

2021 (사)한국약용작물학회

# 추계학술발표회

코로나19 이후 뉴노멀시대의 약용작물 연구



**일시** 2021년 11월 4일(목)

**장소** [온라인]  Airmeet (에어밋),  YouTube 생중계







# 2021 한국약용작물학회 추계학술발표회 일정

■ 주 제 ■ 코로나19 이후 뉴노멀시대의 약용작물 연구  
■ 일자 및 장소 ■ 2021년 11월 4일(목), 온라인(에어팟/유튜브)

## 《 11월 4일(목) 》

09:30~10:00	온라인 접속
10:00~10:20	개회 및 내빈소개 개회사(한국약용작물학회장) 축사(국립원예특작과학원 인삼특작부장) 제31회 과학기술우수논문상 시상
<b>학술강연 &lt;1부&gt;</b> ▶ 좌 장 : 정명근 교수(강원대학교)	
10:20 ~ 10:55	인삼산업 정책 및 발전방향 ↳ 김상돈 서기관(농림축산식품부)
10:55 ~ 11:30	기후변화 및 뉴노멀시대 대응 약용작물 고품질 안정생산 방안 ↳ 김영창 박사(국립원예특작과학원)
11:30 ~ 12:05	디지털 브리딩 기술을 활용한 약용작물 연구 ↳ 양태진 교수(서울대학교)
12:05 ~ 13:00	중 식
<b>학술강연 &lt;2부&gt;</b> ▶ 좌 장 : 마경호 박사(국립원예특작과학원)	
13:00 ~ 13:35	약용작물 미래전략 대응 산업화전략 ↳ 이용욱 소장(내츄럴엔도텍)
13:35 ~ 14:10	Trifuhalol A isolated from <i>Agarum cribrosum</i> inhibits allergic inflammation ↳ 김수남 박사(KIST 한국과학기술연구원)
14:10 ~ 14:45	젊은 과학자 세션/네트워크 약리학을 활용하여 대사 증후군을 억제하는 약용 식물의 신호 전달 경로, 표적 단백질 및 생리 활성 물질의 규명 ↳ 오기광 박사과정생(강원대학교)
14:45 ~ 15:00	휴 식
15:00 ~ 15:30	임시총회
<b>학술발표</b> ▶ 좌 장 : 이이 교수(충북대학교)	
15:30 ~ 17:00	일반 구두 학술발표회/청년과학자 short communication
17:00 ~ 17:10	우수 구두발표상 시상
17:10 ~ 17:20	경품 추첨(인증샷 이벤트)
17:20 ~	폐 회



# 개 회 사

**한국약용작물학회 회원 여러분!**

안녕하십니까?

가을이 단풍처럼 짙어지는 11월입니다. 어느덧 2021년도 마무리되어 가는 시점입니다. 예년보다는 늦었지만 한국약용작물학회 추계학술발표회를 개최하게 된 것을 매우 기쁘게 생각합니다.

이번 학술대회는 되도록이면 회원님들과 직접 만나 연구 결과를 공유하고, 학회와 회원님들의 발전 방안에 대해 의견을 나누었으면 하였으나, 코로나 19로 인한 어려운 여건이 학회의 학술활동에도 많은 제약을 주고 있는 상황입니다. 이에 정부의 방역지침을 준수하고 예기치 못한 상황을 미연에 방지하기 위해 금번 행사도 온/오프라인으로 진행하게 되었습니다. 회원님들의 양해를 부탁드립니다.

그동안 어려운 여건 하에서도 한국약용작물학회에 대한 많은 관심과 애정으로 학회의 발전을 위해 노력해 주신 회원여러분께 감사드립니다. 우리 학회의 학술지가 최근 한국과총의 학술적 평가에서 KCI 최우수등재지로서 선정되었음은 물론 지난해 말 국제적으로도 인정받을 수 있는 스코퍼스(SCOPUS)로 한 단계 도약되었습니다. 따라서 한국약용작물학회는 국내외적으로 위상 제고는 물론 한 단계 발전할 수 있는 계기가 되었습니다. 이러한



원동력은 그동안 노력해 오신 역대 회장님과 편집위원장님 및 학회 사무국을 비롯한 회원 모두의 한결 같은 노력과 협조의 결실로 나타난 결과라고 생각합니다. 이에 회원 모두의 마음을 담아 깊은 감사의 인사를 드립니다.

오늘 학술행사의 주제는 코로나19 이후 뉴노멀 시대의 약용작물 연구 방향입니다. 축사를 맡아주신 국립원예특작과학원 박교선 부장님 감사드립니다. 오늘의 강연자인 농림축산식품부의 김상돈 서기관님을 비롯한 다섯분의 주제 발표 연사님, 젊은 과학자 세션 부분에서 발표를 맡아주신 오기광 박사님, 좌장님으로서 수고해 주실 강원대학교 정명근 교수님과 농진청 마경호 연구관님께 감사드립니다. 그 외에도 젊고 유능한 청년과학자 구두발표가 일반 구두발표와 함께 특색 있게 진행될 예정입니다. 이 진행을 맡아 주실 충북대학교 이이 교수님과 구두 발표자 여러분께도 심심한 감사를 드립니다.

현장에 참여하지 못한 회원 여러분! 사정상 진행의 어려움도 있겠지만 부디 끝까지 온라인 방송으로 참여해 주시어 좋은 연구정보 교류의 학술행사가 되기를 희망합니다. 아울러 온라인 학술행사 진행을 위해 노력해 주시는 방송 업체 관계자 여러분께도 깊은 감사를 드립니다.

끝으로, 오늘 행사를 준비해 주시고 협조해 주신 여러 관계자분들께 깊은 감사를 드리며 얼마 남지 않은 금년도 회원여러분의 안전한 방역수칙 준수로 늘 건강하시고, 연초에 계획하신 성과가 이루어지길 기원합니다.

감사합니다.

2021. 11. 4.(목) 한국약용작물학회 회장 김동휘 드림



## 축 사

안녕하십니까?

국립원예특작과학원 인삼특작부장 박교선 입니다.

오늘 한국약용작물학회 김동휘 회장님과 학술강연 연사분들 그리고 학회 회원님 등이 참여하는 추계학술발표회 및 임시총회를 개최하고, 코로나19 이후 뉴노멀시대를 맞이하여 약용작물 분야 정책·산업동향과 최신 연구 정보를 공유할 수 있게 되어 매우 뜻깊게 생각하며 환영합니다.

여러분들도 아시다시피 세계는 코로나19와 작년부터 오랜 시간 싸움을 하고 있으며, 현재는 정부의 시책에 따른 백신접종에 힘입어 단계적으로 일상과 경제를 회복 해나가고 있습니다.

전문가들은 코로나 상황으로 인하여 산업·경제·사회·문화 등 전반에 걸쳐 우리의 일상이 바뀌어 가고 있고, 향후에는 이러한 변화에 발맞춰 새로운 기준과 표준 마련이 필요하다고 말하고 있습니다.

세계는 현재 그 어느 때 보다 건강에 대한 관심이 높아지고 있고, 산업 전반에도 많은 변화가 요구되고 있습니다.



아울러 저출산, 고령화, 실업률 증가 등에 따른 사회경제적 트렌드가 변하고 있으며, 경제 저성장과 생산비용 증가 그리고 농촌인력의 절대적 부족 등은 농산업의 성장과 발전에 저해요인으로 거론되고 있습니다.

우리 청에서는 이처럼 빠르게 변화하는 트렌드와 환경에 능동적이고 선제적으로 대응하고 있습니다. 더불어 농업인의 소득증대와 국민의 건강 증진 그리고 관련 산업의 동반성장을 위하여 산학관연이 힘을 합쳐 신품종·신소재·신기술의 개발과 보급, 농작업의 기계화 등을 위해 적극적으로 노력하고 있습니다.

한편 약용작물은 그동안 주로 한약재로 이용하여 왔으나, 최근에는 미래의 고부가 기능성 소재로의 활용이 증가하고 있습니다. 건강기능식품 시장은 소비자와 산업체의 다양한 수요로 앞으로의 지속 발전가능성은 높을 것으로 예상합니다.

따라서 코로나 이후 건강 관심 증가 상황을 고려할 때, 약용작물 분야는 새로운 소재 발굴과 제품화 그리고 산업화로 국가 경기회복에 크게 기여할 수 있을 것으로 기대를 모으고 있습니다.

한편 이번 학술발표회는 「코로나19 이후 뉴노멀 시대의 약용작물 연구」라는 주제로 약용작물의 향후 연구·정책 방향과 육종·재배·친환경 분야의 고품질 안정생산 방안 그리고 수급 안정화 그리고 산업화 전략, 새로운 표준·기준 마련을 통한 기능성 분야의 최신 연구내용을 발표하고 공유하며 고민하는 의미 있는 학술행사라고 생각합니다.



아울러 한국약용작물학회가 올해 설립 30주년을 맞이하였기에 회원 여러분들과 함께 기쁨을 나누고 싶습니다.

끝으로 오늘 학술행사의 기획과 진행을 위해 애써주신 학회 임원진과 코로나 상황임에도 소중한 강연을 허락해주신 농림축산식품부 김상돈 서기관님, 국립원예특작과학원 김영창 박사님, 서울대학교 양태진 교수님, 내츨엔도텍 이용욱 소장님, 한국과학기술연구원 김수남 박사님, 강원대학교 오기광 박사과정학생 그리고 좌장을 맡아주신 강원대학교 정명근 교수님과 국립원예특작과학원 마경호 박사님, 충북대 이이 교수님께 감사드리며, 비대면으로 참석하고 계시는 학회 회원분들의 건강과 행복을 기원합니다.

감사합니다.

국립원예특작과학원 인삼특작부장 박교선



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1부

# 학술강연

좌장: 정명근 교수  
(강원대학교)







# 인삼산업 정책 및 발전방향

■ 김상돈 서기관(농림축산식품부)







# 인삼산업 정책 및 발전방향

2021. 11. 4.



