

자화전호(紫花前胡), 백화전호(白花前胡), 아삼(峨參)의 화학 성분 비교

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Chemical constituents of *Angelica decursiva* (Miq.) Franch. & Sav., *Peucedanum praeruptorum* Dunn and *Anthriscus sylvestris* (L.) Hoffm.

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Abstract

The chemical constituents of *Angelica decursiva* (Miq.) Franch. & Sav., *Peucedanum praeruptorum* Dunn and *Anthriscus sylvestris* (L.) Hoffm., papers were investigated and compared. Papers were searched through electronic bibliographic databases with search terms and the chemical constituents were classified by chemical structures. Most constituents were dihydroxanthyletin structures in *A. decursiva* and dihydroseselin structures in *P. praeruptorum* which were coumarin-based structures. *A. sylvestris* showed lignan-based constituents in many literatures, of which dibenzyl butyrolactone structures were mostly reported. *A. sylvestris* must be differentiated from *A. decursiva* and *P. praeruptorum* due to its difference of chemical constituents.

Keywords: Chemical constituents, *Angelica decursiva*, *Peucedanum praeruptorum*, *Anthriscus sylvestris*

서론

前胡는 산형과(繖形科; Apiaceae) 식물인 바다나물(紫花前胡) *Angelica decursiva* (Miq.) Franch. & Sav. (= *Peucedanum decursivum* Maxim.) 또는 흰꽃바다나물(白花前胡) *Peucedanum praer-*

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uptorum Dunn의 뿌리로 化痰止咳平喘藥으로 분류되고 微寒苦辛하면서 肺에 歸經하고 祛痰降氣, 宣散風熱하는 효능을 지닌다.

하지만 실제 국내 약재 유통 상에서는 식물명이 전호인 峨參 *Anthriscus sylvestris* (L.) Hoffm. (繖形科; Apiaceae)가 前胡(또는 土前胡)로 유통되고 있다. 峨參은 補益藥으로 분류되고 微溫甘辛하면서 脾胃肺에 歸經하고 益氣健脾, 活血止痛하는 효능을 가지고 있기 때문에 前胡와는 구별되어야 하는 약재이다. 峨參이 명확한 약효 상 구분 없이 前胡로 사용될 경우 본래 前胡를 통해 발휘하고자 했던 祛痰降氣, 宣散風熱의 효능이 발휘되지 않거나 오히려 다른 효능 또는 부작용이 발생할 가능성이 충분히 존재한다.

따라서 본 연구에서는 紫花前胡, 白花前胡, 峨參으로 기원이 확인된 약재 및 시중에서 ‘전호’로 유통되는 약재에 대해 문헌에 보고된 구성 화학 성분 비교를 통해 한약재인 前胡와 峨參의 차이점을 밝히고 전호류 약재의 올바른 사용에 대한 필요성을 제시하고자 하였다.

본론

1. 자료 및 방법

1) 자료수집 및 검색어

자료 수집은 국내와 국외 학술검색 사이트를 이용하였고, 검색어는 ‘전호, 紫花前胡, 白花前胡, *Angelica decursiva*, *Peucedanum decursivum*, *Peucedanum praeruptorum*, *Anthriscus sylvestris*’ 등을 사용하였다 (Table 1).

Table 1. Electronic bibliographic databases and search terms

검색 사이트	한국교육학술정보원 http://www.riss4u.net 한국학술정보 http://kiss.kstudy.com 과학기술정보통합서비스 http://www.ndsl.kr 전통의학정보포털 http://oasis.kiom.re.kr 한국전통지식포털 http://www.koreantk.com/JZ0100.jsp Pubmed http://www.ncbi.nlm.nih.gov/pubmed 구글학술검색 http://scholar.google.co.kr 구글 http://www.google.co.kr 国立情報学研究所 論文情報 http://ci.nii.ac.jp 中國知識基礎設施工程 http://www.cnki.net
검색어	전호, 바다나물, 흰꽃바다나물, 백화전호, 자화전호, 아삼 紫花前胡, 白花前胡, 峨參 <i>Angelica decursiva</i> , (= <i>Peucedanum decursivum</i>), <i>Peucedanum praeruptorum</i> , <i>Anthriscus sylvestris</i>

2) 비교 방법

검색된 논문 중 전호류 약제의 화학 성분 조성에 관한 논문을 선별하여 각 성분의 화학명과 화학구조식, IUPAC 명칭 등을 조사하였고, 이 중 다수의 비중을 차지하는 성분 골격에 대한 화학 구조는 ChemDraw 12.0 (ChembridgeSoft, USA)를 이용하여 구조식으로 표현하였다.

2. 결과

1) 紫花前胡 *Angelica decursiva* (Miq.) Franch. & Sav.

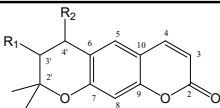
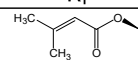





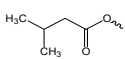

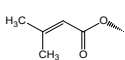
연구 문헌을 조사한 결과, 紫花前胡의 구성 성분은 대부분 coumarin 골격을 가진 성분이 40개로 보고되었고, phenylpropanoid 계열 성분인 decursidate가 1개로 보고되었다 (Table 2). 보고된 coumarin 계열 성분을 골격에 따라 세분하면 dihydroxanthyletin 계열 성분이 21개로 가장 많은 비중을 차지하였고, dihydropsoralen 계열이 8개, psoralen 계열이 5개, dihydroroeselol과 hydroxycoumarin 계열 성분이 각각 3개로 보고되었다 (Table 3).

