彩云木叶化学成分及其抗炎活性研究

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摘　要:为研究彩云木 *Synadenium grantii* 叶的化学成分及部分化合物体外抗炎活性,本研究采用硅胶、Sephadex LH-20 等多种柱色谱进行分离纯化,通过理化性质和 NMR 等波谱数据鉴定化合物的结构,并对部分化合物进行抑制脂多糖诱导 RAW 264.7 细胞释放 NO 活性的测定。从彩云木叶二氯甲烷-甲醇(1∶1)提取物中共分离得到了 10 个化合物,分别鉴定为日尔曼醇(**1**)、大戟醇(**2**)、正二十八烷醇(**3**)、β-谷甾醇(**4**)、豆甾醇(**5**)、ingol-7,8,12-triacetate-3-phenylacetate(**6**)、山柰酚-3-*O*-α-*L*-吡喃鼠李糖苷(**7**)、胡萝卜苷(**8**)、3,4,3′-三甲氧基鞣花酸-4′-*O*-β-*D*-吡喃葡萄糖苷(**9**)、山奈酚-3-*O*-β-*D*-吡喃葡萄糖苷(**10**)。其中 **3** 和 **6**~**10** 为首次从该种植物中分离得到,**3**、**6**、**8** 和 **9** 为首次从聚苞大戟属植物中分离得到,**9** 抑制 LPS 诱导 RAW 264.7 细胞释放 NO 的 IC_{50} 值为 12.0±0.9 μM,显示较好的体外抗炎活性。

关键词:彩云木;化学成分;ingol-7,8,12-triacetate 3-phenylacetate;抗炎活性
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Chemical constituents from the leaves of *Synadenium grantii* and their anti-inflammatory activity

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Abstract: To investigate the chemical constituents from the leaves of *Synadenium grantii* and their anti-inflammatory activities *in vitro*, various column chromatography techniques such as column chromatography on silica gel, Sephadex LH-20 were used to isolate and purify compounds and their structures were identified by spectral data including NMR and physicochemical properties. Some compounds were evaluated for their inhibitory effects on lipopolysaccharide-induced nitric oxide production in RAW264.7 cells. Ten compounds were isolated and identified as germanicol (**1**), euphol (**2**), 1-octacosanol (**3**), β-sitosterol (**4**), stigmasterol (**5**), ingol 7,8,12-triacetate-3-phenylacetate (**6**), kaempferol-3-*O*-α-*L*-rhamnpyranoside (**7**), daucosterol (**8**), 3,3,4′-tri-*O*-methylellagic acid 4′-*O*-β-*D*-glucopyranoside (**9**), kaempferol-3-*O*-β-*D*-glucopyranoside (**10**). Compounds **3** and **6-10** were isolated from the species for the first time, among which compounds **3**, **6**, **8** and **9** were isolated from the plants in genus *Synadenium* for the first time. Compound **9** shows good anti-inflammatory activity *in vitro* with an IC_{50} values of 12.0±0.9 μM.

Key words: *Synadenium grantii*; chemical constituents; ingol 7,8,12-triacetate 3-phenylacetate; anti-inflammatory activity

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彩云木 *Synadenium grantii* 为大戟科(Euphorbiaceae)聚苞大戟属 *Synadenium* 植物,是一种原产于非洲东部多汁灌木,后来作为一种观赏植物引入美洲和欧洲[1],又称"非洲乳木"。该木树枝折断或剥离茎皮,会产生白色乳胶汁[2]。临床报告指出接触该植物的乳胶汁,脸和脖子产生象火烧一样的刺激感[3]。巴西民间常把该植物乳胶汁作为一种传统药物用于多种疾病的治疗,如过敏,胃肠紊乱[4],肿瘤[5]等。该植物的叶也具有广泛的药理活性,研究表明彩云木叶乙醇提取物具有明显的镇痛、抗炎[6],抗菌[7]、抗肿瘤、抗血管生成[8]和改善痛经作用[9]。Hassan 等[10]发现其叶的氯仿提取物具有肿瘤细胞毒和抗寄生虫作用,并从中得到两个新的二萜酯类成分。Andersen 等[11]从中分离得到多个花色素芹菜糖苷类成分。为了深入研究该植物化学资源,继续寻找具有抗炎活性的化学成分,本研究对其叶的二氯甲烷-甲醇(1∶1)提取物的化学成分及其体外抗炎活性进行了研究,以探明其抗炎生物活性物质基础。

