Flavonoids from *Astragalus* Species

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Summary: The biological and physiological activities exhibited by various species of Astragalus have created wide interest in its phytochemistry. This article describes the flavonoids reported from the genus Astragalus up to 2000.

Introduction

The plants of the *Astragalus* species (family: papilionaceae) are rich source of flavonoids. The extracts of a large number of *Astragalus* species have long been used in folk medicine. For example, in Korea, the roots of *Astragalus membranaceous* are used as a tonic to cure gastric and pulmonary diseases, profuse night sweats and hematuria. In China, the extract of *Astragalus tongolensis* is used

Table: List of Flavonoid Isolated From *Astragalus* Species

S. No.	Name of compounds (Struc. No.) Molecular formula Molecular weight	Physical data	Parts used	Source	Ref.
1	Dactilin (1) $C_{28}H_{32}O_{17}$ 640	$(\alpha)D^{25}$+ 15.0°(CHCl3) M.P. 292-294°	Flowers	*A. kadscherensis*	[8]
2	Isorhamnetin-3, 7-diglucoside (2) $C_{28}H_{32}O_{16}$ 624	M.P.-276-78°	-	-	-
3	Robinin (3) $C_{33}H_{40}O_{19}$ 740	M.P. 249-50°	-	-	-
4	Isorhamnetin -3-0-glucoside (4) $C_{22}H_{23}O_{13}$ 495	(α) D79.0°(CHCl3) M.P.175-77°	-	*A. kadscherensis* *A. tribuloides*	[8,9]
5	Acacetin (5) $C_{16}H_{12}O_5$ 284	M.P. 263°	Aerial parts	*A. ammodendron*	[10]
6	Kaempferol-3-0-rutinoside (6) $C_{27}H_{31}O_{16}$ 611	M.P. 227-29°	-	-	-
7	Formononetin $C_{16}H_{12}O_4$ 268	M.P. 258°	roots	*A. clusii*	[11]
8	3,3,5,7- tetramethoxy-4'-oxyflavone $C_{18}H_{19}O_7$ 347	M.P. 185-87°	Aerial parts	*A. centralpinus*	[12]

Table (continued)

S. No.	Name of compounds (Struc. No.) Molecular formula Molecular weight	Physical data	Parts used	Source	Ref.
9	Myrecitin(7) $C_{15}H_{10}O_8$ 318	M.P. 357°	-	*A. quisqualus* *A.loccosifolius*	[13,14]
10.	Transilitin $C_{16}H_{17}O_7$ 321	M.P. 255-56°	-	-	-
11	Rhamnocitrin $C_{16}H_{12}O_5$ 284	M.P. 217-18°	Whole plant	*A. adsurgens*	[15]
12	Isorhamnetine (8) $C_{15}H_{12}O_7$ 304	M.P. 241-42°	-	-	-
13	Artemetin (9) $C_{20}H_{20}O_8$ 388	-	-	-	-
14	Quercimeritin $C_{21}H_{20}O_{12}$ 464	M.P. 247-49°	-	-	-
15	Complanatuside (10) $C_{27}H_{29}O_8$ 481	-	-	*A. complanatus*	[16]
16	Prunetol $C_{15}H_{10}O_5$ 270	M.P. 297-98°	-	*A.adsurgens*	-
17	Narcissin (11) $C_{28}H_{32}O_{16}2H_2o$ 660	M.P. 180-82°	Acrial parts	*A. levieri* *A. sevangensis*	[17]
18	Hyperoside $C_{21}H_{20}O_{12}$ 464	$(\alpha)_{25}$ + 15..5° (Ethanol) M.P. 232 - 5°	-	-	-
19	Astragalin $C_{21}H_{20}O_{11}$ 448	M.P. 179 -80°	-	-	-
20	Quercetin-3-O-rhamnoside $C_{21}H_{21}O_{12}$ 465	M.P. 170 - 80°	-	*A. frigidus*	[18]
21	Quercetin -3-O- routinoside $C_{21}H_{31}O_{10}$ 443	M.P. 190-92°	-	-	-
22	Quercetin-3-O-β-D-glucopyranoside $C_{21}H_{20}O_{12}$ 464	-	-	-	-
23	Saponarin $C_{27}H_{30}O_{16}$ 610	$(\alpha)_D$-7.9° (Pyridine) M.P. 228°	-	*Astragalus species*	[19]
24	Saponaretin (12) $C_{21}H_{22}O_{10}$ 434	M.P. 260-62°	-	-	-
25	Vitexin $C_{21}H_{22}O_{10}$ 434	-	-	-	-
26	Isosaponarin $C_{27}H_{30}O_{14}$ 578	$(\alpha)_D$+25°(c 0.7; CHCl3) M.P. 145-46°	-	-	-
27	3,9-di-O- methyl nissolin $C_{18}H_{18}O_5$ 314	$(\alpha)_D$-200°(c 0.4; CHCl3) M.P. 136-37	Roots	*A.mongholicus*	[30]
28	Apigenin (13) $C_{15}H_{10}O_5$ 270	M.P. 345-50°	Acrial parts	*A.macropterum*	[20]