Table 2. The list of chemical constituents of *A. decursiva*

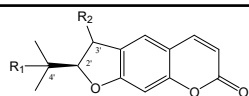
Coumarin	
Name	Chemical Structure
Decursin	3'(S)-seneciolyoxy-3',4'-dihydroxanthyletin
Decursinol, (+)-decursinol, (-)-decursinol	3'(S)-hydroxy-3'4'-dihydroxanthyletin
(-)-Methoxydecursidinol	3'(R)-hydroxy-4'(S)-methoxy-3',4'-dihydroxanthyletin
(+)-3'S-decursinol	3'(S)-hydroxy-3'4'-dihydroxanthyletin
(+)-trans-decursidinol	3'(S),4'(R)-dihydroxy-3'4'-dihydroxanthyletin
AD- I	3'(S)-angeloyloxy-4'(R and S)-isovaleryloxy-3',4'-dihydroxanthyletin
Andelin (AD- II)	3'(S)-angeloyloxy-4'(R)-seneciolyoxy-3',4'-dihydroxanthyletin
PD-C- I	3'(S)-seneciolyoxy-4'(R)-hydroxy-3',4'-dihydroxanthyletin
PD-C-II	3'(S)-hydroxy-4'(R)-seneciolyoxy-3',4'-dihydroxanthyletin
PD-C-III	3'(S)-seneciolyoxy-4'(R)-acetoxy-3',4'-dihydroxanthyletin
PD-C-IV	3'(S)-acetoxy-4'(R)-seneciolyoxy-3',4'-dihydroxanthyletin
PD-C-V	3'(S)-acetoxy-4'(R)-isovaleryloxy-3',4'-dihydroxanthyletin
PD-D-V	3'(S)-acetoxy-4'(R)-angeloyloxy-3',4'-dihydroxanthyletin
Decursidin	3'(S),4'(R)-diseneciolyoxy-3',4'-dihydroxanthyletin
Decursitin B	3'(S),4'(R)-biangeloyloxy-3'4'-dihydroxanthyletin
Decursitin C	3'(S)-seneciolyoxy-4'(R)-angeloyloxy-3'4'-dihydroxanthyletin
Decursitin D	3'(S)-hydroxy-4'(R)-angeloyloxy-3'4'dihydroxanthyletin
Decursitin F	3'(S)-acetoxy-4'(R)-hydroxy-3'4'dihydroxanthyletin
-	3'(S)-seneciolyoxy-4'(R)-hydroxy-3',4'-dihydroxanthyletin
-	3'(S)-hydroxy-4'(R)-seneciolyoxy-3',4'-dihydroxanthyletin

-	3'(S)-angeloyloxy-4'(R)-acetoxy-3',4'-dihydroxanthyletin
Nodakenetin	2R)-2-(2-hydroxypropan-2-yl)-2,3-dihydrofuro[3,2-g]chromen-7-one
Nodakenin	(2R)-2-[2-[(2S,3R,4S,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]oxypropan-2-yl]-2,3-dihydrofuro[3,2-g]chromen-7-one
Decuroside I	Nodakenetin-4'-O-beta-gentiobiose
Decuroside II	Nodakenetin-4'-O-beta-isomaltose
Decuroside III	Nodakenetin-4'-O-beta-maltose
Decuroside IV	Nodakenetin 4'-O-beta-D-apiofuranosyl (1→6)beta-D-glucopyranosyl
Decuroside V	3'(R)-hydroxy-nodakenin-3'-ol
Decuroside VI	6''-[2-trans-butenoyloxy]-nodakenin
Imperatorin	5-hydroxy-8-(1,1-dimethylallyl)psoralen
Isoimperatorin	4-(3-Methylbut-2-enoxy)furo[3,2-g]chromen-7-one
Bergapten	5-methoxypsoralen
(+)-Oxypeucedanin hydrate	5-(2,3-dihydroxy-3-methylbutoxy)psoralen
(+)-Oxypeucedanin	4-[(3,3-dimethyloxiran-2-yl)methoxy]-7H-furo[3,2-g]chromen-7-one
Edultin	3'-angeloyloxy-4'-acetoxy-2',3'-dihydrooroselol
Edulisin II	2'(S),3'(R)-senecioyloxy-O-senecioyloxy-2',3'-dihydrooroselol
Edulisin III	3'-(2-methylbutyryloxy)-4'-acetoxy-2',3'-dihydrooroselol
Umbelliferone	7-hydroxycoumarin
Umbelliprenin	7-farnesyloxycoumarin
Ostruthin	6-geranyl-7-hydroxycoumarin
Phenylpropanoid	Decursidate [2-(4'-hydroxyphenyl)-glycol mono trans-ferulate]

Table 3. Chemical structures of constituents from *A. decursiva*

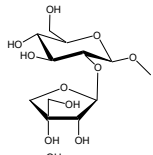
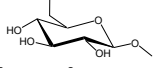
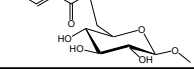
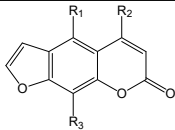
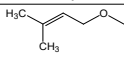
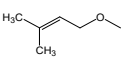
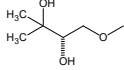
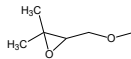
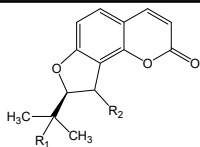
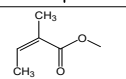

