{20}O_{11}$, yellow powder, Negative FAB-MS m/z: 447 (M-H); ^1H NMR (400 MHz, DMSO-d_6) δ: 4.58 (1H, d, J = 9.8 Hz, H-1″), 6.47 (1H, s, H-3), 6.66 (1H, s, H-8), 6.88 (1H, d, J = 8.2 Hz, H-5′), 7.39 (1H, d, J = 2.2 Hz, H-2′), 7.41 (1H, dd, J = 2.2, 8.2 Hz, H-6′). ^{13}C NMR (100 MHz, DMSO-d_6) see Table 1.

Compound 10 $C_{20}H_{20}O_6$, white powder, EI-MS m/z (%): 356 (M^+, 40), 203 (23), 149 (100), 91 (28), 77 (32); ^1H NMR (400 MHz, $CDCl_3$) δ: 3.04 (2H, brs, H-8, 8′), 3.84 (1H, d, J = 0.71 Hz, H-9′α), 4.19 (1H, d, J = 6.3 Hz, H-9′β), 3.85 (s, OCH_3), 3.84 (1H, d, J = 0.71 Hz, H-9α), 4.22 (1H, d, J = 6.5 Hz, H-9β), 4.69 (2H, brs, H-7, 7′), 5.91 (2H, s, OCH_2O), 6.75 (2H, dd, J = 1.5, 9.0 Hz, H-6, 2′), 6.79 (2H, brs, H-5, 3′), 6.84 (2H, d, J = 2.8 Hz, H-2, 6′); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 135.0 (C-1, s), 106.4 (C-2, d), 145.2 (C-3, s), 147.0 (C-4, s), 108.1 (C-5, d), 119.3 (C-6, d),

85.8(C-7,d),54.2(C-8,d),71.6(C-9,t),132.7(C-1′,s),118.9(C-2′,d),145.2(C-3′,s),147.9(C-4′,s),114.3(C-5′,d),108.7(C-6′,d),85.7(C-7′,d),54.0(C-8′,d),71.6(C-9′,t),101.0(OCH_2O),55.8(OCH_3,q).

Compound 11 $C_{13}H_{12}O_3$, purple powder, EI-MS *m/z*(%):216(M^+,100),185(73),157(20),155(24),129(48),128(78),127(44),126(20);^{13}C NMR(400 MHz,CD_3OD) δ: 3.92(3H,s,OCH_3),5.25(2H,s,CH_2),7.36(1H,d,J=4.3 Hz,H-3),7.55(1H,d,J=2.2 Hz,H-5),7.58(1H,dd,J=6.1,9.7 Hz,H-7),7.94(1H,dd,J=6.1,2.2 Hz,H-6),8.28(1H,d,J=4.3 Hz,H-2),9.63(1H,d,J=9.7 Hz,H-8);^{1}H NMR(100 MHz,CD_3OD)δ:141.6(C-1,s),139.7(C-2,d),113.9(C-3,d),151.9(C-4,s),128.2(C-5,d),138.7(C-6,d),127.0(C-7,d),138.7(C-8,d),117.3(C-9,s),142.7(C-10,s),167.5(C=O),65.1(CH_2OH,t),51.5(OCH_3,q).

References

1 Delectis Florae Reipublicae Popularis Sinicae Agendae Academiae Sinicae Edita, Flora Reipublicae Popularis Sinicae, Beijing:Science Press,1979,Tomus 75:245-246.

2 Manuel AL,Paulino DM,Flavonoids from the Leaves of Chromolaena subscandens. *Journal Natural Products*, 1993, 56: 610-612.

3 Ke Y,Jiang Y,Luo SQ,Studies on the chemical constituents of chinese clinopodium(*Clinopodiumchinense*). *Chin Tradit Herb Drugs*,1999,30:10-12.

4 Gujer R,Magnolato D,Self R,Glucosylated flavonoids and other phenolic compounds from sorghum. *Phytochemistry*, 1986, 25:1431-1436.

5 Yang XW,Zhao J. Studies on the chemical constitutents from *Rabdosia japonica*(Burm. F.)hara var. *Glaucocalyx*(Maxim.)hara. *Nat Prod Res Dev*(天然产物研究与开发),2003,15:490-493.

6 Yu DQ,Yang JS. The Handbook of Analytical Chemical,2nd Edition. Beijing:Chemical Industry Press,1999,7:820.

7 Yu DQ,Yang JS,The Handbook of Analytical Chemical,2nd Edition. Beijing:Chemical Industry Press,1999,7:818.

8 Zhang YJ,Yang CR,Chemical studies on *Gentianella azurea*,a Tibetan medicinal plant. *Acta Botanica Yunnanica*,1994,16:401-406.

9 Kelley CJ, Harruff RC, Carmack M, Polyphenolic acids of Lithospermum ruderale. II. Carbon-13 nuclear magnetic resonance of lithospermic and rosmarinic acids. *Journal of Organic Chemistry*,1976,41:449-455.

10 Abe F, Yahara S, Nonaka G, *et al.* Studies on *Xanthoxylum* spp. Ⅱ. Constituents of the bark of *Xanthoxylum piperitum* DC. *Chem Pharm Bull*,1974,22:2650-2655.

11 Siegel U,Mues R,Doing R,*et al.* The azulenes from *Plagiochila longispina* and *Calypogeia azurea*. *Phytochemistry*, 1992, 31:1671-1678.

12 Choi JS,Yokozawa T,Oura H. Antihyperlipidemic effect of flavonoids from *prunus davidiana*. *Journal Natural Products*, 1991,54:218-224.

13 Wei YQ, Zhao X, Kariya Y, *et al.* Induction of apoptosis by quercetin:involvement of heat shock protein. *Cancer Research*, 1994,54:4952-4957.

14 Odontuya G, Hoult JR, Houghton PJ. Structure-activity relationship for antiinflammatory effect of luteolin and its derived glycosides. *Phytotherapy Research*,2005,19:782-786.

15 Choi DY,Lee JY,Kim MR,*et al.* Chrysoeriol potently inhibits of nitric oxide synthase by blocking AP-1 activation. *Journal of Biomedical Science*,2005,12:949-959.

16 Deliorman OD,Aslan M,Akty G,*et al.* Evaluation of hepatoprotective effect of *Gentiana olivieri* herbs on subacute administration and isolation of active prnciple. *Life Science*, 2003, 72:2273-2283.

17 Kupeli E,Aslan M,Gurbuz I,*et al.* Evaluation of in vivo biological activity profile of isoorientin. *Zeitschrift fur Naturforschung,C. Journal of Biosciences*,2004,59:787-790.

18 Budzianowski J,Pakulski C,Robak J. Studies on antioxidative activity of C-glycosylflavones. *Polish Journal of Pharmacology and Pharmacy*,1991,43:395-401.