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Advances in Study on Chemical Constituents of Lythraceae Plants in China

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Abstract

Shuizhijia (*Rotala rotundifolia*), as the Yi folk conventional medicine, has attracted more and more attention recently. In order to understand chemical composition from Shuizhijia, the review about the Lythraceae, which includes Shuizhijia, has developed based on related articles. Detailed introduction is here for some important types of ingredient, such as alkaloids, flavonoids, triterpenes, tannins, coumarins and naphthalene derivatives, which provides reference for developing and using of lythraceace plants.

Keywords

Lythraceous, Chemical Composition, *Rotala rotundifolia*, Tannins

我国千屈菜科植物化学成分研究进展

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摘 要

水指甲(圆叶节节菜)作为彝族民间习用药材，几年来逐渐受到人们的关注，为了了解其中的化学成分，结合相关文献，对水指甲所属的千屈菜科化学成分作了全面介绍，重点对生物碱类、黄酮类、三萜类、鞣质类、香豆素类和萘衍生物类进行了详细的介绍，为千屈菜科植物的开发利用提供参考。

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关键词

千屈菜科，化学成分，水指甲，鞣质类

1. 引言

千屈菜科，系双子叶植物，约有 25 属，550 种，主要分布于热带和亚热带地区，尤以热带美洲最盛，少数延伸至温带，有些是著名的观赏植物，如紫薇属，有些供染料用[1]。我国主要有 14 种，分布于长江以南及台湾地区。在我国传统医学中，千屈菜具有清热解毒、凉血止血的功效，临床用于痢疾、血崩、便血及外伤出血[2]。现代药理学研究表明，千屈菜具有降血糖、抗菌、止血、抗乙酰胆碱作用[3]。

近些年来，中外学者对千屈菜科植物的化学成分的研究，发现其含有多种类型的化合物，然而，由于千屈菜科植物是全世界水草造景艺术的首选材料，因此对于其药用成分研究深浅不一，如千屈菜科节节菜属植物圆叶节节菜，又名水指甲，作为彝族民间习用药材，对其研究却极少。为了更好的保护药用资源，合理开发和利用千屈菜科植物，本文以耳基水苋、水苋菜、紫薇、大叶紫薇、拘拿花、指甲花、千屈菜、圆叶节节菜等为对象，对其化学成分作一综述。

2. 生物碱类

生物碱类化合物具有心血管系统、中枢神经系统、抗炎、抗菌、抗病毒、保肝、抗癌等多方面的药理活性[56]。到目前为止，从七种植物中共得到 33 种生物碱类成分，其中，大叶紫薇、光千屈菜、拘那花中所含生物碱类成分互有重叠。如图 1，千屈菜科植物生物碱类型主要有光千屈菜定碱、光干屈菜新