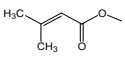
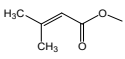
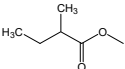

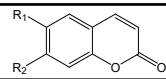
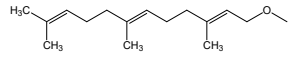
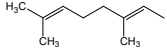
		Dihydroxanthyletin	
Name	R ₁	R ₂	
Decursin		H	
Decursinol		H	
(-)-Methoxydecursidinol		H ₃ CO	
(+)-3'S-decursinol		H	
(+)-trans-decursidinol		HO	
AD- I			
Andelin			

PD-C-I		HO
PD-C-II	HO▶	
PD-C-III		
PD-C-IV		
PD-C-V		
PD-D-V		
Decursidin		
Decursitin B		
Decursitin C		
Decursitin D	HO▶	
Decursitin F		HO
3'(S)-seneciyoxy-4'(R)-hydroxy-3',4'-dihydroxanthyletin		HO
3'(S)-hydroxy-4'(R)-seneciyoxy-3',4'-dihydroxanthyletin	HO▶	
3'(S)-angeloyloxy-4'(R)-acetoxy-3',4'-dihydroxanthyletin		



Dihydropsoresalen

Name	R ₁	R ₂
Nodakenetin	HO—	H
Nodakenin		H
Decuroside I		H
Decuroside II		H
Decuroside III		H

Decuroside IV		H	
Decuroside V		HO	
Decuroside VI		H	
		Psoralen	
Name	R₁	R₂	R₃
Imperatorin		H	H
Isoimperatorin	H	H	
Bergapten	H ₃ CO—	H	H
(+)-Oxypeucedanin hydrate		H	H
(+)-Oxypeucedanin	H		H
		Dihydrooroseleol	
Name	R₁	R₂	
Edultin			
Edulisin II			
Edulisin III			
		Hydroxycoumarin	
Name	R₁	R₂	
Umbelliferone	H	HO—	
Umbelliprenin	H		
Ostruthin		HO—	

2) 白花前胡 *Peucedanum praeruptorum* Dunn

白花前胡의 주요 구성 성분 역시 紫花前胡와 마찬가지로 coumarin 계열이 62개로 보고되어 대부분을 이루었고, benzoic acid 3개, terpene 3개, acetylene 4개, steroid 2개, carboxylic acid 2개, phenanthraquinone, phenylpropanoid, quinoline, phenalenone 등이 각각 1개로 보고되었다 (Table 4). Coumarin 성분을 골격별로 세분하면, dihydroseselin 골격의 성분이 36개로 가장 많이 보고되었고, hydrocoumarin 계열이 10개, dihydropsoresalen과 psoralen 계열이 7개, dihydroangelicin, angelicin, dihydroxanthyletin 계열이 각각 1개로 보고되었다 (Table 5).

Table 4. The list of chemical constituents of *P. praeruptorum*

Coumarin	
Name	Chemical Structure
Praeruptorin A, (+)-praeruptorin A, (±)-praeruptorin A (Pd-Ia)	3'-angeloyloxy-4'-acetoxy-3',4'-dihydroseselin
Praeruptorin B, (+)-praeruptorin B, (±)-praeruptorin B (Pd-II)	3',4'-diangeloyloxy-3',4'-dihydroseselin
Praeruptorin C, (+)-praeruptorin C (Pd-III)	3'-angeloyloxy-4'-seneciolyoxy-3',4'-dihydroseselin
Praeruptorin E, (+)-praeruptorin E Pd-I b	(+)-3'-angeloyloxy-4'-isovaleryloxy-khellactone
Pd-C-I	3'(R)-angeloyloxy-4'-keto-3',4'-dihydroseselin
Qianhucoumarin A	3'(S)-seneciolyoxy-4'(R)-hydroxy-3',4'-dihydroxanthyletin
Qianhucoumarin B	3'(R)-hydroxy-4'(R)-tigloyloxy-3',4'-dihydroseselin]
Qianhucoumarin C	3'(S)-acetoxy-4'(S)-hydroxy-3',4'-dihydroseselin
Qianhucoumarin D	3'(S)-hydroxy-4'(S)-acetoxy-3',4'-dihydroseselin
Qianhucoumarin E	3'(S),4'(S)-diacetoxy-3',4'-dihydroseselin
Qianhucoumarin H	3'(R)-tigloyloxy-4'-keto-3',4'-dihydroseselin
Qianhucoumarin I	3'(S)-angeloyloxy-4'(R)-isovaleryloxy-3',4'-dihydroseselin
Qianhucoumarin J	3'(S)-acetoxy-4'(S)-tigloyloxy-3',4'-dihydroseselin
Peucedanocoumarin I	3'(S)-angeloyloxy-4'(S)-propionyloxy-3',4'-dihydroseselin
Peucedanocoumarin II	3'(S)-2-methylbutyryloxy-4'(R)-acetoxy-3',4'-dihydroseselin
Peucedanocoumarin III	3'(S)-acetoxy-4'(R)-angeloyloxy-3',4'-dihydroseselin
Praeroside II	2H,8H-Benzo[1,2-b:3,4-b']dipyran-2-one, 9-(b-D-glucopyranosyloxy)-9,10-dihydro-10-hydroxy-8,8-dimethyl-, (9R,10R)-
Praeroside III	2H,8H-Benzo[1,2-b:3,4-b']dipyran-2-one,9-(b-D-glucopyranosyloxy)- 9,10-dihydro-10-hydroxy-8,8-dimethyl-,(9S-trans)-
Praeroside IV	2H,8H-Benzo[1,2-b:3,4-b']dipyran-2-one,9-(b-D-glucopyranosyloxy)- 9,10-dihydro-8,8-dimethyl-,(R)-
Praeroside V	2H,8H-Benzo[1,2-b:3,4-b']dipyran-2-one,10-(b-D-glucopyranosyloxy)- 9,10-dihydro-8,8-dimethyl-(9CI)
Pteryxin	3'(S)-acetoxy-4'(S)-angeloyloxy-3',4'-dihydroseselin
Isobocconin	3'(S)-acetoxy-4'(S)-isobutyryl-3',4'-dihydroseselin
d-laserpitin	(+)-3'(S)-hydroxy-4'(S)-angeloyloxy-3',4'-dihydroseselin
-	(-)-trans-khellactone
-	Cis-3',4'-diisovalerylkhellactone