1　材料与方法

1.1　仪器与材料

JEOL ECS 400 MHz 核磁共振仪(Peabody, MA, USA);ESI-MS(API2000 三重四级杆质谱仪,Applied Biosystems, Foster City, CA);分析和半制备型 HPLC 为 Agilent 1100 HPLC(DAD 检测器);色谱柱为 Zorbax SB-C_{18}(Agilent, 4.6 mm × 250 mm × 5 μm, 1 mL/min;9.4 mm × 250 mm × 5 μm, 3 mL/min);紫外分析仪(Spectroline, Westbury, NY, USA);Buchi R-114 旋转蒸发仪;CO_2 培养箱(德国 Heraeus 公司);超净工作台(中国苏州安泰空气技术有限公司);XDS-1B 型倒置显微镜(中国北京佳源兴业有限公司);硅胶 60(0.040 ~ 0.063 mm, EMD Millipore, Billerica, MA, USA);Sephadex LH-20(GE healthcare Bio-sciences AB);MCI Gel CHP20P;大孔树脂 HP-20(日本,三菱);薄层硅胶板 GF 254(Merck KGaA, Darmstadt Germany),正己烷、乙酸乙酯、氯仿、甲醇(Fisher Chemical, Certified ACS, Fair Lawn, NJ, USA);其他试剂为分析纯;二甲基亚砜(DMSO)、噻唑蓝(MTT)、脂多糖(LPS)(Sigma 公司);DMEM 培养基购于 HyClone ™公司;胎牛血清(FBS)购于浙江天杭生物科技有限公司;NO 检测试剂盒(上海碧云天生物科技有限公司)。

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1.2　提取与分离

干燥的彩云木叶(900 g),适当粉碎,用 3 L CH_2Cl_2-MeOH(1∶1, V/V)混合液室温浸渍提取 3 次,合并提取液减压浓缩除去溶剂,得提取浸膏 63.5 g。取上述浸膏 46.9 g 经硅胶柱色谱(0.040 ~ 0.063 mm)分离,以正己烷-乙酸乙酯系统梯度洗脱(100∶1→1∶100),得 62 个流分 F1 ~ F62。取流分 F15 经硅胶柱色谱,正己烷-乙酸乙酯(6∶1)洗脱后再经 Sephadex LH-20 柱用 CH_2Cl_2-MeOH(1∶1)洗脱得化合物 **1**(20.0 mg),流分 F19 经硅胶柱色谱由正己烷-乙酸乙酯(20∶1→4∶1)洗脱得化合物 **2**(10.2 mg)。流分 F26 经硅胶柱色谱/正己烷-乙酸乙酯(4∶1)得化合物 **3**(3.6 mg),流分 F30 经硅胶柱色谱用正己烷-乙酸乙酯(4∶1)洗脱后得 3 个主要次级流分 F26a-F26c,F26a 经重结晶得化合物 **4**(50.0 mg),F26c 再经硅胶柱色谱/正己烷-乙酸乙酯(10∶1)得化合物 **5**(40.1 mg);流分 F38 上 Sephadex LH-20 柱经 CH_2Cl_2-MeOH(1∶1)洗脱得 2 个主要次级流分 F38a 和 F38b, F38a 经 RP-HPLC/乙腈-水(4∶1→9∶1)梯度洗脱得化合物 **6**(15.3 mg)。流分 F60 经硅胶柱由 CH_2Cl_2-MeOH-H_2O(200∶10∶1)洗脱得 3 个次级流分 F60a ~ F60c,F60a 经再硅胶柱分离得化合物 **8**(30.6 mg),F60c 经 Sephadex LH-20 柱 MeOH 洗脱得化合物 **7**(8 mg)。流分 F62 用大孔吸附树脂依次用纯水、50% 和 95% 乙醇水溶液洗脱,取 50% 乙醇洗脱液经硅胶柱由 CH_2Cl_2-MeOH(20∶1→5∶1)梯度洗脱得 4 个次级流分 F62a ~ F62d,F62a 经 RP-HPLC 用 MeOH-H_2O 梯度洗脱得化合物 **9**(9.4 mg),F62d 经 Sephadex LH-20 柱以 MeOH 洗脱得化合物 **10**(7.0 mg)。