Table (continued)

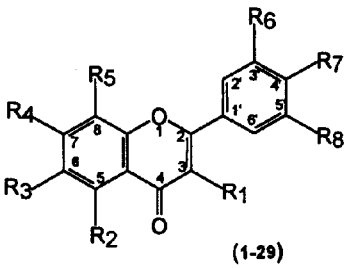
S. No.	Name of compounds (Struc. No.) Molecular formula Molecular weight	Physical data	Parts used	Source	Ref.
29	Apigenin-7-O-β-D glucoside (14) $C_{21}H_{20}O_{10}$ 432	-	-	-	-
30	Apigenin-7-O-β-D glucopyranoside (15) $C_{21}H_{20}O_{10}$ 432	M.P. 239-41°	Flowers	*A. kadscherensis*	[21]
31	Apigenin-7-0-rutinoside (16) $C_{27}H_{30}O_{15}$ 594	M.P. 239-41°	Whole plant	*A. onobrychis*	[22]
32	Kaempferol (17) $C_{15}H_{10}O_6$ 286	M.P. 276-78°	-	-	-
33	Querectin (18) $C_{15}H_{10}O_7$ 302	M.P. 314°	-	-	-
34	Isoquercitrin $C_{21}H_{20}O_{12}$ 464	M.P. 225-27°	-	*A.adsurgens*	[15]
35	Rutin (19) $C_{27}H_{30}O_{16}$ 610	$(\alpha)_D^{23}$+ 13.82° (Ethanol) M.P. 214-15°	-	-	-
36	Luteolin (20) $C_{15}H_{10}O_6$ 286	M.P. 328-30°	-	*A.cremophilos*	[23]
37	Luteoline-7-0-glucoside (21) $C_{21}H_{20}O_{12}$ 464	-	-	-	-
38	Quercitrin (22) $C_{21}H_{20}O_{11}$ 448	$(\alpha)_D$-73.5° (c 4.0; MeOH) M.P. 176-79°	Stems & leaves	*A. bornmullerianus*	[24]
39	Quercitin-3-glucoside (23) $C_{21}H_{21}O_{11}$ 449	M.P. 195-96°	-	*A. membranaceus*	[25]
40	Rhamnocitrin-3-glucoside $C_{22}H_{22}O_{11}$ 462	-	-	-	-
41	Isorhamnetin -7-O-rhamnoside $C_{22}H_{23}O_{12}$ 479	M.P. 235-37°	Aerial parts	*A.centralpinus*	[26]
42	Isorhamnetin-3-O-glucorhamnoside (24) $C_{28}H_{34}O_{18}$ 658	M.P. 215°	-	-	-
43	5,7,4, trihydroxy-3, 3'-dimethoxy flovone (25) $C_{17}H_{14}O_7$ 330	-	-	-	-
44	3,3,5,7-tetramethoxy-4'-hydroxy flovone (26) $C_{19}H_{18}O_7$ 358	M.P. 180-81°	-	-	-
45	3,7-dihydroxy flavone (27) $C_{15}H_{10}O_3$ 238	M.P> 165-67°	-	-	-
46	Rhamnetin (28) $C_{16}H_{12}O_7$ 316	M.P. 292-94°	-	*A.floccosifolius*	[27]
47	Rhamnetin-3-O-β-D-galactoside $C_{22}H_{23}O_{13}$ 495	-	-	-	-
48	Kaempferol-3-rutinosyl-7-O-rhamnopyranoside $C_{33}H_{40}O_{19}$ 740	M.P. 190-90	-	*A.cicer*	[28]