-	Cis-3',4'-diseneciolykhellactone
-	3',4'-diangeloyl-cis-khellactone
-	3'-angeloyl-4'-senecioly-cis-khellactone
-	3',4'-disenecioly-cis-khellactone
-	3'(R)-O-Acetyl-4'(S)-O-tigloylkhellactone
-	3'-angeloyloxykhellactone
-	3'(R),4'(R)-3'-senecioly-4'-angeloyl-3',4'-dihydroseselin
-	Cis-3',4'-disenecioly-3',4'-dihydroseselin
-	3',4'-diisovaleryloxy-dihydroseselin
-	3'(R)-hydroxy-4'(R)-tigloyloxy-3',4'-dihydroseslin
Umbelliferone	7-hydroxycoumarin
Apiosylskimmin	Umbelliferone-7-apiosylglucoside
Skimmin	7-O-β-D-glucopyranosyl-umbelliferone
Scopoletin	7-hydroxy-6-methoxycoumarin
Scopolin	Scopoletin 7-glucoside
Isoscapoletin	6-hydroxy-7-methoxycoumarin
Hymexelsin	Scopoletin-7-apiosylglucoside
Isofraxidin	6,8-dimethoxy-7-hydroxycoumarin
Praeroside VI	(2R)-7-hydroxy-8-(2,3-dihydroxy-3-methylbutyl)-coumarin
-	8-carboxy-7-hydroxycoumarin
Ammijin	-
Rutarin	(2S)-2-(2-hydroxypropan-2-yl)-9-[(2S,3R,4S,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]oxy-2,3-dihydrofuro[3,2-g]chromen-7-one
Isorutarin	(2R)-9-hydroxy-2-[2-[(2S,3R,4S,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]oxypropan-2-yl]-2,3-dihydrofuro[3,2-g]chromen-7-one
Praeroside I	rutaretin-4'-O-(6-vanilloyl-β-D-glucopyranoside)
Nodakenin	紫花前胡 참조
Nodakenetin	紫花前胡 참조
Marmesinin	2-(hydroxyisopropyl)-2,3-dihydro-6,7-furanocoumarin
Arnocoumarin	2-(1-methylethenyl)-7H-furo-(3,2-g)-1-benzopyran-7-one
Bergapten	5-methoxy-psoralen
Imperatorin	5-hydroxy-8-(1,1-dimethylallyl)psoralen
Isoimperatorin	4-(3-Methylbut-2-enoxy)furo[3,2-g]chromen-7-one
Isopimpinellin	5,8-dimethoxy-psoralen
Xanthotoxin	8-methoxy-psoralen
Psoralen	-
Apterin	8-[2-(glucosyloxy)isopropyl]-9-hydroxy-8,9-dihydroangelicin
Angelicin	2H-furo-(2,3-h)-1-benzopyran-2-one
Aegelinol	3'(R)-hydroxy-3',4'-dihydroxanthyletin
Benzoic acid	Baihuaqianhuoside (3'-Methoxy-4'-β-D-glucopyranosyloxypropiophenone) Vanillic acid Gallic acid
Terpene	Acetyltractylodinol Tanshinone I Tanshinone II
Acetylene	α-D-glucopyranose-1-hexadecanoate D-mannitolmonohexadecanoate Palmitic acid (hexadecanoic acid) Tetracosanoic acid

Steroid	β -sitosterol
	Daucosterol
Carboxylic acid	Butyric acid
	Anchoic acid (Dicarboxylic acid)
Phenanthraquinone	9,10-dihydrophenanthric acid (9,10-dione-3,4-methylenedioxy-8-methoxy)
Phenylpropanoid	Eleutheroside B ₁
Quinoline	2, 6-dimethyl quinoline
Phenalenone	(-)-sclerodin

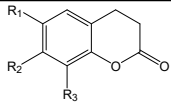
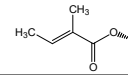
Table 5. Chemical structures of constituents from *P. praeruptorum*