1.3　体外细胞毒和抗炎活性筛选实验

1.3.1　细胞毒实验

取对数生长期 RAW264.7 小鼠巨噬细胞按 1 × 10^5 个/mL, 200 μL/孔接种于 96 孔板中,用含 10% FBS 的 DMEM 培养基于 37 °C、5% CO_2 培养箱中培养 24 h 后弃培养基,分别加入不同浓度的部分单体化合物至 0、3.125、6.25、12.5、25、50 μM 继续培养 24 h,每组设 3 个复孔,MTT 法测定细胞存活率。

1.3.2 抗炎活性筛选

取单体化合物分别用 DMSO 配制成 50 μM 的溶液作为储备液,加药时用无血清培养基稀释。同样条件培养细胞 24 h 后弃培养基,加入 100 μL 浓度为 0、3.125、6.25、12.5、25、50 μM 的系列单体化合物溶液孵育 4 h,每组设 3 个复孔,加入终质量浓度为 1 μg/mL 的 LPS 刺激细胞继续培养 20 h。离心,取上清液,移至新的 96 孔板,按照试剂盒说明书规定的方法,在 540 nm 波长下用酶标仪测定 NO,计算最大半数抑制浓度(IC_{50})值。

2 实验结果

2.1 结构鉴定

化合物 1 白色针晶(正己烷-乙酸乙酯);mp. 179 ~ 181 ℃,ESI-MS:*m/z* 465 $[M+K]^+$。^{1}H NMR(400 MHz,$CDCl_3$)δ:0.75(3H,s,H-23),0.83(3H,s,H-25),0.89(3H,s,H-24),0.93(6H,s,H-26,27),0.94(3H,s,H-28),1.03(3H,s,H-29),1.08(3H,s,H-30),3.46(1H,dd,*J* = 5.6,11.0 Hz,H-3),4.86(1H,s,H-19);^{13}C NMR(100 MHz,$CDCl_3$)δ:142.9(C-18),129.8(C-19),76.4(C-3),51.1(C-5),49.3(C-9),43.5(C-14),41.1(C-8),38.9(C-4,13),38.5(C-1),37.8(C-16),37.7(C-22),37.5(C-10),34.6(C-7),34.5(C-17),33.5(C-21),32.3(C-20),31.5(C-29),29.3(C-30),28.4(C-23),27.6(C-15),26.4(C-12),25.6(C-2),25.4(C-28),22.3(C-26),21.1(C-11),18.4(C-6),16.7(C-25),16.2(C-24),14.8(C-27)。以上数据与文献[12]基本一致,故化合物 **1** 鉴定为日尔曼醇。

化合物 2 白色针晶(正己烷-乙酸乙酯);mp. 116 ~ 118 ℃,ESI-MS:*m/z* 465 $[M+K]^+$。^{1}H NMR(400 MHz,$CDCl_3$)δ:0.76(3H,s,H-18),0.79(3H,s,H-29),0.86(3H,s,H-30),0.89(3H,d,*J* = 6.4 Hz,H-21),0.96(3H,s,H-28),1.00(3H,s,H-19),1.60(3H,s,H-26),1.68(3H,s,H-27),3.24(1H,dd,*J* = 11.8,4.6 Hz,H-3),5.10(1H,t,*J* = 7.0 Hz,H-24);^{13}C NMR(100 MHz,$CDCl_3$)δ:134.2(C-9),133.7(C-8),131.1(C-25),125.4(C-24),79.2(C-3),51.1(C-17),50.2(C-5),50.1(C-14),44.2(C-13),39.1(C-4),37.4(C-20),36.6(C-10),36.5(C-1),35.4(C-22),31.2(C-16),30.9(C-15),28.2(C-12),28.1(C-29),27.8(C-7),26.6(C-28),25.9(C-27),25.1(C-23),24.5(C-2),21.6(C-11),20.3(C-19),19.1(C-21),18.8(C-6),17.8(C-26),15.7(C-18),15.6(C-30)。以上数据与文献[13]基本一致,故化合物 **2** 鉴定为大戟醇。

化合物 3 白色粉末;ESI-MS:*m/z* 392 $[M-H_2O]^+$。^{1}H NMR(400 MHz,$CDCl_3$)δ:0.88(3H,t,*J* = 6.5 Hz,H-28),1.26(-CH_2-),3.65(2H,q,*J* = 6.6 Hz,H-1);^{13}C NMR(100 MHz,$CDCl_3$)δ:63.3(C-1),33.0,32.1,29.9,29.8,29.6,29.5,25.9,22.9(多个亚甲基 C 信号),14.3(C-28)。以上数据与文献[14]基本一致,故化合物 **3** 鉴定为正二十八烷醇。