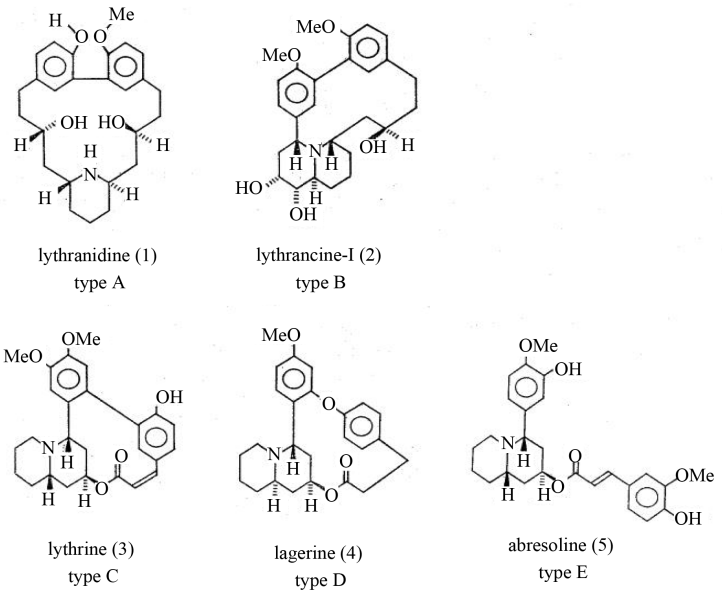

Figure 1. Types of alkaloids in lythraceae plants
图 1. 千屈菜科植物的生物碱类型

碱、千屈菜碱、紫薇碱等五类。如表 1。

3. 黄酮及其衍生物类

黄酮类成分药理作用主要表现在对心脑血管系统的作用，清除体内自由基，除具有预防心血管、癌症等作用外，还具有解酒、抗炎、抗病毒、保肝及雌激素样作用[57]。黄酮类成分是千屈菜科植物的主要成分之一，迄今，已经从八种千屈菜科植物中发现 63 种黄铜及其衍生物类成分见表 2，在植物药理作用中发挥重要作用。Diab 等[20]从紫薇甲醇提取物中纯化得到 4-methoxy apigenin-8-C_1-β-D-glucopyranose 对于四种细菌均有抑制作用。HO 等研究发现圆叶节节菜黄酮成分具有抗氧化作用[24]。

4. 三萜类

三帖类化合物具有溶血、抗癌、抗炎、抗菌、抗病毒、降低胆固醇等活性[58]。三萜类成分是千屈菜科植物的共有成分，如表 3 所示现已从 9 种植物中分离鉴定出 34 种三萜类成分，其中 betulinic acid、oleanolic acid、ursolic acid 普遍存在。研究发现，三萜类成分是大叶紫薇的主要活性成分类别之一，具有降血糖作用，纵伟等[26] [59] [60]采用薄层色谱分离-分光光度法测定大叶紫薇叶中的总三萜含量，发现以氯仿:丙酮(4:1)为展开剂，5%香草醛醋酸溶液 0.3 ml 和高氯酸 1 ml 为显色剂，在 60℃条件下反应 15 min，结果与 HPLC 法分析结果没有明显差异，作者用此含量测定法对比研究超声提取和加热回流提取工艺下总三萜的含量。他通过比较 HPD-100、AB-8、D101、NAK-Ⅱ和 S-8 五种大孔树脂对大叶紫薇总三萜的吸附和解吸附能力，发现 HPD-100 对总三萜粗提物进行纯化，产品纯度由 15.6%提高至 30.3%。

5. 鞣质及其衍生物类

鞣质类化合物主要具有抑菌、抗肿瘤、抗氧化、降血糖、免疫调节、抗病毒等作用[61]。鞣质也是千

Table 1. Alkaloids from lythraceae plants
表 1. 千屈菜科植物中的生物碱成分

植物来源	化合物	植物基原	参考文献
紫薇 *Lagerstroemia indica L.*	lagerstroemine, dihydroverticillatine, decinine, decodine	花、叶、茎皮	[10]
	Biphenyl, Biphenyl Ether Quinolizidine N-oxide Alkaloids,		[3]
	5-epi-dihydrolyfoline, dihydrolyfoline, Lagerine		[4]
大叶紫薇 *Lagerstroemia speciosa* (L.) *Pers*	Lasubine I, II	叶	[5]
拘拿花 *Lagerstroemia subcastata Koehne*	sarusubine A	花	[6]
	lasubineI, lasubine II, subcosineI, subcosine II, Lythrine, Cryogenine, lythridine		[7]
指甲花 *Lawsonia inermis* L.	Harmine, harmaline	花	[8]
	balsaminone A		[9]
千屈菜 *Lythrum salicaria* L.	choline	全草	[10]
光千屈菜	Lythranine, lythridine, guanithylline, Lythrum new alkaliⅠ II III IV VI VI VII, deoxidation Lythrum new alkali I I IIⅠ		
虾子花 *Woodfordia fruticosa* (L.) *Kurz*	(trace)	叶	[10]

Table 2. Flavonoids and their derivatives from lythraceae plants
表 2. 千屈菜科植物中的黄酮及其衍生物类成分