Name	Dihydroseselin	
	R ₁	R ₂
Praeruptorin A		
Praeruptorin B		
Praeruptorin C		
Praeruptorin E		
Pd-I b		
Pd-C- I		
Qianhu coumarin A		
Qianhu coumarin B		
Qianhu coumarin C		
Qianhu coumarin D		
Qianhu coumarin E		
Qianhu coumarin H		
Qianhu coumarin I		
Qianhu coumarin J		

Peucedanocoumarin I		
Peucedanocoumarin II		
Peucedanocoumarin III		
Praeroside II		HO
Praeroside III		HO
Praeroside IV		H
Praeroside V	H	
Pteryxin		
Isobocconin		
d-laserpitin	HO	
(-)-trans-khellactone	HO	HO
Cis-3',4'-diisovalerykhellactone		
Cis-3',4'-diseneciolykhellactone		
3',4'-diangeloyl-cis-khellactone		
3'-angeloyl-4'-seneciyl-cis-khellactone		
3',4'-diseneciyl-cis-khellactone		
3'(R)-O-Acetyl-4'(S)-O-tigloyl-khellactone		
3'-angeloyloxykhellactone		HO
3'(R),4'(R)-3'-seneciyl-4'-angeloyl-3',4'-dihydroreselin		
Cis-3',4'-diseneciyl-3',4'-dihydroreselin		
3',4'-diisovaleryloxy-dihydroreselin		

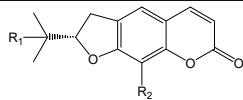
3'(R)-hydroxy-4'(R)-tigloyloxy-3',4'-d
hydroseslin

HO|||||



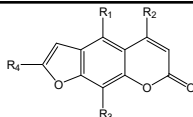

Hydrocoumarin

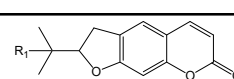
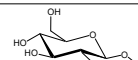
Name	R ₁	R ₂	R ₃
Umbelliferone	H	HO—	H
Apiosylskimmin	H		H
Skimmin	H		H
Scopoletin	H ₃ CO—	HO—	H
Scopolin	H		H
Isoscooletin	HO—	H ₃ CO—	H
Hymexelsin	H ₃ CO—		H
Isosfraxidin	H ₃ CO—	HO—	H ₃ CO—
Praeroside VI	H	HO—	
8-carboxy-7-hydrox- ycoumarin	H	HO—	

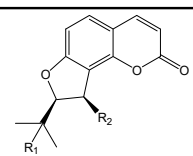
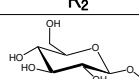


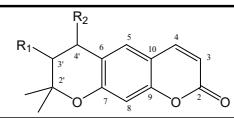
Dihydropsoyralen

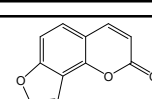
Name	R ₁	R ₂
Ammijin		H
Praeroside I		HO—
Rutarin	HO—	
Isorutarin		HO—
Nodakenin		紫花前胡 참조 (Table 5)
Nodakenetin		紫花前胡 참조 (Table 5)

		Psoralen		
Name	R ₁	R ₂	R ₃	R ₄
Psoralen	H	H	H	H
Arnocoumarin	H	H	H	
Xanthotoxin	H	H	H ₃ CO—	H
Isopimpinellin	H ₃ CO—	H	H ₃ CO—	H
Imperatorin		紫花前胡 참조 (Table 5)		
Isoimperatorin		紫花前胡 참조 (Table 5)		
Bergapten		紫花前胡 참조 (Table 5)		

		Dihydropsoresalen		
Name	R ₁			
Marmesinin				

		Dihydroangelicin		
Name	R ₁	R ₂		
Apterin	HO—			

		Dihydroxanthyletin		
Name	R ₁	R ₂		
Aegelinol	HO—	H		

		Angelicin		
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3) 峨參 *Anthriscus sylvestris* (L.) Hoffm.

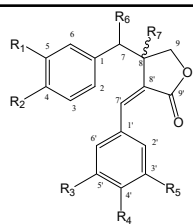
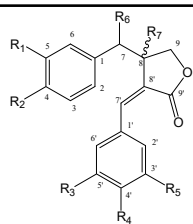
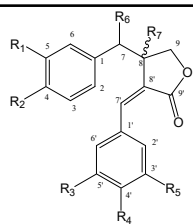
峨參의 주요 구성 성분은 lignan 계열이 29개로 가장 많은 비중을 차지하였고, phenylpropanoid 계열이 8개, coumarin 5개, steroid 5개, fatty acid 6개, phthalate 2개, polyacetylene, benzoic acid, glyceride and ester, pyrimidine derivative 등이 각각 1개씩 보고되었다 (Table 6). Lignan 계열 성분 중 dibenzyl butyrolactone 계열이 17개, aryltetralin lignans 계열이 12개로 보고되었다 (Table 7).