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| 04 |  | '21년 인삼산업 종합계획 수립 추진(안) |



# I

## 인삼산업 현황

### 1 인삼산업 현황

#### 가. 세계 속의 한국 인삼산업

- 세계적으로 인삼은 한국, 중국, 미국, 캐나다에서 주로 생산
- 세계 인삼시장의 경쟁 과열 심화 속에서, 고려인삼은 다른 나라 인삼에 비해 월등한 효능과 품질관리(6년근 재배) 등으로 경쟁력 확보
- \* 고려인삼은 세계 인삼시장에서 중국, 미국, 캐나다 인삼에 비해 3~4배 수준 높은 가격

세계 주요 인삼 수출국가 수출단가 비교

(단위 : 달러/kg)

구분	2017	2018	평균
대한민국	185.3	244.2	214.8
미국	69.6	95.5	82.6
캐나다	55.8	47.1	51.4
중국	47.4	44.9	46.1

\* 출처: Global Trade Atlas



## 2 인삼산업 현황

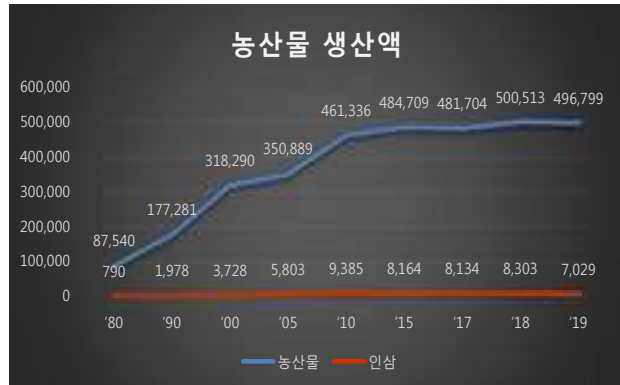
### 나. 한국 농업에서 인삼산업의 위치- 1

#### 생산액 비교

❖ 대한민국 전체 농산물

생산액 대비 인삼은 2%

미만의 생산액 유지



< 농산물 생산액 >

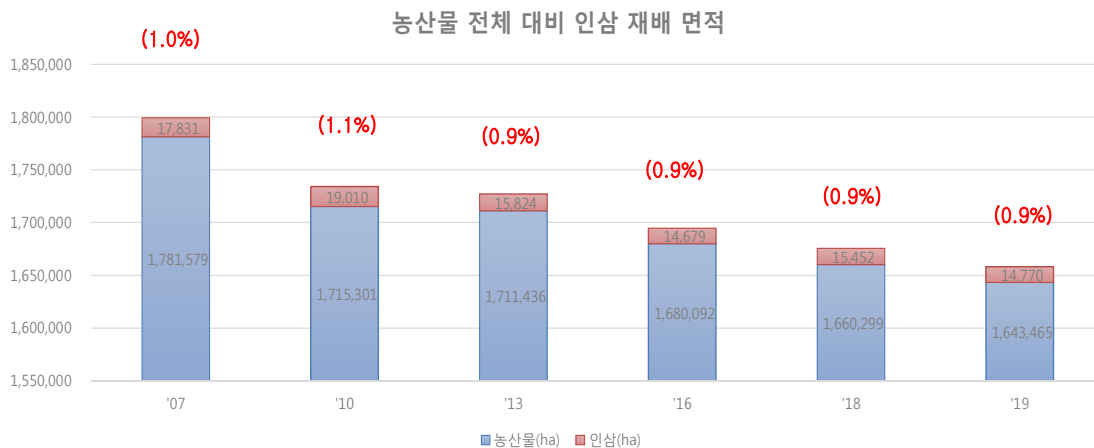
구분	단위	'80	'90	'00	'05	'10	'15	'17	'18	'19
농산물	억원	87,540	177,281	318,290	350,889	461,336	484,709	481,704	500,513	496,799
인삼	억원	790	1,978	3,728	5,803	9,385	8,164	8,134	8,303	7,029
비율	%	0.9	1.1	1.2	1.7	2.3	1.7	1.7	1.7	1.4

## 3 인삼산업 현황

### 나. 한국 농업에서 인삼산업의 위치 -2

#### 농산물 전체 대비 인삼 생산 면적

❖ 인삼 재배면적은 전체 농산물 대비 1% 이하





## 4 인삼산업 현황

### 다. 인삼 수출

#### 수출액 현황

❖ '19년 인삼수출액은  
**210백만불**  
[전년대비 22백만불 증가, 11.9%]  
**중화권 수출 비중**  
**56.2% 수준**

#### < 주요국 수출실적(최근 3개년) >

국가명		2017년		2018년(A)		2019년(B)		((B/A)*100)-100(%)	
		물량(톤)	천(\$)	물량(톤)	천(\$)	물량(톤)	천(\$)	물량	금액
계(a)		6,410	158,393	7,512	187,742	10,575	210,277	40.7	11.9
중 화 권  (b)	중국	753	37,975	986	51,187	1,589	69,391	61.1	35.6
	홍콩	194	21,335	395	28,997	527	28,899	33.7	△0.3
	대만	484	18,446	560	20,375	658	19,919	17.5	△2.2
	(소계)	1,431	77,756	1,941	100,559	2,774	118,209	42.9	17.6
일본		576	28,790	677	32,837	761	34,483	12.3	5.0
미국		1,215	21,150	1,077	23,701	1,203	20,919	11.7	△11.7
베트남		2,546	12,959	3,137	15,201	4,542	21,301	44.7	38.9
기타		643	17,737	680	15,445	1,295	15,365	90.4	△0.8

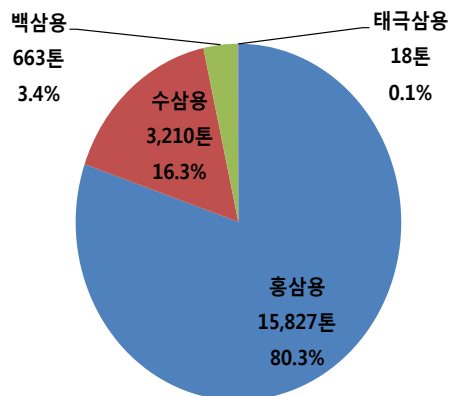
#### < 농산물 수출에서 인삼류가 차지하는 비중 >

구 분	'90	'95	'01	'06	'10	'15	'17	'18	'19
농산물수출(백만\$)	795.0	1,086.6	1,251.9	2,008.2	3,721.6	5,220.6	6,046.6	6,006.7	6,148.3
인삼수출액(천\$)	164,945	139,936	74,766	89,060	124,204	155,081	158,393	187,742	210,277
비율 (%)	20.7	12.9	6.0	4.4	3.3	3.0	2.6	3.1	3.4

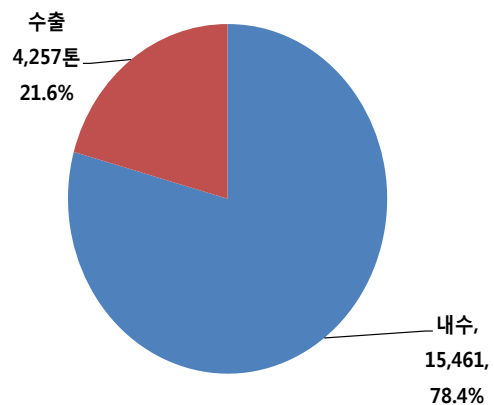
## 5 인삼산업 현황

### 라. 인삼 제품 유형 및 수출 비중

#### 소비형태 : 19,718톤('19년 추정)



#### 내수/수출 비중



※ 인삼농협, (주)KGC인삼공사, (주)농협홍삼 판매자료 등을 기준으로 농협경제지주에서 추정

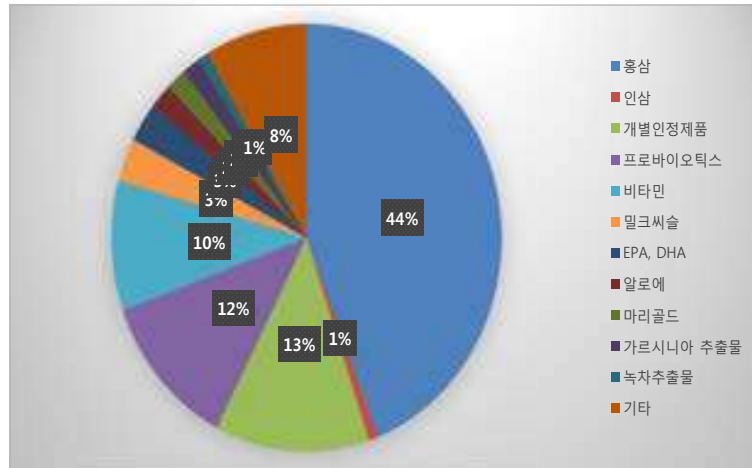


## 6 인삼산업 현황

### 마. 건강기능성 식품과 인삼

#### 인 · 홍삼의 위치

- ❖ 건강기능식품 중 **절반** 비중 차지
- \* 홍삼 44%, 인삼 1%



\* 출처 : 2018년 식품의약품안전처 통계

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## 7 인삼산업 생태계

### 인삼산업 구조

- ❖ KGC가 시장의 70% 점유
  - 나머지는 11개 인삼농협, 한삼인과 천여개 제조업체 공존
- ❖ 정관장이 대표 브랜드로 자리매김
  - 한삼인과 인삼농협의 개별 브랜드, 각 제조업체별 브랜드 공존

### 인삼산업의 구조적 문제점

- ❖ 건강식품시장 성장과 함께 인삼 가공제품의 산업규모도 지속 성장 추세, 약 2조원대로 추정
- ❖ 내수, 수출시장이 뿌리삼에서 제품류로 급격히 변화하고 있으나, 일부 업체를 제외하고는 뿌리삼 산업에 치중

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## II

# 환경변화 및 당면 과제

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### 1 소비자 관심 변화

#### 먹거리(식품)



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## 2 인삼에 대한 소비자 관점



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## 3 우리의 현실은?