植物来源	化合物	植物基原	参考文献
耳基水苋 *Ammannia arenaria H.B.K.*	kaempferol, quercetin, kaempferol-3-O-*α*-L-arabinofuranoside, kaempferol-3-O-*β*-D-xylopyranoside, vitexin, kaempferol-3-Oglucoside, quercetin-3-O-rhamnoside, rutin		[11]
水苋菜 *Ammannia baccifera* L.	Quercetin, Flavanol	茎、叶	[12]
	flavonoids		[13]
	Emodins		[14]
	Kempferol-3-O-glucoside、Quercetin-3-O-glucoside、quercetin-3-O-rutinoside		[15]
紫薇 *Lagerstroemia indica* L.	Delphinidin-3-Arabinoside, petunidin-3-Arabinoside, Malvidin-3-Arabinoside, scabiolide-3-O-Glucoside	花	[16]
	Isovitexin, Vitexin, Isoorientin, Orientin, Astralagin, Rutin, Apigenin-7-O-C_1-*β*-D-glucoside, Catechin, Epicatechin, Luteolin-7-O-C_1-*β*-D-glucoside, Apigenin, Kaempferol, Luteolin, Quercetin		[17]
	lagerindiol		[18]
	Kaempferol, quercetin, hyperin		[19]
	‘4-methoxy apigenin -8-C_1-*β*-D-glucopyranose		[20]
大叶紫薇 *Lagerstroemia speciosa* (L.) *Pers*	Quercetin, kaempferol, hyperin	叶	[5]
指甲花 *Lawsonia inermis* L.	Luteolin, luteolin-7-O -glucoside, acacetin-7-O -glucoside, luteolin-3’-glucoside, Apigenin-7-glucoside, Apigenin-4’-glucoside	茎、叶	[10]
	Luteolin7-O-b-D-glucopyranoside, Luteolin 4’-O-b-D-glucopyranoside, Apigenin7-O-b-D-glucopyranoside, Apigenin 4’-O-b-D-glucopyranoside, Luteolin 7-O-Sulfate Steviosin-7-O-rutinoside		[21]
	isoscutellarin, tricin, kaempferin, isoquercitrin, quercetin		[22]
千屈菜 *Lythrum salicaria* L.	Apigenin, kaempferol-3-O-(6″-O-Eferuloyl) -*β*-D-glucopyranoside, a biflavonoid A, isoplumbagin	全草	[9]
	Lythrum glycoside, Vitexin, orientin, isovitexin, isoorientin, scabiolide-3-galactosidase, malvin		[10]
水指甲 *Rotala rotundifolia*	quercetin 3-O-*β*-D-2-acetylglucuronide, quercetin 3-O-*β*-D-2″-acetylglucuronide methyl ester, kaempferol, quercetin, quercetin 3-O-*β*-D-glucuronide methyl ester, quercetin 3-O-*β*-D-glucuronide, apigenin	全草	[24]
虾子花 *Woodfordia fruticosa* (L.) Kurz	Polystachoside, Myricetin-3-galactosidase, Quercetin-3-rhamnosid, Naringenin-7-glucoside, Kaempferol-3-glucoside, scabiolide-3, 5-diglucoside, chrysophanol-8-O-*β*-D-glucopyranoside, quercetin -3-O-*α*-L-pyranarabinoside, quercetin-3-O-*β*-D-pyranxyloside, myricetin-3-*α*-L-pyranarabinoside, Noradrenaline, Quercetin-3-O-(6"-gallic acid)-*β*-D-galactosidase, quercetin-3-O-(6"-gallic acid) -*β*-D-glucosidase, myricetin, -3-O-(6"-gallic acid)-*β*-D-galactosidase	花、叶	[10]
	pelargonidin-3, 5-diglucoside, Myricetin, quercetin, Quercetin-3-*β*-L-Arabinoside, Myricetin-3-O-*β*-D-galactoside		[23]