Table 6. The list of chemical constituents of *A. sylvestris*

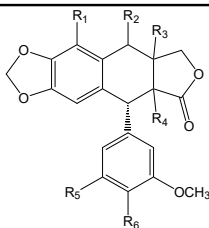
Lignan	
Name	Chemical Structure
Nemerodin (anhydropodorhizol)	2-(3,4,5-trimethoxybenzylidene)-3-(3',4'-methylenedioxybenzyl)- γ -butyrolactone
Kaerophyllin	A-(trans-3,4-dimethoxybenzylidene)-beta-(3',4'-methylenedioxybenzyl)- γ -butyrolactone
Jatrophan	(Z)-2-(3,4-methylenedioxybenzylidene)-3-(3',4'-dimethoxybenzyl)- γ -butyrolactone
Isosuschilactone	(E)-2-(3,4-methylenedioxybenzylidene)-3-(3',4'-dimethoxybenzyl)- γ -butyrolactone
7-Hydroxyanhydropodorhizol	-
(-)-hibalactone	(3E,4R)-4-(benzo[1,3]dioxol-5-ylmethyl)-3-(benzo[1,3]dioxol-5-ylmethylidene)oxolan-2-one
Sylvestrin	2-(3',4',5'-trimethoxybenzylidene)-3-(3'',4''-methylenedioxybenzyl)- γ -butyrolactone
(-)-Deoxypodorhizone	(3R)-3 α -(3,4,5-Trimethoxybenzyl)-4 β -(1,3-benzodioxole-5-ylmethyl)tetrahydrofuran-2-one
Arctigenin	(3R,4R)-4-[(3,4-Dimethoxyphenyl)methyl]dihydro-3-[(4-hydroxy-3-methoxyphenyl)methyl]-2(3H)-furanone
(-)-hinokinin, Hinokinin	(3R,4R)-3,4-bis(1,3-benzodioxol-5-ylmethyl)oxolan-2-one
Morelensin	5-demethoxydeoxypodophyllotoxin
Yatein	(3R,4R)-4-(1,3-benzodioxol-5-ylmethyl)-3-[(3,4,5-trimethoxyphenyl)methyl]oxolan-2-one
7-Hydroxyatein	-
Matairesinol	(3R,4R)-3,4-bis[(4-hydroxy-3-methoxyphenyl)methyl]oxolan-2-one
Dimethylmatairesinol	-
Dimethylthujaplicatin methyl ether	2,3-dimethyl-2-(4"-hydroxy-3",5"-dimethoxybenzyl)-3-(4'-hydroxy-3'-methoxybenzyl)-butyrolactone
-	(-)-trans-2-(3",4",5"-trimethoxybenzyl)-3-(3',4'-methylenedioxybenzyl)butyrolactone
(-)-Deoxypodophyllotoxin, Deoxypodophyllotoxin (anthricin)	Furo[3',4':6,7]naphtho[2,3-D]-1,3-dioxol-6(5ah)-one, 5,8,8A,9-tetrahydro-5-(3,4,5-trimethoxyphenyl)-, (5R,5ar,8ar)-
Podophyllotoxin	7-hydroxy-3',4',5'-trimethoxy-4,5-methylenedioxy-2,7'-cycloclonan-9',9-lactone
Isodeoxypodophyllotoxin (isoanthricin)	-
Angeloyl-podophyllotoxin	-
Deoxypicropodophyllin	-
Picropodophyllotoxin (Picropodophyllin)	(5R,5aR,8aS,9R)-5-hydroxy-9-(3,4,5-trimethoxyphenyl)-5a,6,8a,9-tetrahydro-5H-[2]benzofuro[5,6-f][1,3]benzodioxol-8-one
Isopicropodophyllone	(5aS)-5a,6,8a β ,9-Tetrahydro-9 α -(3,4,5-trimethoxyphenyl)furo[3',4':6,7]naphtho[2,3-d]-1,3-dioxole-5,8-dione
Podophyllotoxone	(5aR)-5a α ,6,8a β ,9-Tetrahydro-9 α -(3,4,5-trimethoxyphenyl)furo[3',4':6,7]naphtho[2,3-d]-1,3-dioxole-5,8-dione
Bursehernin	(3R-trans)-4-(1,3-benzodioxol-5-ylmethyl)-3-((3,4-dimethoxyphenyl)methyl)dihydro-2(3H)-furanone
α -Peltatin	(5aR,8aR,10R)-4-hydroxy-10-(4-hydroxy-3,5-dimethoxyphenyl)decahydrofuro[2',3':6,7]naphtho[2,3-d][1,3]dioxol-8(7H)-one
β -Peltatin	-
β -Peltatin-a-methylether	-
Phenylpropanoid	
Crocatoone (latifolone)	1-(3'-methoxy-4',5'-methylenedioxyphenyl)-propan-1-one
Elemicin	1-(3',4',5'-trimethoxyphenyl)-2-propene
-	1-(3'-methoxy-4',5'-methylenedioxyphenyl)-1 ξ -methoxy-2-prop