### 2019년 1월 1일, PLS 전면 시행

❖ PLS 시행으로 인삼 안전성 부적합률이 높아질 개연성이 높음

- 높아진 안전성 부적합 기준으로, 인삼은 장기간 재배 및 토양 장기잔류 농약 등으로 인한 오염 피해 발생 가능성이 높은 상황

\* 인삼공사, 농협 계약물량 약 30%는 안전, 비계약물량 및 미경작신고 물량 약 70%가 안전성이 취약

#### < 인삼 안전성 부적합 비율 >

구분	17년	18년	19년
일반농산물	1.90%	1.30%	1.20%
인삼	2.20%	5.40%	2.80%

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## 4 활로 모색...Where to

**소비자 니즈...안전성 강화**

**경쟁 심화...제품,소비,수출 다변화**

**고령화사회...소비자 중심, 건기식**

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## 5 당면 과제와 해결 방안



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### III

## ‘16년 인삼산업 발전대책

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### 1 발전대책 개요

비전	세계 시장을 선도하는 인삼 종주국 위상 회복 민간 주도의 자율적 인삼산업 성장기반 조성	
목표	◆ 인삼 생산액(억원) : ('14) 8,453 → ('20) 15,000 → ('25) 25,000 ◆ 인삼류 수출액(백만\$) : ('14) 184 → ('20) 300 → ('25) 500	
세부 추진 과제	1. 민간 중심의 산업경쟁력 강화	① 자조금 확대 및 범인삼업계 화합 도모 ② 고려인삼정책포럼 운영 등 역량 강화 ③ 농협 체질개선 및 경영효율화 도모
	2. 수출·소비 및 6차산업화 확대	① 국가별 비관세장벽 해소 ② 할랄권, 미주 등 수출시장 다변화 ③ 소비촉진 및 신규 융·복합시장 확대
	3. 인삼 R&D-산업화 연계 강화 및 투자 확대	① 인삼 R&D 산업기획단 재편 ② 인삼 R&D 체계 개편 ③ 인삼 산업화와 연계한 국제 공동연구 강화 ④ 신소재·임상·재배실증 등 연구 확대
	4. 고품질 청정인삼 생산유통 기반 구축	① 종자·묘상 생산유통 보급시스템 구축 ② 산양삼 협업·협력 체계 강화 ③ ICT 활용 및 계열화현대화 사업 내실화 ④ 단계별 안전성 인프라 구축 강화
	5. 제도개선	① 인삼 경작신고 의무화 등 현장 의견 반영 ② 인삼 포장규제 완화 등 규제 개선

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## 2 주요 추진대책(1)

### 민간 중심 산업경쟁력 강화

- **인삼 의무자조금 연착륙 유도 및 2단계 가입 확대**
  - 생산, 제조, 유통, 소비, 수출 등 Chain별 참여 확대를 통한 민간 역량 결집
  - \* (1단계) 농가, 인삼농협, 자체검사업체 → (2단계) 수출업체 등 참여 확대
- **민간 주도의 고려인삼정책포럼 운영 등 역량 강화**
  - 의무자조금단체를 중심으로 정책파트너를 구성하여 상호 협력 및 역량 결집 추진
- **인삼농협 등 체질개선 및 경영효율화**
  - 재고물량 감소, 브랜드 통합 및 마케팅 강화 등

### 고품질 청정 인삼 생산 기반 구축

- **인삼 종자·묘삼 보급 체계 구축**
  - 주산지별 종자 수매, 저장, 개갑, 묘삼생산, 유통 등 일괄보급시스템 구축
- **인삼 안전성 인프라 구축을 위한 GAP 인증 전면 확대**
  - 인삼 재배화사업, 생산시설현대화사업 등 지원시 GAP 인증농가 우선 지원
- **ICT 활용, 인삼 스마트팜 시스템 도입 등**
  - 원거리 경작으로 인한 도난, 작물 관리 등의 어려움 해결을 위해 ICT활용한 관리
- **인삼검사소의 검사역량 강화 및 위생환경 개선 지원**
  - 협약재용 인삼검사 등 업무량 증가에 따른 검사 기기·시설·인력 추가 확보

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## 3 주요 추진대책(2)

### 수출소비 시장 및 6차 산업화 확대

- **수출 국가별 비관세장벽 대응**
  - (대만) 대만 중약재 식품사용 관리규정 대응 (홍콩) 중의약 조례 개정
- **수출시장 개척 및 확대를 위한 '고려인삼 종합정보망' 구축**
  - 고려인삼에 대한 재배, 유통, 효능, 요리법 등 종합 정보 제공 및 마케팅 활용
- **고려인삼 가치 재조명·집대성으로 우수성 홍보 및 문화유산 보존**
  - 고려인삼 재배와 문화에 대해 '무형문화재' 등록 추진
- **온라인 플랫폼 지원사업 강화**
  - 중국 등 해외 유력 온라인 역직구를 등을 통한 릴레이 판촉(온라인·홈쇼핑) 강화

### R&D, 유통 및 제도 등 개선

- **수출국 연구기관과 공동 임상연구를 통한 효능 홍보 추진**
  - 고려인삼 효능에 대한 공동연구를 통한 홍보, 기능성표시 식품 등록 등으로 수출 확대 도모
- **고려인삼 R&D·산업기획단 확대 재편**
  - 정부, 산·학·연 등이 참여, 현장 소통 강화를 통한 주요 과제 발굴
- **고려인삼 연구결과 국제적 공유를 위한 국제인삼심포지엄 개최**
  - 학술대회 특별강연, 구두·포스터 발표, 인삼 및 인삼사진 전시회 등
- **경작신고 의무화 등을 통한 의무자조금 역량 강화**
  - 의무자조금단체 거출대상자 정보권한 강화, 지원배채 등 강화

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## 4 인삼 관련 주요 사업[1]

### 인삼·특용작물계열화

#### 예산현황

단위: 백만원

사업명	2019결산	2020예산(A)	2021예산(B)	B-A	B/A(%)
인삼·특용작물계열화	17,453	19,418	20,281	863	4.4

#### 사업개요

- ✓ (목적) 재배단계부터 이력관리를 통한 **고품질 청정인삼 생산기반** 구축
- ✓ (지원내용/대상) **계약자금** 및 **수매사업비** 용자 지원 / 생산자단체·일반업체 등
- ✓ (지원조건) **용자 80%, 5년 거치 일시상환(계약재배)**
  - \* 인삼 **수매자금**은 **농업자금이차보전사업**으로 지원
- ✓ (사업시행주체) 농협경제지주

#### 사업 추진방향

- ✓ **안전성이 확보된 원료 생산·공급·유통**을 통해 인삼산업 경쟁력 제고

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## 5 인삼 관련 주요 사업[2]

### 인삼·특용작물유통시설지원

#### 예산현황

단위: 백만원

사업명	2019결산	2020예산(A)	2021예산(B)	B-A	B/A(%)
인삼·특용작물유통시설지원	1,145	1,031	876	△155	△15.0

#### 사업개요

- ✓ (목적) 주요 **생산권역별 조직화·규모화·브랜드화**된 인삼 전문 생산단지 조성
- ✓ (지원내용/대상) **생산·가공·유통시설, 마케팅·컨설팅** 지원 / 생산자단체·농업법인 등
- ✓ (지원조건) 생산유통시설 - **국고 30%, 지방비 40%, 자부담 30%**  
마케팅·컨설팅 - **국고 30%, 지방비 60%, 자부담 10%**
- ✓ (사업시행주체) 지자체, 농협경제지주

#### 사업 추진방향

- ✓ **조직화·규모화**를 통한 유통구조 개선으로 **강소 브랜드 육성** 및 인삼산업 경쟁력 제고

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## 6 인삼 관련 주요 사업[3]

### 인삼생산시설현대화사업

#### 예산현황

단위: 백만원

사업명	2019결산	2020예산(A)	2021예산(B)	B-A	B/A(%)
인삼생산시설현대화	2,896	3,230	2,896	△334	△10.3

#### 사업개요

- ✓ (목적) **자연재해 예방** 및 **노동력 절감**을 통한 인삼 생산능력의 경쟁력 제고
- ✓ (지원내용/대상) 고품질 인삼생산 관련 시설·장비 지원 / 농업경영체
  - \* 해가림시설 등 내재해시설(50백만원/ha), 무인방제시설(15/ha), 내재해형 비닐하우스 시설(180/ha)
- ✓ (지원조건) **국고 20%, 국고융자 30%**, 지방비 30%, 자부담 20%
  - \* 융자조건 : 고정금리(2%) 또는 변동금리, 3년 거치 7년 분할 상환
- ✓ (사업시행주체) 지자체

#### 사업 추진방향

- ✓ **GAP 인증, 자조금 납부 농가 우선 지원**으로 안전하고 현대화된 인삼재배시설 확대

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## 6 인삼 관련 주요 사업[4]

### 농식품원료구매

#### 예산현황

단위: 백만원

사업명	2019결산	2020예산(A)	2021예산(B)	B-A	B/A(%)
농식품원료구매	332,652	372,882	372,882	-	-

#### 사업개요

- ✓ (목적) 농식품 수출업체 지원을 통해 농식품 수출 견인 및 소득증대에 기여
- ✓ (지원내용/대상) 수출업체 원료 구매 및 운전자금 등 지원/ 수출업체 등
- ✓ (지원조건) **국고융자 80 ~ 90%**
  - \* 융자조건 : 고정금리(농업경영체 2.5%, 농업경영체 외 3.0%) 또는 변동금리, 1년 만기 상환
  - 평가결과(수출실적 등)에 따라 금리 우대 차등 지원**
- ✓ (사업시행주체) 한국농수산물유통공사

#### 사업 추진방향

- ✓ 우수 수출업체 지원 및 인센티브 확대를 통한 인삼류 수출 제고

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## IV

### ‘21년 인삼산업 종합계획 수립 추진(안)

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#### 1 인삼산업법상 종합계획에 포함되어야 할 사항