Table 3. Triterpenoid from lythraceae plants
表 3. 千屈菜科植物中的三萜类成分

植物来源	化合物	植物基原	参考文献
耳基水苋 *Ammannia arenaria H.B.K.*	3-*β*, 15*α*, 23, 28-tetrahydroxyolean-12-en-3-O-arabinopyaranoside, 3-*β*, 23, 28-trihydroxy-olean -12-en-3-O-*β*-D-glucopyranoside	叶、根	[11]
	betulinic acid		[10]
水苋菜 *Ammannia baccifera* L.	triterpenes	全草	[13]
紫薇 *Lagerstroemia indica* L.	Lagerindiside, quadranoside I, betulinic acid, 3*β*-acetoxyolean-12-en-28-acid, arjunolic acid 28-O-glucopyranoside, hederagenin, arjunolic acid, oleanolic acid, maslinic acid, 3*β*, 23-dihydroxy-1-oxo-olean-12-en-28-oic acid	花	[25]
	Maslinicacid-2*α*-hydroxydeanolicacid, colosolicacid-2*α*-hydroxydeanolicacid, oleanolic acid		[26] [27]
大叶紫薇 *Lagerstroemia speciosa* (L.) *Pers*	ursolic acid, 3*β*-23-dihydroxy-1-oxo-olean-12-en-28-oic acid, 3*β*-hydroxy-1-oxo-olean-12-en-28-oic acid, asiatic acid, 23-hydroxyursolic acid, 24-methylene cycloartanol acetate	叶	[5]
	2*α*-hydroxyuvaol, 2*α*-hydroxybetulinic acid		[28]
指甲花 *Lawsonia inermis* L.	Mignonettetreeterpinum, lupeol, 3*β*-hydroxy -20-oxygen -30-norlupane, betulic acid, betulin, 3*β*, 30-dyhydroxy-20(29)-*α*-Lupene	皮	[10]
	rosamutin, euscaphic acid,		
	1b, 2b, 3b, 19a-tetrahydroxyurs-12-en-28-oic acid, ursolic acid, arjunic acid		[29]
千屈菜 *Lythrum salicaria* L.	Ursolic acid, oleanolic acid, Birch acid	全草	[10]
光千屈菜	Birch acid, oleanolic acid, Ursolic acid		
水指甲 *Rotala rotundifolia*	gallic acid	全草	[55]
虾子花 *Woodfordia fruticosa* (L.) *Kurz*	Lupeo, betulinol, oleanolic acid, Ursolic acid, gallic acid	花、叶	[10]

屈菜科植物的共有成分见表 4，已经发现 49 种，Ellagic acid 普遍存在。鞣质提取方法多样，晏丽等利用超声波辅助提取紫薇花中的绿原酸[31]，探讨了乙醇浓度、料液比和超声时间等因素对绿原酸得率的影响，通过正交试验确定紫薇花中绿原酸的最佳提取工艺。

6. 甾体类

目前，已发现甾体类成分 17 种(如表 5)，其中，*β*-sitosterol 及其衍生物占据主要地位，罗伦才等[62]以 *β*-sitosterol 为对照品对水豆瓣进行薄层色谱(TLC)鉴别，并建立了水豆瓣质量标准，用于质量控制。

7. 香豆素类

香豆素，又称双呋喃环和氧杂萘邻酮，是自然界中重要的一类天然有机化合物，具有抗病原微生物、

Table 4. Tannins and their derivatives from lythraceae plants
表 4. 千屈菜科植物中的鞣质及其衍生物类成分

植物来源	化合物	植物基原	参考文献
耳基水苋 *Ammannia arenaria H.B.K.*	ellagic acid		[11]
水苋菜 *Ammannia baccifera* L.	ellagic acid	茎叶	[13]
	Alkyl rans-4-hydroxycinnamte		[30]
	gallic acid, 3’4’-three-O-methylellagic acid		[10]
	chlorogenic acid		[31]
紫薇 *Lagerstroemia indica* L.	Decarboxy ellagic acid, p-methoxy gallic acid methyl ester, 1, 3-di-O-galloyl-4, 6-hexahydroxydiphenoyl -b-C1-glucopyranose, Ellagic acid, 3-O-methylgallate, Tellimagrandin	根、叶	[17]
	caffeic acid, ethyl caffeate, Gallic acid ethyl ester		[19]
	ellagic acid		[32]
大叶紫薇 *Lagerstroemia speciosa* (L.) *Pers*	Lagertannin, lagerstroemin, Flosin B, Reginin A, LagertanninsA, LagertanninsB, LagertanninsC, penta-O-galloyl-D-glucopyranose, valoneaic acid dilactone, 3, 3’-di-O-methylellagic acid, 3, 4, 8, 9, 10-pentahydroxydibenzo[b, d]pyran-6-one, 3-Omethyl-ellagic acid 4’-sulfate, 3-O-methyl ellagic acid, 4, 4’-di-O-methyl ellagic acid, 3, 3’, 4’-tri-O-methyl ellagic acid, 3’-O-methyl-3, 4-methylenedioxy ellagic acid, 3, 5, 3’-tri-Omethyl flavellagic acid, 3, 3’, 4, 5-tetra-O-methyl flavellagic acid, 3′, 4′-di-O-methyl-3, 4-methylenedioxy flavellagic acid	叶、果实、茎	[5]
	3, 4, 3’-tri-O-methyl flavellagic acid, 3, 4, 3’4’-tetra-O-methyl flavellagic acid		[28]
	caffeic acid, ethyl caffeate, Gallic acid ethyl ester		[33]
拘拿花 *Lagerstroemia subcastata* Koehne	Ellagic acid	花	[34]
	Tannin		[35]
指甲花 *Lawsonia inermis* L.	ellagic acid, phyllemblin	花	[9]
千屈菜 *Lythrum salicaria* L.	chlorogenic acid	全草	[10]
水指甲 *Rotala rotundifolia*	ellagic acid, phyllemblin	全草	[55]
虾子花 *Woodfordia fruticosa* (L.) *Kurz*	Woodfordin ABCDEFGH, Isoschimawallin A, oenothein AB, Tellimagrandin Ⅰ, gemin D, Heterophyllin A, 1, 2, 4, 6-tetra-O-galloyl-*β*-D-glucose, 1, 2, 3, 6-tetra-O-galloyl-*β*-D-glucose, 1, 2, 3, 4, 6-penta-O-galloyl-*β*-D-glucose, ellagic acid	花、叶	[10]