	ene 1-(3'-methoxy-4',5'-methylenedioxyphenyl)-2 ξ -angeloyloxyprop an-1-one
Anthriscusin	O-(Z)-2-angeloyloxymethyl-2-butenyl]-3'-methoxy-4',5'-meth ylenedioxcinnamyl alcohol
Anthriscinol	1,(3'-methoxy-4',5'-methylenedioxyphenyl)-2-propen-3-ol
Anthriscinol methyl ether	-
	2-Butenoic acid, 2-methyl-4-[[[(2Z)-2-methyl-1-oxo-2-buten-1-yl]oxy]-, (2E)-3-(7-methoxy-1,3-benzodioxol-5-yl)-2-propen-1yl ester, (2Z)-
Coumarin	Nodakenin
	Scopolin (7-O-glucosyl-6-methoxycoumarin)
	5-methoxypsoralen
	Isoscopoletin
Steroid	Scopoletin (7-hydroxy-6-methoxycoumarin)
	Sitosterol
	β -sitosterol
	Stigmasterol
Fatty acid	Campesterol
	Stigmasteryl-D-glucoside
	Octadecadienoic acid (linoleic acid)
	Methyl palmitate
	Methyl stearate
	Methyl linoleate
Polyacetylene	Methyl arachidate
	Methyl benenate
Phthalate	Falcarindiol
	[(3R,8S,9Z)-Heptadeca-1,9-dien-4,6-diyne-3,8-diol]
Benzoic acid	Diethylhexyl phthalate
	2-methyl-7,9-undecadien
Glyceride and ester	3-Methoxy-4,5-methylenedioxybenzoic acid
Pyrimidine derivative	Glycerin triacetate
Acyloxycarboxylic acid	Uracil
	(Z)-2-angeloyloxymethyl-2-butenic acid

Table 7. Chemical structures of constituents from *A. sylvestris*

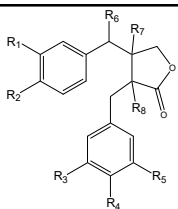
Name	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇
Nemerolisin				H ₃ CO—		H	H
7-Hydroxyanhydropodorhizol				H ₃ CO—		HO—	H
Kaerophyllin				H ₃ CO—		H	H

Jatrophan	H ₃ CO—		H	H	H
Isosuschilactone	H ₃ CO—		H	H	H▶
(-)-hibalactone			H	H	H
Sylvestrin		H ₃ CO—		H	H



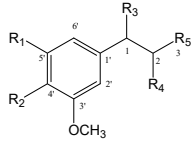
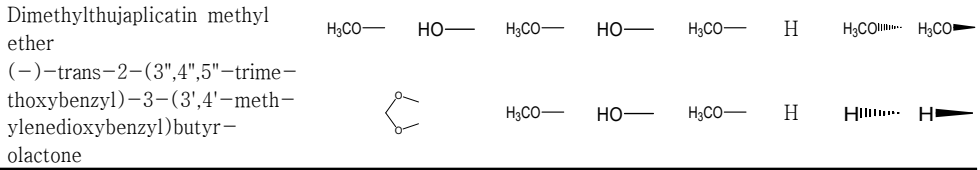
Aryltetralin lignans

Name	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆
Deoxypodophyllotoxin	H	H	H	H▶	H ₃ CO—	H ₃ CO—
Podophyllotoxin	H	HO—	H	H▶	H ₃ CO—	H ₃ CO—
Isodeoxypodophyllotoxin	H	H	H	H▶	H ₃ CO—	H ₃ CO—
Angeloylpodophyllotoxin	H		H	H▶	H ₃ CO—	H ₃ CO—
Deoxypicropodophyllin	H	H	H	H	H ₃ CO—	H ₃ CO—
Picropodophyllotoxin	H	HO—	H	H	H ₃ CO—	H ₃ CO—
Isopicropodophyllone	H	O=		H▶	H ₃ CO—	H ₃ CO—
Podophyllotoxone	H	O=	H	H▶	H ₃ CO—	H ₃ CO—
Bursehernin	H	H	H	H	H	H ₃ CO—
α-Peltatin	HO—	H	H	H▶	H ₃ CO—	HO—
β-Peltatin	HO—	H	H	H▶	H ₃ CO—	H ₃ CO—
β-Peltatin-α-methylether	H ₃ CO—	H	H	H▶	H ₃ CO—	H ₃ CO—



Dibenzyl butyrolactone (γ-butyrolactone)

Name	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈
(-)-Deoxypodorhizone				H ₃ CO—		H	H	H▶
Arctigenin	H ₃ CO—		H	HO—	H ₃ CO—	H	H	H
(-)-Hinokinin			H			H	H	H▶
Morelensin			H	H ₃ CO—		H	H	H
Yatein				H ₃ CO—		H	H	H
7-Hydroxyatein				H ₃ CO—		HO—	H	H
Matairesinol	H ₃ CO—	HO—	H	HO—	H ₃ CO—	H	H	H
Dimethylmatairesinol	H ₃ CO—		H	H ₃ CO—		H	H	H



Phenylpropanoid

Name	R ₁	R ₂	R ₃	R ₄	R ₅
Anthriscusin			H ₂ C=		
Anthriscinol			H ₂ C=		HO—
Anthriscinol methyl ether			H ₂ C=		H ₃ CO—
2-Butenoic acid, 2-methyl-4-[[[(2Z)-2-methyl-1-oxo-2-buten-1-yl]oxy]-, (2E)-3-(7-methoxy-1,3-benzodioxol-5-yl)-2-propen-1yl ester, (2Z)-			H ₂ C=		
Crocatone			O=	H	H ₃ C—
Elemicin	H ₃ CO—	H ₃ CO—	H	H	H ₂ C=
1-(3'-methoxy-4',5'-methylenedioxyphenyl)-1ξ-methoxy-2-propene			H ₃ CO—		H ₂ C=
1-(3'-methoxy-4',5'-methylenedioxyphenyl)-2ξ-angeloyloxypropan-1-one			O=		H ₃ C—

3. 고찰

전호류 약재에 관해 기존에 보고된 연구 문헌을 수집·분류하여 기원 약재의 구성 화학 성분을 정리한 결과 약재 간 구성 성분의 차이점을 확인할 수 있었다.