化合物 4 无色针晶(正己烷-乙酸乙酯);mp. 136 ~ 138 ℃。^{1}H NMR(400 MHz,$CDCl_3$)δ:5.35(1H,d,*J* = 5.2 Hz,H-6),3.52(1H,m,H-3α),1.00(3H,s,H-19),0.92(3H,d,*J* = 6.5 Hz,H-21),0.84(3H,t,*J* = 7.6 Hz,H-29),0.83(3H,d,*J* = 7.0 Hz,H-26),0.81(3H,d,*J* = 6.9 Hz,H-27),0.68(3H,s,H-18);^{13}C NMR(100 MHz,$CDCl_3$)δ:140.9(C-5),121.8(C-6),71.9(C-3),56.9(C-14),56.2(C-17),50.2(C-9),45.9(C-24),42.4(C-4),42.4(C-13),39.9(C-12),37.4(C-1),36.6(C-10),36.2(C-20),34.0(C-22),32.0(C-7),32.0(C-8),31.7(C-2),29.3(C-25),28.3(C-16),26.2(C-23),24.4(C-15),23.2(C-28),21.2(C-11),19.9(C-27),19.5(C-19),19.1(C-21),18.9(C-26),12.1(C-29),11.9(C-18)。以上数据与文献[15]基本一致,故化合物 **4** 鉴定为 β-谷甾醇。

化合物 5 白色针晶(乙酸乙酯);mp. 165 ~ 167 ℃。^{1}H NMR(400 MHz,$CDCl_3$)δ:5.36(1H,br. d,*J* = 5.0 Hz,H-6),3.55(1H,m,H-3),0.69(3H,s,CH_3-18),0.83(3H,s,CH_3-19),0.91(3H,d,*J* = 6.0 Hz,H-21),5.13(1H,dd,*J* = 8.0,15.1 Hz,H-22),5.01(1H,dd,*J* = 8.0,15.1 Hz,H-23),0.84(3H,d,*J* = 6.3 Hz,CH_3-26),0.79(3H,d,*J* = 5.5 Hz,CH_3-27),0.81(3H,t,*J* = 7.4 Hz,CH_3-29);^{13}C NMR(100 MHz,$CDCl_3$)δ:141.0(C-5),138.5(C-22),129.6(C-23),121.9(C-6),72.1(C-3),57.1(C-14),50.4(C-9),57.0(C-17),51.5(C-24),42.6(C-13),42.5(C-20),40.6(C-4),40.0(C-12),37.5(C-1),36.8(C-10),32.2(C-7),32.2(C-8),32.0(C-2),31.9(C-25),29.1(C-16),25.6(C-28),24.6(C-15),21.4(C-27),21.2(C-11),20.2(C-21),19.6(C-19),19.2(C-26),12.5(C-29),12.3(C-18)。以上数据与文献[16]报道一致,故鉴定

化合物**5**为豆甾醇。

化合物6　白色粉末;ESI-MS: *m/z* 611 [M + H]$^+$。^{1}H NMR(400 MHz, $CDCl_3$) δ:2.76(1H,dd,*J* = 15.0,9.0 Hz,H-1′),1.67(1H,d,*J* = 15.0 Hz,H-1′),2.50(1H,m,H-2),5.14(1H,d,*J* = 8.6 Hz,H-3),5.39(1H,br s,H-5),5.14(1H,br s,H-7),4.52(1H,dd,*J* = 1.9,10.7 Hz,H-8),1.09(1H,dd,*J* = 9.0,10.9 Hz,H-9),1.02(1H,dd,*J* = 9.0,10.9 Hz,H-11),4.81(1H,dd,*J* = 3.4,10.9 Hz,H-12),2.86(1H,qd,*J* = 3.8,7.1 Hz,H-13),0.91(3H,d,*J* = 7.5 Hz,H-16),2.06(3H,d *J* = 1.2 Hz,H-7),1.04(3H,s,H-18),0.81(3H,s,H-19),1.04(3H,d,*J* = 7.1 Hz,H-20),1.96,2.06,2.09(各 3H,s,3 × CH_3COO),3.70(2H,br s,H-7′),7.26 ~ 7.33(5H,m,H-2′,6′,3′,5′,4′);^{13}C NMR(100 MHz, $CDCl_3$) δ:207.7(C-14),170.5,170.8,170.4(3 × CH_3CO),170.3(C-8′),139.4(C-6),133.8(C-1′),129.3(C-3′,5′),128.6(C-2′,6′),127.2(C-4′),117.3(C-5),77.0(C-7),76.9(C-3),73.4(C-4),71.6(C-8),71.2(C-15),71.1(C-16),70.7(C-12),43.1(C-13),41.5(C-7′),31.5(C-1),29.8(C-2),29.6(C-11),29.2(C-18),24.7(C-9),20.7,21.0,21.1(3 × CH_3CO),19.4(C-10),17.6(C-17),16.2(C-19),13.5(C-20)。以上数据与文献[17]基本一致,故化合物**6**鉴定为 Ingol 7,8,12-triacetate 3-phenylacetate。