Table (continued)

S. No.	Name of compounds (Struc. No.) Molecular formula Molecular weight	Physical data	Parts used	Source	Ref.
49	Isorhamnetin-3-O-glucopyranoside $C_{22}H_{22}O_{12}$ 478	M.P. 168-70°	-	-	-
50	Apigenin-7-O-apiosyl glucoside (29) $C_{26}H_{27}O_{14}$ 563	M.P. 188-90°	-	-	-
51	Apigenin-7-O-glucopyranoside $C_{21}H_{20}O_{10}$ 432	M.P. 239-41°	Flowers	*A.kadscherensis*	[21]
52	8-methoxy vestitol(30) $C_{17}H_{18}O_5$ 302	$(\alpha)_D^{25}$ - 8.0° (c 0.075)	Roots	*A.alexandrinus* *A.trigonus*	[29,30]
53	Vestitol (31) $C_{16}H_{16}O_4$ 272	M.P. 154-57°	-	-	-
54	7-hydroxy-2',3'-trimethoxy isoflavan (32) $C_{18}H_{20}O_5$ 316	-	-	-	-
55	7-0-methyl isomucronulatol (33) $C_{18}H_{20}O_5$ 316	$(\alpha)_D$-110° (c 0.4, CHCl3) M.P. 140-41°	-	*A.mongholicus*	[31]
56	Isomucronulatol 7,2-di-o-glucoside (34) $C_{29}H_{38}O_{16}$ 626	M.P. 150-51°	-	-	-
57	5-hydroxy isomucronulatol-2,5-di-O-glucoside (35) $C_{29}H_{38}O_{16}$ 642	$(\alpha)D_{17.7}$°(c 0.3; MeOH) M.P. 160-62°	-	-	-
58	5,7,3',4'-tetramethoxy isoflavan (36) $C_{19}H_{19}O_5$ 327	-	roots	*A.clusii*	[11]
59	5,7,2'-trimethoxy isoflovan (37) $C_{18}H_{17}O_4$ 297	-	-	-	-
60	2' -hydroxy-7,4' -dimethoxy isoflavan (38) $C_{17}H_{15}O_4$ 283	-	-	-	-
61	Astragaluquinone (39) $C_{17}H_{16}O_6$ 316	$(\alpha)D_{25}$-55°(c 0.65;CHCl3) M.P. 125-26°	-	*A. alexandrinus* *A. trigonus*	-
62	Mucroquinone (40) $C_{17}H_{16}O_6$ 316	M.P. 169-72°	-	-	-
63	Claussequinone (41) $C_{16}H_{14}O_5$ 286	M.P. 189-94°	-	-	-

because of having sweat, warming, tonic and diuretic properties. *Astragalus senecas* has been used into an ointment to relieve the pain of burns. *Astragalus scaberrimus* is used as remedy for diarrhea, numbness of the muscles, weak lungs, asthma and nervousness [1].

Polysaccharides reported from *Astragalus sinicus* and *Astragalus mongholicus* prolong the survival of mice suffering from tumor, inhibit neoplastic proliferation and remarkably resisted the thymus and adrenal gland atropy caused by vaccination of cancer cells [2]. Flavonoids (isoquercitrin, astraglin, populnin, narcissin, kaempferol, isorhamnetin-3-0 β D-glucopyranoside and quercetin) isolated from *Astragalus virgetus* lowered the systemic arterial pressure in experimental animals more effectively than standard pepaverine-HCl [3]. Astragaluquinone, 8-methoxy vestitol and 7-hydroxy-2', 3', 4' - trimethoxy isoflavan isolated from the roots