紫花前胡의 경우 보고된 구성 성분이 대부분 coumarin을 기본 골격으로 하는 화학 구조를 보였다. 이를 세분하여 하위 골격 구조와 작용기별로 구분하면 비교적 많은 문헌에서 보고된 성분인 decursin과 decursidin 등이 속해 있는 dihydroxanthyletin 계열, 그리고 nodakenetin과 nodakenin 등이 속해 있는 dihydroorsoralen 계열, 그 밖에 psoralen 계열과 dihydroorsolol 계열, hydroxycoumarin 계열로 크게 분류할 수 있었다. 이 중 dihydroxanthyletin 계열은 가장 많은 성분이 속해 있는 구조로 xanthyletin을 기본 골격으로 하고 3', 4' 탄소 위치에 각각 수소가 1개씩 결합되어 있는 형태를 나타낸다. 그리고 여기에 결합되는 작용기는 대부분 angeloyloxy, seneciolyoxy, acetoxy 등이 있었고 이들은 모두 산소가 결합된 형태로 기본 구조에 연결되어 있었다.

白花前胡의 경우 紫花前胡에서와 마찬가지로 coumarin을 기본 골격으로 하는 화학 구조가 대부분을 차지했고, benzoic acid, terpene 등의 구조를 가진 화합물도 소수 보고되었다. 白花前胡에서 보고된

coumarin을 세부 하위 골격 구조와 작용기별로 분류해보면, 많은 문헌에서 보고된 성분인 praeruptorin A (Pd-I a), praeruptorin B (Pd-II) 등이 속해 있는 dihydroseselin 계열이 가장 많은 비중을 차지하였고, umbelliferone이 속해 있는 hydrocoumarin 계열, dihydropsoresalen, psoralen, dihydroangelicin, angelicin, dihydroxanthyletin 계열 등으로 분류할 수 있었다. 이 중 dihydroseselin 계열은 seselin을 기본 구조로 하여 3', 4' 탄소에 각각 수소가 1개씩 결합된 형태를 나타낸다. 여기에 결합된 작용기는 angeloyloxy, seneciyoxy, tigloyloxy, acetoxy, isovaleryloxy, propionyloxy 등 紫花前胡에 비해 다양한 것으로 확인되었다.

峨參의 경우, 紫花前胡나 白花前胡와는 전혀 다르게 lignan과 phenylpropanoid를 기본 골격으로 하는 화학 성분들이 주로 보고되었고, coumarin 계열 성분은 白花前胡에서 보고된 5가지 성분들이 존재하는 것으로 확인되었다. 峨參에서 보고된 lignan 계열의 성분은 가장 많은 문헌에서 보고된 nemosin과 yatein이 포함된 dibenzyl butylolactone을 기본 골격으로 하는 계열과 deoxypodophyllotoxin (anthricin)이 포함된 aryltetralin을 기본 골격으로 하는 계열로 분류되었다. 이 중 dibenzyl butylolactone은 γ -butyrolactone을 기본 구조로 하여 여기에 benzyl기가 2개 결합된 형태의 화학구조 혹은 2개의 phenylpropanoid가 8, 8' 탄소에서 결합한 형태를 나타내는 것으로 볼 수 있다.

紫花前胡와 白花前胡 모두 coumarin을 기본 골격으로 하는 화학 성분들이 보고되었으나, 紫花前胡에는 dihydroxanthyletin 계열의 성분이 주로 보고되었고, dihydropsoresalen 계열과 psoralen 계열 등의 성분이 보고된 반면, 白花前胡에는 dihydroseselin 계열의 성분이 주로 보고되었고, hydrocoumarin 계열, dihydropsoresalen 계열 등의 성분이 보고되었다. 이 중 dihydropsoresalen 계열은 紫花前胡, 白花前胡에서 모두 보고되었으나 nodakenin과 nodakenetin을 제외하면 서로 일치하는 성분이 없었다.

Coumarin을 기본 골격으로 하는 성분이 주로 보고된 '前胡'류 약제와는 달리 峨參에서는 lignan과 phenylpropanoid 골격 등 기본골격에서부터 일치하는 성분이 거의 없었다. Coumarin은 그 자체가 기본 골격이 되어 여기에 여러 가지 구조의 작용기가 결합함으로써 다양한 특성을 나타내는 물질이고, lignan은 phenylpropanoid를 기본 골격으로 하여 이들 phenylpropanoid가 2개 이상 결합된 형태를 존재하며 다양한 작용기가 결합하게 된다. 따라서 문헌에서 보고된 화학 성분을 통해 각 기원약제를 비교한 결과, 紫花前胡와 白花前胡는 峨參과 뚜렷한 구분점이 있는 것으로 확인되었다.

결론

紫花前胡, 白花前胡, 峨參의 성분에 대한 문헌연구를 수행한 결과, 紫花前胡와 白花前胡 모두 coumarin을 기본 골격으로 하는 성분들이 대부분 보고되었고, 이 중 紫花前胡에서는 dihydroxanthyletin 계열이, 白花前胡에서는 dihydroseselin 계열의 성분이 주로 보고되었다. 峨參에서는 lignan을 기본 골격으로 하는 성분들이 대부분 보고되었고, 이 중 dibenzyl butyrolactone 계열의 성분이 주로 보고되었다.

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