##### \* 인삼산업법상 종합계획에 포함되어야 할 사항

- 인삼산업 발전 및 지원을 위한 중장기 정책목표 및 기본방향
- 인삼산업 발전을 위한 기술의 연구·개발 및 보급에 관한 사항
- 인삼산업 발전을 위한 전문인력의 양성 및 교육
- 인삼류 및 인삼제품류의 생산성 향상 및 가격안정에 관한 사항
- 인삼류 및 인삼제품류의 유통·수출·판로지원에 관한 사항
- 품질검사 등 인삼류 검사의 개선에 관한 사항
- 인삼산업과 다른 산업 간의 연계 강화에 관한 사항
- 그 밖에 농림축산식품부장관이 인삼산업의 발전을 위하여 필요하다고 인정하는 사항

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## 2 인삼산업 여건변화 및 미래대응

### 가. 여건 변화

- 초작지 감소, 연작장해 심화, 관세 인하, 수출경쟁 심화, 기후변화, 뿌리삼 소비감소, 공급과잉 등

### 나. 미래 대응

- 예정지 안정적 확보,
- 생산, 유통, 가공, 효능 R&D 방향 설정 및 대응
- 인삼 종주국 지위 유지 발전
- 인삼문화 확산

## 3 인삼산업 종합계획 마련[안]

- (거버넌스 구축) 산업 종사자(정책, 연구, 생산, 유통·가공·수출, 학계) 등과 연계하여 논의 주제 및 계획안 마련
  - 농식품부, 농진청, 지자체, 학회, 연구계, 생산자, 협회 등이 논의 주제를 마련하고 논의를 통해 계획 마련

- (주제별 논의 그룹) 정책·제도, R&D, 지원체계 등 주요 과제로 나눠 논의(논의 그룹은 기관성격에 따라 분류하되, 전문가 참여)
  - (정책·제도) 경작신고 의무제, 자조금단체 육성, 계약재배 활성화, 수급제도 도입, 인삼 산업 진흥체계 등
    - \* (지원체계) 종합계획 원활한 시행과 주기적 피드백을 통한 계획 현행화를 위해 기존 기관 기능 및 거버넌스 강화 논의(별도의 지원기관 설립 논의 포함)
  - (R&D) 중장기 연구방향 및 연구목표 설정, 정부 및 민간연구 협력방안, 기획연구과제 도입방안, 연구성과 활용방안 등



## 4 인삼산업 종합계획 세부방안

□ **(세부방안)** 생산, 유통·가공, 소비·수출 등을 분야별 제도개선 추진

○ **(생산)** 수급, 생산이력, 안전성 등과 연계한 인삼 경작신고 의무화 제도 도입방안, 재해보험 확대(작물 보험) 등

- 의무자조금과 연계한 도입 및 관리방안을 마련하고, 단계적으로 수급조절 과도 연계 방안 검토

- 농업경영체 연계 또는 신규 개발 등 관리시스템 개발 방안 등

## 4 인삼산업 종합계획 세부방안

○ **(유통)** 거래가격 신뢰도 제고를 위한 공판시스템 도입, 계약재배 확대 및 수매제도 개선방안 마련, 대량소비처 확대 등

- 인삼농협을 중심으로 새로운 거래가격 공시제도 도입, 지방도매시장 가격 제도화 등 거래가격 투명화 및 공개제도 마련

- 수삼 등 농협 유통 확대 방안, 농협 대외 수출 창구 일원화 강화 방안, 온라인 유통망 확충, 학교급식·군납 등 대량소비처 개발 등

- 자조금 홍보 등 홍보사업 내실화, 공동 마케팅, 농협 및 인삼공사 국제 유통 협업 방안 등



## 4 인삼산업 종합계획 세부방안

○ **(가공)** 다양하고 가격경쟁력을 갖춘 가공제품 개발을 위한 원료 관리, 가공 기술 개발, 공동가공 등 추진

- 제조업체 규모화(영세업체 연합, 농협 연합), 제품 인지도(브랜드) 및 경쟁력 강화, 제품 표준화, 제품 안전성 강화 등

○ **(기타)** 세계문화유산 등재 등 인삼 가치 제고, 수출활성화 방안 등

※ R&D 분과는 농진청이 주관하여 관련 기관·단체와 협의하여 선정, 논의하되 생산, 유통, 가공, 수출 등 산업 전반에 대해 작성

감 사 합 니 다.





# 기후변화 및 뉴노멀시대 대응 약용작물 고품질 안정생산 방안

■ 김영창 박사(국립원예특작과학원)







# 기후변화 및 뉴노멀시대 대응 약용작물 고품질 안정생산 방안

2021. 11. 4.

김 영 창



## 발 표 내 용

1 약용작물 일반 현황

2 약용작물 주요 연구 성과

3 안정·안전 생산 방안



# 약용작물 일반 현황

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## 1. 약용작물 산업 현황

### ■ 특용작물 생산실적조사(2019년, 농식품부 통계)



구분	농가수(호)	생산량(M/T)
유지작물	200,538	63,720
섬유작물	122	166
기호작물	2,687	4,973
약용작물	30,241	64,111
버섯류	2,058	152,853
기타	241	1,635
합계	235,887	287,458

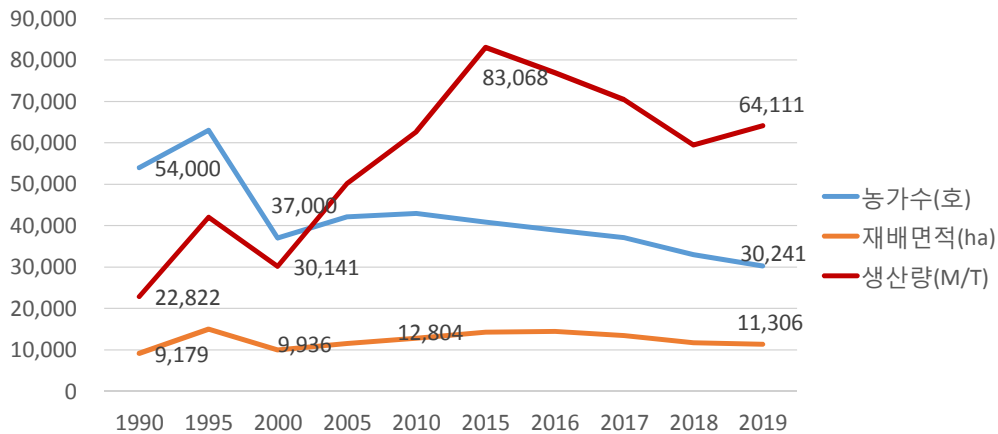
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## 약용작물 산업 현황

### ■ 생산 추이

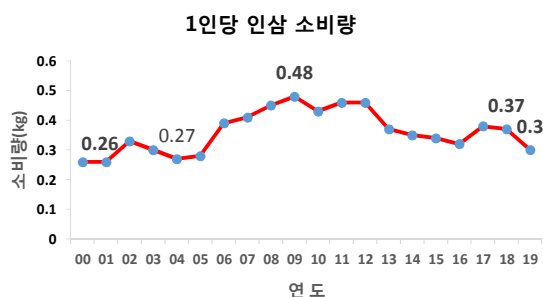
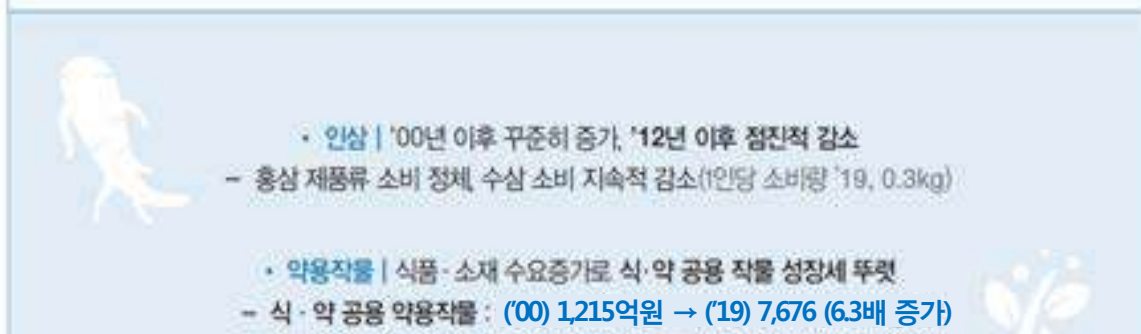
2000년 이후 웰빙 추구와 건강·기능성에 대한 관심 증대로 **생산 증가**,  
2015년 이후 점차 감소하다가, **2019년 생산량은 다시 증가**세



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### ■ 소비 시장

#### 약용작물 지속적 성장, 인삼 소비 증가세 둔화



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## ■ 수급 및 이용현황

- 생산량의 약 70%는 식품용(일반식품, 건강기능), 나머지는 한약재로 이용 추정, 색소, 화장품 등 기능성 제품으로 외연 확대

- 국내 건기식시장 지속적 성장, 새로운 기능성 요구

- 건기식시장 : 4.6조 ('19, 전년대비 3.5% ↑) → 5조 ('20, 전년대비 8% ↑ 예상)
- 5대작물 : ('00) 황기, 천궁, 도라지, 더덕, 마 → ('16) 오미자, 복분자, 마, 도라지, 천마

- 국내 수요의 약 30%가 수입품이며, 자급률은 약 70% 수준

연도	생산(천톤) (A)	수입(천톤) (B=약용+식용)	수출(천톤) (C)	국내소비(천톤) (D=A+B-C)	자급률(%) (B/D)
2017	70.5	27.8	0.5	98.3	71.7
2018	59.4	28.7	0.4	88.1	67.4
2019	64.1	32.3	0.4	96.4	66.8

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## ■ 건강기능식품 시장

### 시장 동향(건강기능식품)

- 국내 건기식 시장규모는 '18년 4.4조원으로 '22년까지 연평균 7%성장 전망
- 세계 건기식 시장규모는 '19년 1,748억달러로 '25년까지 연평균 7.9%성장 전망