抗肿瘤、抗氧化、抗炎镇痛、抗凝血、保肝作用等[63]。香豆素成分是指甲花的主要成分，如表 6，20 世纪 80 年代，Zhuraev 等[64]从指甲花中首次分离出莨菪亭(7-羟基-6-甲氧基香豆素)、七叶亭(6、7-二羟基香豆素)。

8. 萘衍生物类

萘衍生物主要发现于水苋菜和指甲花中(表 7)，其中，水苋菜中主要以四氢萘酮类为主，水指甲中主

Table 5. Steroid from lythraceae plants
表 5. 千屈菜科植物中的甾体类成分

植物来源	化合物	植物基原	参考文献
耳基水苋 *Ammannia arenaria H.B.K.*	*β*-sitosterol-3-O-*β*-D-glucoside	全草	[11]
水苋菜 *Ammannia baccifera* L.	*β*-sitosterol, *β*-sitosterol-*β*-D-glucoside, siigmasteryl-3-o-*β*-D-glucopyranside	全草	[30]
	Cardiac glycosides, Phytosterols		[14]
紫薇 *Lagerstroemia indica* L.	sitosterol	根	[10]
	3, 4, 3'-tri-O-methylellagic		[36]
大叶紫薇 *Lagerstroemia speciosa* (L.) *Pers*	*β*-Sitosterol, carotene, dandelion sterol acetate, *β*-sitosterol acetate, campesterol, carotenecetylate	叶	[28]
指甲花 *Lawsonia inermis* L.	*β*-Sitosterol, stigmasterol, *β*-Sitosterol glucoside, 24*β*-ethyl-4-cholestene-3*β*-alcohol	叶、根	[10]
千屈菜 *Lythrum salicaria* L. 光千屈菜	*β*-Sitosterol	全草	[37]
水指甲 *Rotala rotundifolia*	*β*-sitosterol, 19*α*-pomolic acid 3*β*-acetate, 7-oxo-*β*-sitosterol, 6*β*-hydroxystigmast-4-en-3-one	全草	[55]
虾子花 *Woodfordia fruticosa* (L.) *Kurz*	*β*-sitosterol	花、叶	[10]

Table 6. Coumarins from lythraceae plants
表 6. 千屈菜科植物中的香豆素类成分

植物来源	化合物	植物基原	参考文献
水苋菜 *Ammannia baccifera* L.	Coumarines	根	[12]
紫薇 *Lagerstroemia indica* L.	6, 7-dihydroxycoumarin	叶	[19]
大叶紫薇 *Lagerstroemia speciosa* (L.) *Pers*	6, 7-dihydroxycoumarin	叶	[33]
指甲花 *Lawsonia inermis* L.	Fraxetin, scopoletin, aesculetin, scopoletin, a bicoumarin A, Lacoum arin, 6, 7-dihydroxycoumarin, 7 hydroxy-6-methoxycoumarin, fraxetin	叶	[9] [63] [64]
水指甲 *Rotala rotundifolia*	esculetin	全草	[24]

要以萘醌为主，这就预示着两者具有不同的药理活性。研究表明，4-hydroxy-a-tetralone 和 4-O-myricitoyl-a-tetralone 具有明显的抗结核作用[30]。20 世纪 80 年代 Afzal 等[65]对从指甲花叶中提取的 1,2-二羟基-4-葡糖氧基萘醌的抗菌活性进行了研究表明：1,2-二羟基-4-葡糖氧基萘醌对枯草杆菌、酵母菌属 Paslorianas 有抑制作用。Morello 等[66]研究表明 2-羟基-1,4-萘醌的衍生物是肿瘤细胞呼吸的有效抑制剂。