化合物7　黄色粉末;ESI-MS *m/z*:455 [M + Na]$^+$,^{1}H NMR(400 MHz, $(CD_3)_2CO$) δ:0.90(3H,d,*J* = 5.8 Hz,H-6″),3.86(1H,m,H-2″),3.69(1H,m,H-3″),3.30(2H,m,H-4″,5″),5.54(1H,d,*J* = 1.2 Hz,H-1″),6.27(1H,br s,H-6),6.47(1H,br s,H-8),6.91(2H,d,*J* = 8.4 Hz,H-3′,5′),7.80(2H,d,*J* = 8.4 Hz,H-2′,6′),12.72(1H,s,5-OH),4.20,3.86(各 1H,br s,7,4′-OH);^{13}C NMR(100 MHz, $(CD_3)_2CO$) δ:179.3(C-4),164.9(C-7),163.2(C-5),161.0(C-4′),158.4(C-2),158.0(C-9),135.7(C-3),131.7(C-2′,6′),122.5(C-1′),116.3(C-3′,5′),105.8(C-10),102.6(C-1″),99.5(C-6),94.5(C-8),72.9(C-4″),72.1(C-2″),71.5(C-3″),71.3(C-5″),17.8(C-6″)。以上数据与文献[18]基本一致,故化合物**7**鉴定为山柰酚-3-*O*-α-*L*-吡喃鼠李糖苷。

化合物8　白色粉末(氯仿-甲醇);^{1}H NMR(400 MHz, DMSO-d_6) δ:5.33(1H,s,H-6),4.42(1H,t,*J* = 5.8 Hz,H-3),4.22(1H,d,*J* = 7.8 Hz,H-1′),0.65(3H,s,CH_3-18),0.95(3H,s,CH_3-19),0.90(3H,d, *J* = 6.5 Hz,CH_3-21),0.83(3H,t,*J* = 6.2 Hz,H-29),0.81(3H,d,*J* = 7.0 Hz,H-26),0.79(3H,d,*J* = 6.9 Hz,H-27);^{13}C NMR(100 MHz,DMSO-d_6) δ:141.3(C-5),122.3(C-6),100.8(C-1′),79.0(C-3),56.2(C-14),55.4(C-17),49.6(C-9),45.1(C-24),41.9(C-13),39.3(C-4),38.2(C-12),36.8(C-1),36.2(C-10),35.5(C-20),33.4(C-22),31.5(C-8),31.4(C-7),29.3(C-2),28.7(C-25),27.8(C-16),25.4(C-23),23.9(C-15),22.6(C-28),20.6(C-11),19.8(C-27),19.1(C-26),18.9(C-19),18.6(C-21),11.8(C-29),11.7(C-18),73.5(C-2′),76.9(C-3′),70.1(C-4′),76.8(C-5′),61.1(C-6′)。以上数据与文献[19]基本一致,故化合物**8**鉴定为胡萝卜苷。

化合物9　白色粉末(甲醇);mp. 266 ~ 267 ℃。^{1}H NMR(400 MHz, DMSO-d_6) δ:7.85(1H,s,H-5′),7.66(1H,s,H-5),5.48(1H,d,*J* = 8.4 Hz,H-1″),5.17(1H,d,*J* = 8.4 Hz,2″-OH),5.08(1H,d,*J* = 5.3 Hz,4″-OH),4.58(1H,t,*J* = 5.3 Hz,3″-OH),4.10(3H,s,3-OCH_3),4.05(3H,s,3′-OCH_3),4.01(3H,s,4-OCH_3),3.70(1H,m,H-2″),3.52(1H,m,H-3″),3.36(2H,m,H-4″,5″),3.24(2H,m,H-6″);^{13}C NMR(100 MHz, DMSO-d_6) δ:158.5(C-7′),158.2(C-7),154.4(C-4′),151.9(C-4),141.9(C-2′),141.3(C-3′),141.2(C-2),140.9(C-3),113.7(C-6′),112.9(C-1′),112.7(C-6),112.4(C-1),112.1(C-5),107.6(C-5′),101.3(C-1″),77.3(C-3″),76.5(C-5″),73.3(C-2″),69.5(C-4″),61.7(3′-OCH_3),61.4(3-OCH_3),60.5(C-6″),56.8(4-OCH_3)。以上数据与文献[20]基本一致,故化合物**9**鉴定为3,4,3′-三甲氧基鞣花酸-4′-*O*-β-*D*-吡喃葡萄糖苷。