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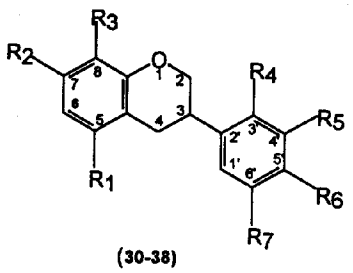

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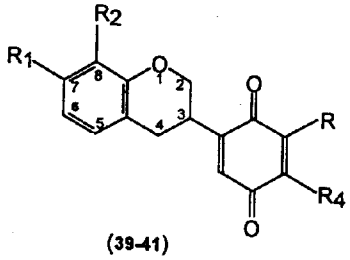

(39-41)

S. No.	R1	R2	R3	R4	R5	R6	R7	R8
1	glc	OH	H	OH	H	OMe	glc	H
2	glc	OH	glc	H	H	OMe	OH	H
3	Ga-R	OH	H	Rha	H	H	OH	H
4	glc	OH	H	OH	H	OMe	OH	H
5	H	OH	H	OH	H	H	OMe	H
6	Rut	OH	H	OH	H	H	OH	H
7	OH	OH	H	OH	H	OH	OH	OH
8	OH	OH	H	OH	H	OMe	OH	H
9	OMe	OH	OMe	OMe	H	OMe	OMe	H
10	glc	OH	H	OH	H	H	OH	glc
11	R-G	OH	H	OH	H	OMe	OH	H
12	H	OH	glc	OH	H	H	OH	H
13	H	OH	H	OH	H	H	OH	H
14	H	OH	H	glc	H	H	OH	H
15	H	OH	H	G-P	H	H	OH	H
16	H	OH	H	Rut	H	H	OH	H
17	OH	OH	H	OH	H	H	OH	H
18	OH	OH	H	OH	H	OH	OH	H
19	Rut	OH	H	OH	H	OH	OH	H
20	H	OH	H	OH	H	OH	OH	H
21	H	OH	H	OH	H	OH	glc	H
22	Rha	OH	H	OH	H	OH	OH	H
23	glc	OH	H	OH	H	OH	OH	H
24	G-R	OH	H	OH	H	OMe	OH	H
25	OMe	OH	H	OH	H	H	OMe	H
26	OMe	OMe	H	OMe	H	H	OMe	OH
27	OH	H	H	OH	H	H	H	H
28	OH	OH	H	OMe	H	OH	OH	H
29	H	OH	H	A-G	H	H	OH	H
30	H	OH	OMe	OH	H	OMe	H	
31	H	OH	H	OH	H	OMe	H	
32	H	OH	H	OMe	OMe	OMe	H	
33	H	OMe	H	OH	OMe	OMe	H	
34	H	glc	H	glc	OMe	OMe	H	
35	H	OH	H	glc	OMe	OMe	glc	
36	OMe	OMe	H	H	H	OMe	OMe	
37	OMe	OMe	H	H	OMe	H	H	
38	H	OMe	H	H	OH	H	OMe	
39	OMe	OMe	OH	H				
40	OH	OMC	H	OMe				
41	OH	H	H	OMe				

glc = glucose
Rut = rutinose
G-R = Glucorhamnoside
A-G =apiosyl glucoside
G-P = glucopyranoside
Rha = Rhamnoside
Ga-R= galactose-1-rhamnose
R-G = rhmnoglucoside

of *Astragalus alexandrinus*. [4] The effects of total flavonoids and total saponins isolated from *Astragalus monogholicus* possessed the ability to depress luminol chemilu-minescence (CL) and inhibit lipid peroxidation. The effect of total flavonoids was stronger than that of total saponins. Total polysaccharides of *Astragalus* (TPA) had slight inhibiting effects on Xanthine Oxidase emitted CL, enhanced the respiratory burst and had no effect on the generating respiratory burst of PMNs [5]. Preparations containing *Astragalus* extracts also remove stains, plaque and food residues from teeth and more effective in removing tobacco stains from teeth than a conventional tooth paste [6]. The effects of different doses of *Astragalus* saponin on the experimental heart failure rat models were studied by the hemodynamic method. It was found that the saponin at low doses (2 mg) increased heart failure while in middle (4 mg) and high doses (8 mg) antagonized heart failure [7].

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