9. 其他类成分

研究发现，大叶紫薇种子中含有多种脂肪酸成分，如软脂酸、亚油酸[43]，在叶中含有大量的挥发油[48]，在籽中含有多种氨基酸，如 Asp、Thr、Ser [67]。此外，指甲花中含有的呫吨酮类物质，如指甲花

醌、散沫花呫吨酮具有明显的药理作用。如表 8 所示。

10. 结语

从现有研究看，千屈菜科植物化学成分类型多样，其药理活性也有较大差异，紫薇、大叶紫薇和指

Table 7. Naphthalene derivatives from lythraceae plants
表 7. 千屈菜科植物中的萘衍生物类成分

植物来源	化合物	植物基原	参考文献
水苋菜 *Ammannia baccifera* L.	4-hydroxy-a-tetralone, tetralone-4-O-b-D-glucopyranoside	全草	[15]
	(-)-(4R)-Hydroxy-1-tetralone, (-)-(4S)-acetoxy-1-tetralone, (-)-(4S)-hydroxy-1-tetralone-4-O-*β*-D-glucoside, 1, 4-naphthoquinone, 4-hydroxy-1-tetralone, lawsone		[30]
	1, 4-naphthoquinone, 1, 2-dyhydroxy-4-glucosyloxynaphthalene		[10]
	2-hydroxyl-1, 4-naphthoquinone		[40]
	1, 3-dihydroxynapthalene		[41]
指甲花 *Lawsonia inermis* L.	Cis-hexahydro-8*α*-methyl-1.8-[2H, 8H]-naphthalenedione	叶	[38]
	methyl naphthalene carboxylates, 3-Amino-2-methoxycarbonyl-1, 4-naphthoquinone, (4S)-4-Hydroxy-a-tetralone, 3a, 4a-Dihydroxy-a-tetralone, Lawsone		[21]
	1, 2, 4-Trihydroxynaphthalene-1-O-b-D-glycopyranoside		[39]
	2-methoxyl-1, 4-naphthoquinone		[9]

Table 8. Other chemical constituents from lythraceae plants
表 8. 千屈菜科植物中的其他类成分

植物来源	化合物	植物基原	参考文献
耳基水苋 *Ammannia arenaria H.B.K.*	2-*α*, 3-*β*, 23-trihydroxyolean-12-en-28-oic acid-28-O-*β*-D-glucopyranoside, cyanaroside, hentriacontane, dotriacontanol, 1, 30-triacontanediol, ambacinin, ambacinol		[11]
水苋菜 *Ammannia baccifera* L.	phenol	茎、叶、根	[13]
	Hentriacontine, dotriacontanol, betulinic acid, lupeol		[30]
	Leucoanthocyanin, Emodins		[14]
	Lageracetal, amyl alcohol,		[10]
	strosideA、B、C		[18]
紫薇 *Lagerstroemia indica* L.	Brevifolin, Nilocitin, 2, 3-hexahydroxydiphenic acid-*α*/b-glucoside, Astralagin	花、叶、皮、根	[17]
	Morusinol, Neocyclomorusin, (+)-Clove resin Alcohols -4-O-b-D-glucopyranoside, Yunnanensin A		[42]
	9, 9’-dihydroxy-3, 4-methoxylenedioxy -3’-methoxy[7-O-4’-8-5’]-neolignan, Pterospermin, (2R, 3S)-dihydrodehydroconiferyl alcohol, Gochidioboside, 7S, 8R-dihydrodehydroconiferyl alcohol 4-O-b-D-glucopyranoside, Hovetrichoside A、B, (1’S, 2’R)-guaiacyl glycerol, Carthamoside B5, (+)-(7S, 8S)-guaiacyl-glycerol, 8-O-b-D-glucopyranoside, D-threo-guaiacyl-glycerol-8-O-b-D-(6’-o-galloyl)-glucopyranoside, Alatusol A, Ficusol, Evofolin B, Marphenol C		[18]