출처: 한국건강기능식품협회

Statista, Global functional food market revenue 2019~2025

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## 수출입

인삼 특작 산업은 지속적으로 성장하나 수출 부진, 수입 증가

• **인삼** | 홍삼 내수 한계, 수출 부진, 신규시장 개척 필요

\* 수출액 : ('10) 189백만\$ → ('16) 133 → ('18) 187

• **약용작물, 버섯** | 수출은 정체, 수입은 급격하게 증가

\* **한약재(304품목)** 및 **식약공용 식품(96품목)** **연간 37천 톤 수입**

- **[한약재]** ('13) 17.3천 톤 → ('19) 4.8, **[식품]** ('13) 15.4 → ('19) 32.2

- ('19) 수입액 : **[한약재]** 18.5 백만 \$, **[식품]** 63.0 백만 \$

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## 환경 변화



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## 기후변화에 따른 작목 변화

### 농작물 복상 및 유망작목 증가



### 기후변화로 인한 작목별 재배면적 및 소비 변화



💡 데이터 기반 재배기술 확립 필요 💡

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## 여건변화 및 시사점



- 기후변화 대응, 작목별 맞춤형 품종 개발 및 조기 보급 시급
- 연작장에 경감 안정생산 및 소비자 신뢰 확보 안전생산기술 필요
- 기능성 효능 구명, 식품, 화장품 등 웰빙 건강 소재 개발 확대 등

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## 2. 약용작물 산업 진단

### 생산단계

다품목, 소규모 생산  
품종개발, 재배기술 미흡  
종자생산기반 미구축  
기계화, 첨단화 미흡  
농약 등록

#### 연작장해

주산단지 유지 어려움



생산기반 취약

### 유통단계

외국산 수입 증가  
원산지 부정 유통  
부실인증  
소비자 접근성 제약



소비자 불신

### 이용단계

민간 관심·역량 부족  
기능성 실용화 미흡  
표준화 미흡  
신수요 대응 부족



성장동력 미 창출

약용작물 산업은 **성장 잠재력**에 비해 **발전속도는 느린 상황**

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## 약용작물 주요 연구 성과

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## 1. 품종 개발

**신품종 육성 : 34작물 107품종(~'20)**

- ❖ **지황** : 병해충에 강한 **‘토강’**(‘09)  
 수량 많은 **‘다강’**(‘10)  
 기계수확용 **‘한방애’**(‘20)



- ❖ **감초** : 글리시리진 고함유 **‘원감’** (‘13)
  - 만주감초 대비 글리시리진 고함량 (글리시리진 3.96%)
  - 수입대체 가능 국내 최초 육성 품종(성분고함유, 내병다수성)



- ❖ **삼주** : 고품질, 다수성 삼주 **‘다출’** (‘08)
  - 평창재래 대비 다수성이고 **약효성분(Atractylon)** 함량 높음
  - 수입량 563톤(연도)로 국내 재배 시 **수입대체 효과**가 높음



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## 2. 안정 · 안전생산 기술 개발

- ❖ **기후변화 대응 고품질 · 안정생산기술 개발**
  - 일천궁 **고온경감** 스마트 멀칭 신소재 개발: 엽 고사율 30%↓, 생육 25~37%↑
  - 약용작물 종자 생산방법 **매뉴얼** 보급: 원지 등 4작목
- ❖ **PLS 대응 약용작물 적용 농약 선발 : 8작목 23품목**
  - 대상작목: 황기, 도라지, 지치(**종자소독제** 6품목), 백수오, 잔대(**살충제** 3품목), 결명자, 백출, 잔대(**살균제** 11품목), 지황, 백출(**제초제** 3품목)
- ❖ **병해충 및 위해물질 안전 관리기술 개발**
  - 당귀, 울무 **곰팡이독소** 관리기술 개발: 중점관리지점(CCP) 설정(**영농활용**)
  - ‘오매’ **벤조피렌** 생성환경 구명: 1차 훈연 과정 삭제 제안(**정책제안**)



천궁 고온경감 효과



종자생산 매뉴얼



병해충 농약등록



병해충관리책자

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### 3. 산업화 소재 개발

#### ❖ 건강기능식품 ‘기능성 원료’ 인정

- **인삼 뼈 건강** 개선(2019-2호) : 모든 산업체 표기 가능, 소비 확대 기대
- **오가피열매추출물** 혈압조절(2019-11호) : 기업체 기술이전(총 10건, 2.3억원)

#### ❖ 신규 기능성 식·의약 소재 발굴 (원료등록 추진 포함)

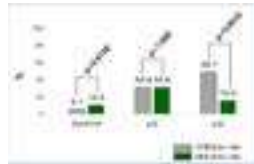
- (항스트레스) 인삼, (관절건강) 황기복합물, (간건강) 흑삼, 강황, (인지능) 기린초 (면역증진) 산수유, (항당뇨) 쓴씀바귀, (미백) 감초, 도라지

#### ❖ 기능성 소재 **산업체 기술이전** (‘16~’20)

- 간 손상 예방 흑삼 조성물, 인지능 개선 복합 조성물 등 **특허출원 110건**
- **기술이전 175건**(천만원 이상 43건) : 21억원(사업화율 20%)



인삼 ‘뼈건강’



오가피열매 ‘혈압조절’



흑삼 기술이전 제품



잇꽃흰민들레 기술이전 제품

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**안정·안전 생산 방안**

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## 고품질 안정생산 전략 및 추진 내용

### 생 산

고품질·안정 생산, 생산성 향상(기계화, 디지털화), 친환경 생산

전 략	추진내용 및 목표
1. 수요자 맞춤형 품종 육성	◆ 복합 저항성, 기능성 강화, 수출용, 가공용 신품종 보급 확대 ☞ 인삼·약용 품종 보급률 : ('20) 33% → ('25) 40 → ('30) 50
2. 디지털 농업 적용 재배기술 혁신	◆ 안정생산, 생산비 절감을 위한 디지털농업 기술 개발 ☞ ('21) 생산단계별 디지털화 → ('25) 디지털 모델 현장 실증 → ('30) 디지털 시설 전국 확대
3. 병해충 종합 방제, 안정생산 기반 구축	◆ (인삼·약용) 곰팡이병 제어기술 확립 및 연작장해 경감기술 개발 ☞ ('22) 인삼뿌리썩음병 종합방제기술 구축 → ('25) 선도농가 보급

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## 고품질 안정생산 전략 및 추진 내용

### 기능성

원료 표준화, 과학적 효능 구명, 신소재 개발 및 가공·이용 연구

전 략	추진내용 및 목표
4. 식물자원 이용 건기능성 소재 개발 및 산업화	◆ (기능성소재) 신규 기능성 식·의약 소재 및 향장 소재 발굴 ◆ (산업화) 기능성 소재의 기술이전 확대를 통한 산업활성화 ☞ 건강기능식품원료 등록 : ('20) 3건 → ('25) 6 → ('30) 10
5. 생명공학기술 도입 첨단 연구	◆ (유전체) 전장유전체 완성, 마커 개발 및 유전자 교정기술 확립 ◆ (전사체·단백질체) 목표형질 연관 바이오마커 개발 및 고도화 ◆ (대사체) 성분육종, 유용성분 대량분석체계 확립 및 DB 구축 ☞ 마커 개발 : ('20) 염류·고온 → ('23) 습해저온 → ('26) 내병성

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## 1. 고품질 우량 품종 개발

- ❖ 전략 ① 시장수요, 잠재력이 큰 품목 **단계적 선택, 집중, 애로해결**  
 ② **육종효율 증진** : 육종체계 구축, 디지털 육종 등 신기술 도입



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## 품목별 세부 실천계획

- (I: 감초, 지황) 수입의존 품목은 국산품종 육성·보급으로 신속 대체
  - 종자보급센터(안동 등 6개소), 실용화재단, 민간 통상실시 확대
- (II: 대마, 식방풍) 신수요 품목은 표준품종 개발 및 기능성 산업화
  - (표준품종) 소면적 약용작물 표준품종 개발(9개 도원 공동연구)
    - \* 1단계('17~'21) : 더위지기 등 10품목, 2단계 사업('22~'26) : 더덕, 백수오 등 18품목
  - (기능성 산업화) 자원의 생산 및 품질 표준화 연구('22 ~ '26)
    - \* 의료용 특용자원 생산 표준화, 면역강화·정신건강 특용자원 원료 표준화
- (III: 오미자, 도라지) 10위권 이내 대면적 재배 품목은 품종 육성에 집중
  - 종자번식 및 영양번식 특용작물 7개 품목 품종 개발
    - ☞ 당귀·황기('90년대 육성), 오미자·도라지(지자체) → ('25) 황기, 오미자, 더덕 등 7개 품종
- (IV: 울무, 구기자) 최근 수요 감소 품목은 용도 다양화 연구 강화
  - 울무 등 약용작물 지역특산물 생산 및 이용기술 개발('19 ~ '23)

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## 주요 약용작물 육종 목표

대면적 재배 약용작물	수입의존 약용작물
<ul style="list-style-type: none"> <li>•오미자 : 영양번식 확립, 숙기(조만생)</li> <li>•더덕 : 고수량성, 유효성분 고함량</li> <li>•도라지 : 내습성, 배수체 다수성</li> <li>•당귀 : 내고온성, 내추대성</li> <li>•황기 : 내습성, 연작장해 해소</li> </ul>	<ul style="list-style-type: none"> <li>•작약 : 지표성분 기준 적합, 다수성</li> <li>•감초 : 지표성분 고함유, 약전 기준부합</li> <li>•지황 : 내병성, 기계화적성</li> <li>•삼주 : 약전규격 기준부합</li> <li>•천궁 : 내고온성, 변이창출(돌연변이)</li> </ul>

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## 2. 안정 생산 기술 구축



재배혁신  
(인삼)

### ◆ 연속재배 가능 무이동 디지털 재배시스템 구축

- 경사식 → 2중구조 하우스 → 기후변화 대응

### ◆ 일관체계, 생산단계별 디지털화 및 종합 관리



디지털  
농업

### ◆ 데이터 기반 스마트 안정생산

- 고온, 수분 스트레스 영향 평가(데이터 수집, 분석)