化合物10　黄色粉末;^{1}H NMR(400 MHz, CD_3OD) δ:8.06(2H,d,*J* = 8.9 Hz,H-2′,6′),6.89(2H,d,*J* = 8.9 Hz,H-1′,5′),6.41(1H,d,*J* = 2.1 Hz,H-8),6.21(1H,d,*J* = 2.1 Hz,H-6),5.26(2H,d,*J* = 7.5 Hz,H-1″),3.69(1H,dd,*J* = 2.3,11.9 Hz,$H_α$-6″),3.53(1H,dd, *J* = 5.4,11.9 Hz,$H_β$-6″),3.43(2H,m,H-2″,5″),3.19(2H,m,H-3″,4″);^{13}C NMR(100 MHz, CD_3OD) δ:179.5(C-4),

166.2(C-7),163.1(C-5),161.6(C-4′),159.1(C-2),158.6(C-9),135.4(C-3),132.3(C-2′,6′),122.8(C-1′),116.1(C-3′,5′),105.7(C-10),104.0(C-1″),99.9(C-6),94.8(C-8),78.5(C-5″),78.1(C-3″),75.7(C-2″),71.4(C-4″),62.6(C-6″)。以上数据与文献[21]基本一致,故化合物 **10** 鉴定为山柰酚-3-*O*-*β*-*D*-吡喃葡萄糖苷。

2.2 部分化合物细胞毒和抗炎活性

部分化合物细胞毒性和抗炎活性结果如表 1 所示,化合物 **1**、**2**、**6**、**7**、**9** 和 **10** 在 50 μM 浓度下对细胞没有明显毒性。化合物 **9** 抑制 LPS 诱导 RAW 264.7 细胞释放 NO 的 IC_{50} 值为 12.0 ± 0.9 μM,显示出了较强的抑制活性。化合物 **1**、**2**、**7** 和 **10** 的 IC_{50} 值分别为 28.0 ± 1.6、30.8 ± 2.0、38.4 ± 2.1 和 33.5 ± 1.7 μM,化合物 **6** 的 IC_{50} 值大于 50 μM。

表 1 部分化合物的细胞毒性和抗炎活性

Table 1 Cytotoxicity and anti-inflammatory activity of some compounds

化合物 Compound	细胞毒性 Cytotoxic activity	抗炎活性 Anti-inflammatory activity
	Toxic dose(μM)	IC_{50}(μM)
1	>50	28.0 ± 1.6
2	>50	30.8 ± 2.0
6	>50	>50
7	>50	38.4 ± 2.1
9	>50	12.0 ± 0.9
10	>50	33.5 ± 1.7

3 结论与讨论

本研究对彩云木的二氯甲烷-甲醇(1∶1)提取物的化学成分及其体外抗炎活性进行了研究,从中分离鉴定了 10 个化合物,化合物类型主要包括三萜(2 个)、Ingol 烷型二萜(1 个)、黄酮苷类(2 个)、甾醇及其苷类(3 个)、多酚类(1 个)和脂肪醇(1 个)。其中化合物 **3**、**6** ~ **10** 为首次从该种植物中分离得到,化合物 **3**、**6**、**8** 和 **9** 为首次从聚苞大戟属植物中分离得到。

以脂多糖(LPS)诱导 RAW264.7 细胞为体外炎症模型,通过抑制一氧化氮(NO)生成实验评价部分化合物抗炎活性,其中 **1**、**2**、**7** 和 **10** 具有较弱的抗炎活性,多酚类化合物 **9** 显示出较好的抗炎活性,有潜力成为治疗炎症性相关疾病的新型药物资源。该研究丰富了彩云木叶的化学成分,解析其抗炎活性物质基础,为其药物研发及利用提供了科学依据。

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