Continued

	(7S, 8R)-dihydrodehydrodiconiferyl alcohol,		[28]
	Palmitic acid, 4-methyl-hexadecanoic acid, behenic acid, oleic acid, linoleic acid, stearic acid, cis-11-eicosenoic acid, cis-11, 13-eicosadienoic acid, Arachidonic acid, tricosanic acid, Erucic acid, lignoceric acid		[43]
	Azelaic acid, 12-acetoxyl -9-octadecenic acid, methyl heptane		[5]
	Laccerol, (2α, 3β)-Urs-12-ene-2, 3, 28-triol		[44]
	Protocatechuic acid		[45]
大叶紫薇 *Lagerstroemia speciosa* (L.) *Pers*	Gentianic acid, Cetene, resorcinol, 1, 1-dibutoxy butane, montanyl alcohol, hentriacontane, tritriacontane, tetracosaene, hexacosaene, Palmitic acid ethyl acetate, cydonic acidethyl acetate, octadecanoic acidethyl acetate, arachic acidethyl acetate	叶、种子	[46]
	Alphitolic acid		[47]
	2-ethyl-1-hexyl alcohol, (Z)-3, 7-dimethyl -2, 6-octadienealdehyde, (E)-3, 7-dimethyl -2, 6-octadienealdehyde, (R)-3, 4-2H-8-hydroxyl-3-methyl -1-H-2-chromene-1-keto, 4-benzyl pyridine, dibutyl phthalate, ethyl palmitate, 10, 13-octadecadienoic acidmethyl ester, (E)-9-Methyl stearate, (Z, Z)-9, 12-octadecadienoic acid, (Z, Z)-9, 12-octadecadienoic acidethyl ester, 9-octadecenic acidpropyl ester, acetic acid-13-tetradecene-1-ester, phthalic acid(2-ethylhexyl) monoester,		[48]
	lawsone, laxanthone, lawsoniaside, lalioside, D-mannitol, 3-methynonacosane -1-alcohol		[10]
	Histamine dichloride, Formic acid, Acetic acid, Glycolaldehyde, 2-methoxy-1-propanol, Hexamethyl-cyclotrisiloxane, 4-hydroxy-4-methyl-2-pentanone, Butyrolactone, 3-cyclohexene-1-carboxylic acid, Octamethyl-cyclotetrasiloxane, Hexanedioic acid, Benzoic acid		[49]
	p-hydroxybenzoicacid, 3-O-[6′-O-palmitoyl-β-D-glucosyl]-α-spinasterol, spinasterol, propyl heptadecanoate, a biquinone A, 3-O-[6'-O-palmitoyl -β-D-glucityl]-α-spinasterol, spinasterol, cydonic acid propyl ester		[9]
指甲花 *Lawsonia inermis* L.	Lawsochylin A, Lawsonaphthoate A, Lawsonaphthoate B, Lawsonaphanthate C, 9-Hydroxy-4-megastigmen-3-one, (+)-Dihydrodehydrodiconiferyl alcohol, 4-Hydroxybenzaldehyde, O-n-Butyl 13.b-D-glucopyranoside, D-Glucopyranose, Methyl pheophorbide b, Oleamide, 2-Butoxysuccinic acid, 1, 5-Diphenylpent-3-en-1-ynes	叶	[21]
	2-hydroxy-1, 4-naphthoquinone		[8]
	tri-acontyl tri-decanoate		[50]
	Linalool, α-terpineol, Etherphenylvinyl, 1.3-indandione, Eugenol, Oxirane-tetradecyl, Hexadecanoic acid, Phytol		[51]
	luteolin-7-J-b-D-glucopyranoside		[39]
	(+)-pinoresinol di-O-b-D-glucopyranoside, Syringaresinol di-O-b-D-glucopyranoside		[52]
	Syringinoside, Daphneside, Daphnorin, Agrimonolide 6-o-b-D-glucopyranoside		[53]
千屈菜 *Lythrum salicaria* L.	Loliolide, dibutyl phthalate, diisobutyl phthalate, butyl-isobutyl phthalate, diheptyl phthalate, dinonanyl phthalate	全草	[10]
水指甲 *Rotala rotundifolia*	Rotundifoline, vomifoliol	全草	[54]
	1, 2-O-di-galloylglycerol		[55]

甲花的研究较多，而其他植物如水指甲、千屈菜、水苋菜等则主要作为水草或杂草开展研究，严重影响其合理应用和发展。

今后应大力保，护千屈菜科植物资源，同时应对其化学成分进行深入的研究，寻找具有生物活性的

天然产物，并为其民间应用提供科学依据。在研究中应注意建立千屈菜科药用植物质量标准，以为今后的使用提供质量控制，保证疗效确切。

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