- 의료용 자원 표준생산 기술 개발

- 우량 육묘 체계화 기술 개발

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## 데이터 기반 디지털 농업

### 디지털 농업 (Digital Agriculture)

농업 관련(생산·유통·소비 등) 데이터를 디지털 형식으로 수집, 저장·관리, 결합, 분석 및 공유하여 의사결정 지능과 새로운 가치를 창출하는 것

\* 농업전망 2021(농경연): 기존의 정밀농업이나 스마트농업보다 생산, 유통, 소비 등 농업 활동의 전 과정에서 데이터를 적극 활용



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## 디지털 농업에 필요한 조건

### 1. 데이터 수집 및 관리

#### 목표

농업 현장, 연구실 등 데이터 수집확대, 표준화 및 품질관리

#### 농업 데이터 종류

- 생산** 토양, 기상, 병해충, 작황데이터
- 유통** 농산물이력, 도매가격, 수출통계데이터
- 소비** 농식품소비, 농산물브랜드, 식품영양, 국민건강데이터

농업데이터는 계절, 지역, 품종 등 다양한 요인이 있어  
데이터 표준화, 수집관리분석 체계 마련 등  
정부의 마중물 역할이 중요



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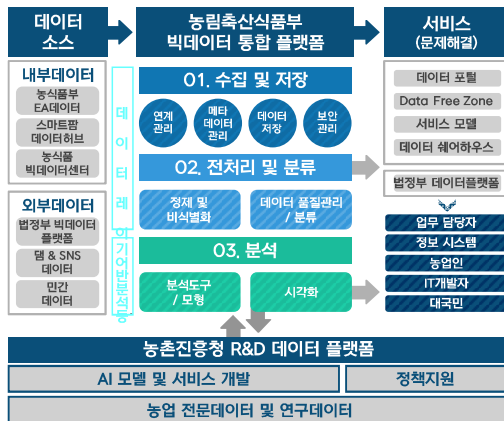
## 디지털 농업에 필요한 조건

### 2. 인공지능(AI) 서비스

#### 목표

인공지능(AI) 서비스를 통한  
농업인 정밀 의사결정 지원

#### AI 서비스 플랫폼 구성도



생육  
관리

- 생산성 향상 생육관리 AI 모델개발을 노지, 축산으로 확대

#### 시설원예

(20) 토마토 → (21~) 딸기, 파프리카, 참외, 오이, 수박, 국화 등

#### 노지·축산

(21~23) 벼, 밀, 콩, 양파, 배추 → (24~) 사과, 한우, 젓소 등 5



의사  
결정  
지원

- 작목선택, 적지추천, 출하지원 등  
농업인 의사결정지원 모델 개발

\* 토양, 기상, 소비 등 빅데이터 연계를 통한  
유망작목 발굴과 마케팅 전략 수립 등

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## 디지털 농업에 필요한 조건

### 3. 데이터 개방·공유 및 활용

#### 목표

민간 기술창업 지원 및  
유관기관 협력체계 구축



데이터  
개방·공유

- 데이터 개방·공유를 통한 기술창업 지원 및  
유관기관 협력체계 구축

\* 농업기상, 토양, 병해충, 종합빅데이터 등 개방  
: ('20) 143건 → ('21) 241건

\* 농축산분야 인공지능 학습용 데이터 구축(과기부) :  
병해충 이미지 구축 등

#### 국내 농업 스타트업 현황

팜에이트(식물공장), 엔씽(스마트팜),  
에이아이에스(농작물생육관리솔루션) 등



데이터  
센터

- 데이터의 체계적인 저장·관리 및  
공유를 위한 데이터 센터 구축

\* (1단계) 현장데이터센터 → (2단계) 연구데이터센터  
→ (3단계) 통합 플랫폼



지역거점  
육성

- 전국 시군 농업기술센터를  
데이터 수집·확산  
지역거점으로 육성



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## 원예작물 디지털 기술 예시

### 목표

서민 생활 민감 채소 수급 안정

\*배추, 무, 양파, 마늘, 고추 등

### 원예 분야 현장적용



배추

- 인공위성, 드론 활용 재배면적 작황 조기 예측으로 수급지원



양파

- 주산지 수확량 예측 기술 개발
- 저장, 가공, 재고량 파악 기술



사과

- 기후변화 대비 적지 작목 추천
- 신소득 작목 재배기술 개발



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## ▶ 노지 디지털농업 실증포 조성 ('21~'23)



### 노지 생육·환경 정보 디지털화 및 정책사업 연계 기반기술 개발

- ① **기반기술** : 기상·토양, 양·수분, 생육 데이터 수집·분석('21) → 생육진단, 예측모델
- ② **신규사업** : 노지 디지털농업 핵심 실용화 기술 개발('22~'31, 예타)
- ③ **정책지원** : 농식품부 노지 스마트농업 정책사업 기술지원(식량, 원예 → 특용 확대)

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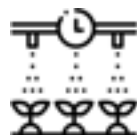


## ■ 약용작물 디지털 농업 연계 시설 현대화

장애요인 개선, 연구시스템 효율화, 안전한 연구환경 조성



비포장 농로  
콘크리트 타설  
⇒작업효율 및  
연구환경 안전 향상



통합 물관리 시스템구축  
⇒가뭄 대응  
인력을 자동관수로 대체



QR 코드 이용  
포장이력시스템 구축  
⇒과거 사업 이력  
현재 수행과제 파악



통신망 및  
기상관측시설 구축  
⇒실시간 데이터 분석,  
정확한 시험포장 기상  
환경 측정 가능

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## 3. 안전 생산 기술 개발



인삼

### ◆ 병해충 종합방제기술

- 연작장해, 병원균 진단 기술 및 종합방제기술 개발
- \* ('21) 현장접목 8개소 4.0ha → ('30) 신기술보급사업

### ◆ PLS 대응 약제저항성 곰팡이병 분석 및 관리



약용작물

### ◆ 연작장해 원인 구명 및 경감기술

- 인삼, 약초 후작물 선발, 작부체계 설정

### ◆ PLS 대응 문제병해충 농약직권등록, 친환경 신소재 선발

- 농약 미등록 약용작물 방제약제 선발 : ('20) 34작목→ ('25) 50
- *Phoma* 균 방제용 약용작물 유래 천연물 신소재 개발 : 2건('27)

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## 4. 기능성 연구



### 건기식 원료

#### ◆ 건강기능식품 기능성 원료 개발

- 유망 소재 원료 표준화, 유효성 평가, 산업화 연계
- \* 면역 강화(항바이러스 등), 정신건강(인지능 개선 등)

### 신소재 자원

#### ◆ 소비자 수요 맞춤 신규 기능성 소재 발굴

- \* 의약품(항치매), 기능성화장품(미백, 주름개선)

### 기반구축

#### ◆ 약용작물 대사체 DB 구축

- 대사체기술 활용한 원산지 판별 및 표준 분석법 개발

#### ◆ 추출물 은행 구축 및 대내외 협력체계 구축

### 기능성 증진

#### ◆ 특용작물 기능성 증진 기술 개발

- 발효, 숙성, 포제 기술 등 적용

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## 전통 의약 소재 新가치 창출 기술 개발

### 전통 지식

#### - 고문헌 처방 스크리닝

→ 전통처방의 임상적 효능 및 적응증 확대 연구

\*고문헌: 상한론, 제생방, 동의보감 등

+

### 빅데이터

#### - 대사체·빅데이터 활용 기능성 소재 개발

→ DB기반 기능성 예측 알고리즘 개발

+

#### - 세포·동물 및 빅데이터, 인공지능 결합을 통한 안전성, 유효성 예측 모델 개발

### 지역특화작목

#### - 수입원료 소재 지역특화작목 연계·차별화 기술 개발

#### - 기능성 원료 및 성분 타겟 재배기술(육종 등) 확립

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## 5. 새로운 용도 발굴

### ❖ 의료용 대마 연구 : 품종, 생산·품질 표준화

- 품종육성 : 의료용 대마 **품종육성**(CBD ↑, THC ↓)
- 재배생산 : 식물공장 시스템 적용 **대량생산 기술**
- 품질관리 : 원료 **품질 표준화** 기술



의료용 대마 품종

### ❖ 용도 다양화 : 품목 발굴, 표준화 기술

- 품목 : 울무새싹 → 대마새싹, 쌈채소, **신선소비용** 등,
- 표준화 : 실내 생산 기술, **표준화 모델** 개발



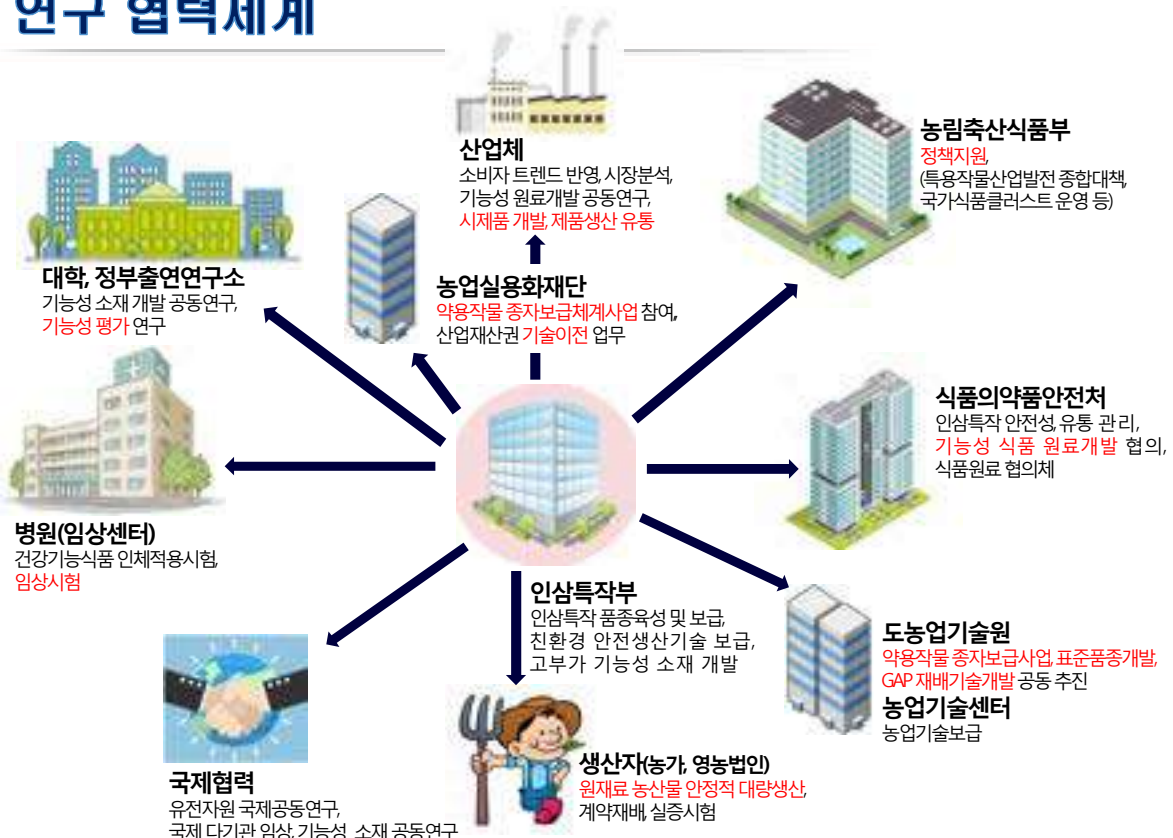
울무 새싹

### ❖ 미래 수요 발굴 : 간편식용, 도시·치유농업용 소재 등

- 식품소재 : HMR, RTD(Ready to drink)
- 체험소재 : **도시농업**(텃밭, 분화용), **치유농업**(허브)

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## 연구 협력체계



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# 디지털 브리딩 기술을 활용한 약용작물 연구

■ 양태진 교수(서울대학교)







약용식물학회 (2021.11.4, 11:30-12:05)

# 디지털 브리딩 기술을 활용한 약용작물 연구

**양태진** (tjyang@snu.ac.kr)

서울대학교 식물생산과학부

서울대학교 농림생물자원학부

BK21 농림생물자원 창의인재양성 사업단

(BK21 ABC 사업단)

서울대학교 식물유전체육종연구소



서울대학교



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3. 인삼 유전체 해독과 진화 구명



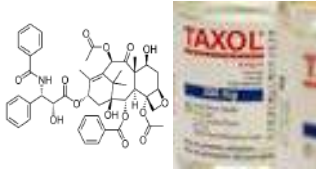
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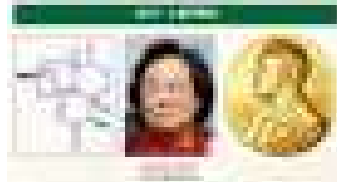
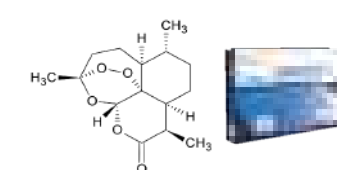
## 그린 바이오 산업

- 약용식물 유전자원을 이용한 바이오산업의 무한가치
- 암, 에이즈, 신종플루, 신종코로나바이러스 등 난제병의 극복을 위한 해법?
- 건강한 삶에 대한 염원

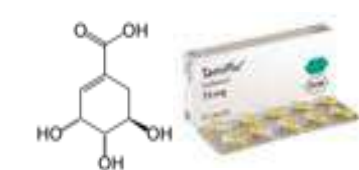
주목나무: (Paditaxel : 항암제(Taxol))



개동쑥: (Artemisinin: 말라리아치료제)



팔각회향 (Shikimic acid: 신종플루치료제)



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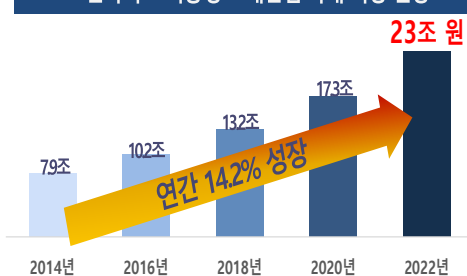
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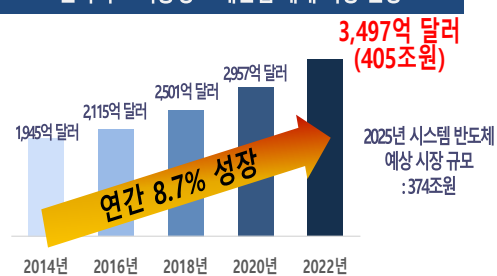
## 바이오 산업 동향

- 그린바이오 산업의 가파른 성장
- 바이오 헬스케어 소재산업→ 한국 차세대 3대 주력 산업 중 하나

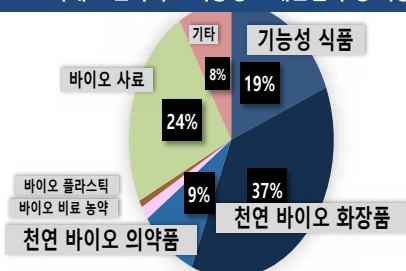
그린바이오 기능성 소재산업 국내 시장 전망



그린바이오 기능성 소재산업 세계 시장 전망



국내 그린바이오 기능성 소재산업 구성 비중



정부 주도 바이오산업 육성 계획 보도

"한방화장품 맞나요" ...국내외서 인기폭발로 화장품산업 견인

K뷰티, 부상한 청정세...싱가포르의 젊은 '스킨케어' 열풍

정부 K-뷰티 화장품산업 지원, 세계 3대 수출국가로 도약

文대통령 "바이오헬스 산업, 5대 수출 주력산업으로 육성"

정부, R&D 내년 예산 16% 증액... "바이오헬스 산업 먹거리로 키운다"

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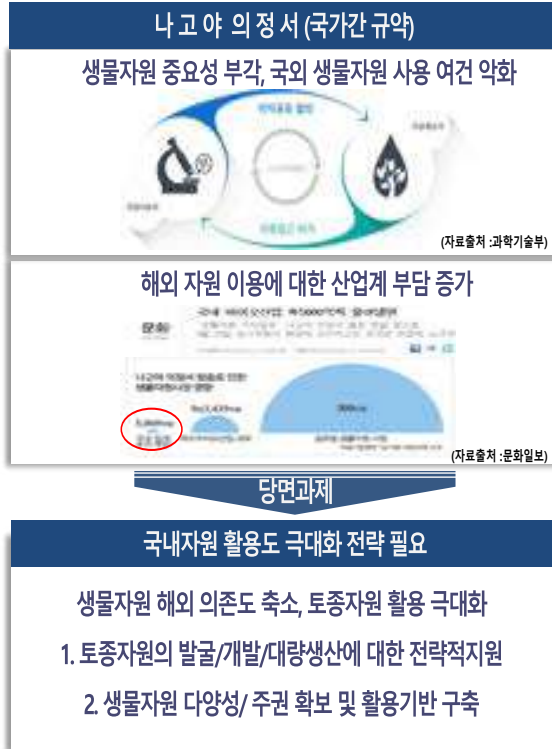
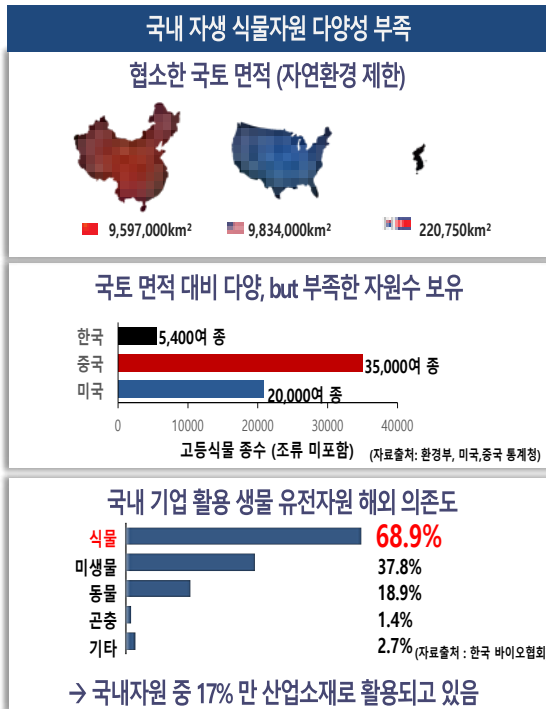


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## 나고야의정서와 국내 자원식물 개발의 중요성



## 식물자원의 종류 / 다양성 / 중요성









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3. 인삼 유전체 해독과 진화 구명

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## 식물의 유전체 특징과 종내 유전자원 다양성

### 식물의 진화와 유전체 다양성

식물의 배수체현상과 진화과정: 환경에 적응/ 유전체 다양성 형성



세포 한 개당 한 종을 구성하는 DNA 염기 개수 2011, NATURE 473

바이러스:	~20 Kbp ( ~ 2만)
척추동물:	~3,000,000 Kbp ( ~ 30억)
식물:	100,000~100,000,000 Kbp ( ~ 1,000억)

→ 식물유전체 크기는 종에 따라 1,000배 차이



*Genlisea tuberosa*  
식충식물 중 하나  
61 Mbp



*Paris japonica*  
(백합목 엘란티아과)  
샷갓식물 근연종  
150,000 Mbp

### 식물 종내 자원의 다양성

#### 인삼 자원 다양성



#### 고추 자원 다양성



#### 옥수수 자원의 다양성

Maize has more molecular diversity than humans and apes combined



1.34%  
0.09%  
1.42%



사람과 침팬지 유전정보 차이 < 옥수수 재래종 유전정보 차이

다양한 자원 보존과 활용가치 무한

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## 식물 자원의 다양성과 우수 품종 개발

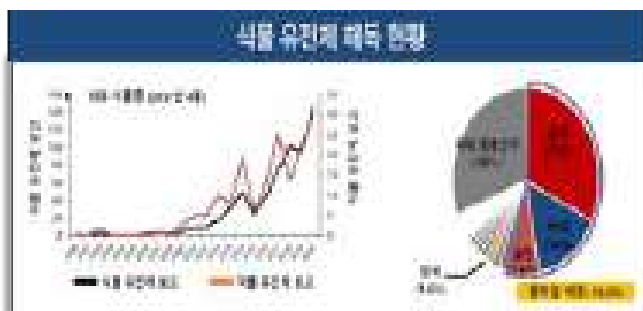


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## 유전체정보 생산과 활용 & 디지털 육종



전세계 생물 유전체주권확보 경쟁 치열

- 식물 유전체 해독 기술: 더욱 빠르고 정밀하게 진행됨
- 미국, 중국 등 유전체강국: 정부 주도 바이오 빅데이터 연구 지원 강화



**작물 육종**  
더 우수하고 균일하고 고품질 종자

**유전체기반 디지털분자육종**  
초우수 품종 단기간에 개발 가능

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## 토종 자원 활용 및 극대화 전략의 필요성

### 1. 토종 자원 발굴·개발·활용을 위한 전략적 지원



- 바이오소재에 대한 해외 식물자원의 의존도 높음
- 홍삼, 알로에, 밀크씨슬, 메리골드, 가르시니아 캄보지아, 쏘팔메토
- 토종자원을 이용한 개별인증 제품 개발 고도 성장: 72%

#### 토종자원 활용 산업 대표 사례



- 당귀, 천궁, 백작약 복합추출물  
- 면역력 증진

- 백수오, 당귀, 한속단 복합추출물  
- 여성 갱년기 개별인증

소재에 대한 바이오기업의 요구  
· 국내원료 품질 표준화와 스마트생산 확대  
· 나고야의정서 이후 국내자원 요구도 증가

토종자원을 이용한 스타 바이오제품 개발

→ 나고야의정서 대응 바이오산업 육성의 가장 모범 사례

### 2. 생물자원 다양성·주권 확보·활용기반 구축

#### 한반도 고유식물의 해외 유출 방지

· 사례: 나도송마 종자 1000립 (독일 종자회사-96 유료)

- 구상나무 (*Abies koreana* E.H.Wilson) 해외원예품종 (54종)



#### 해외 도입 식물의 활용성 극대화

· 생물다양성 협약(1992) 이전 도입 식물의 관리 및 보존 체계 수립 시급

- 대상종 활용 및 관리 확대 예) 복분자, 블랙라즈베리, 감초, 이엽우피소 등



백수오 이엽우피소

#### 국가별 식물등록현황

식물명	한국	중국
백수오	○	×
이엽우피소	×	○

- 이엽우피소는 1990년 초반부터 한국제배 → 2015년 가짜백수오 사건이후 거의 멸절  
→ 자원주권 포기? → 주권 확보 필요

## 연구성과 : 한반도 토종 약용식물 유전체, 육종, 자원개발 (인삼, 방풍, 백수오 등)

### 1. 인삼 유전체 완성/ 디지털정보구축

- 인삼유전체 세계 최초 해독, 대사회로, 생명공학 기반 조성
- 두릅, 오기피, 황칠 등 근연식물 연구 기반 제공



교훈: 한반도 식물 자원 통합 연구의 필요성 절실함

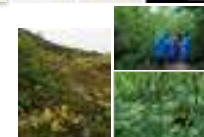
### 2. 약용식물 개발 및 유전체 해독: 식방풍·백수오·이엽우피소 등

- 울릉도, 제주도, 금오도, 연도, 남서해안 자원 수집, 개발, 유전체연구
- 대서물질, 기능성의 종내 다양성 → 맞춤형 바이오소재 개발 중요



### 3. 한반도 자원발굴, 유전체, 바코딩

- 키스트, 서울대, 한택식물원 등 공동 연구
- 기능성식물 자원 공동 발굴 및 오믹스통합연구



- 한반도 토종식물종: 8,000 종 → 기능성 식물종 발굴 (기존연구)
- 해외 자원을 대체할 수 있는 식물종 협력 개발 (다부처연구)
- 동일종내자원 다양성 → 우수소재 맞춤형식물소재개발 (요구 기술)

- 바이오소재의 유전체 빅데이터생산 및 관리를 위한 국가 지원 필요
- 우수 소재 종자개발/스마트 대량생산을 위한 부처간 협력 체계 구축



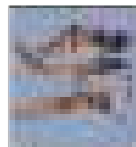
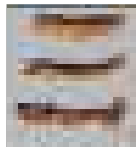
## 식방풍: 방풍나물: 갯기름나물



## 방풍 / 식방풍 / 해방풍

### 식방풍 vs 방풍 vs 해방풍

식물명: 갯기름나물 한약명: 식방풍 학명: <i>Peucedanum japonicum</i> (기름나물속)	식물명: 방풍 한약명: 방풍 학명: <i>Saposhnikovia divaricate</i> (방풍속)	식물명: 갯방풍 한약명: 해방풍 학명: <i>Glehnia littoralis</i> (갯방풍속)
--	--	---



1. 방풍나물은 한약 방풍, 갯기름나물속을 포함하지만 두종 식물이다. 방풍은 한약 방풍, 갯기름나물속이 아니다.
2. 방풍은 방풍나물속의 한약 방풍, 갯기름나물속이 아니다. 방풍은 한약 방풍, 갯기름나물속이 아니다.
3. 방풍과 갯기름나물속은 방풍나물속이 아니다. 방풍과 갯기름나물속은 방풍나물속이 아니다.

### 식방풍의 효능 (한국)



### 방풍나물의 이용

- 대한민국 (한국)
- 이른 한약 방풍의 대용품으로 이용
  - 한약 갯기름나물의 잎을 이용한 음식 (한국) 및 한약으로 활용





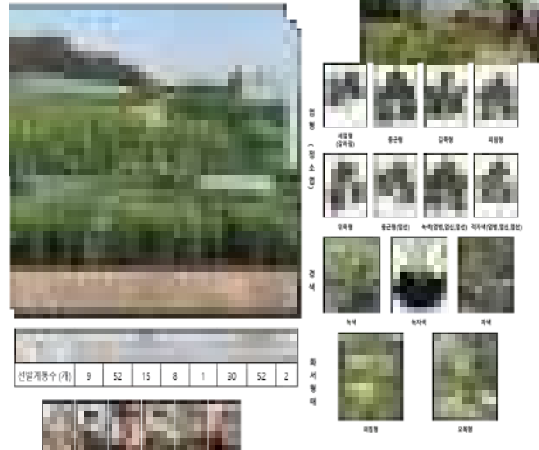
## 식방풍 자원 수집 및 유전체 육종

### 갯기름나물의 분포



### 식방풍 자원 수집 및 우수계통 육성

- 식방풍 자원 수집 및 우수계통 육성: 300계통 이상
- 울릉도, 제주도, 금오도, 연도, 남서해안 등 자원 수집 계통 육성



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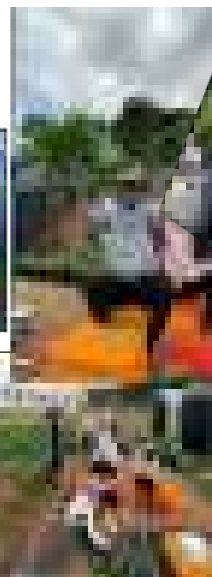


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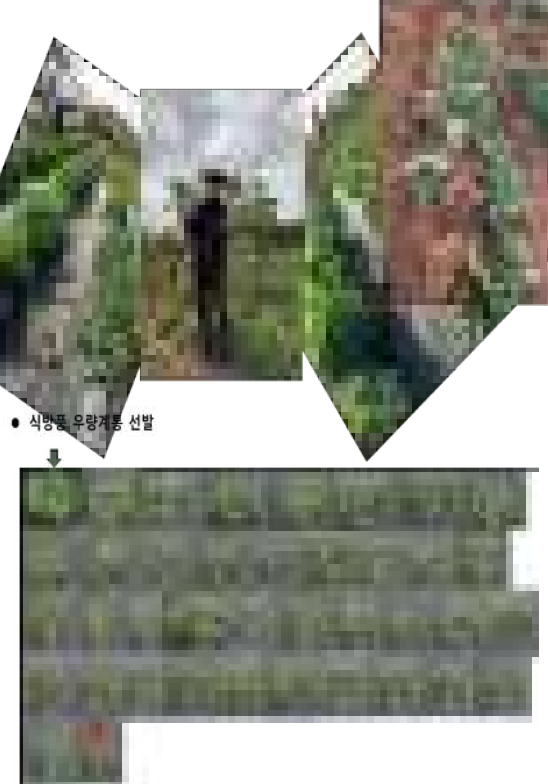
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## 우수 식방풍 계통 개발

- 식방풍 우량계통 육성 형질 조사
- 지상부 잎 생육
- 지하부 뿌리 생육



- 식방풍 우량계통 선발



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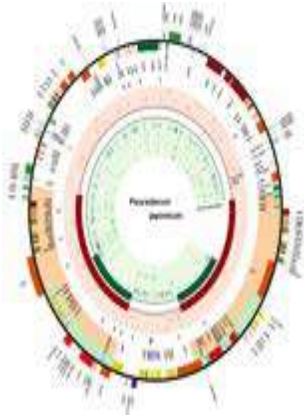
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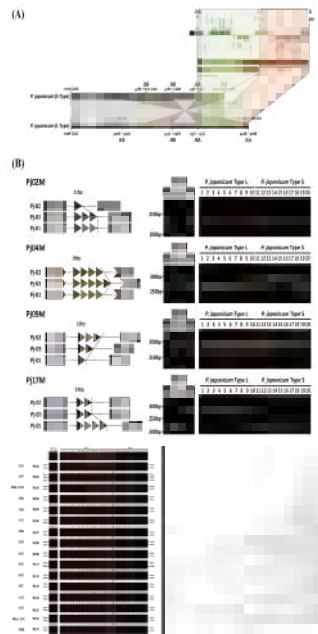


## 우수 식방풍 계통 육종을 위한 분자육종 시스템 구축

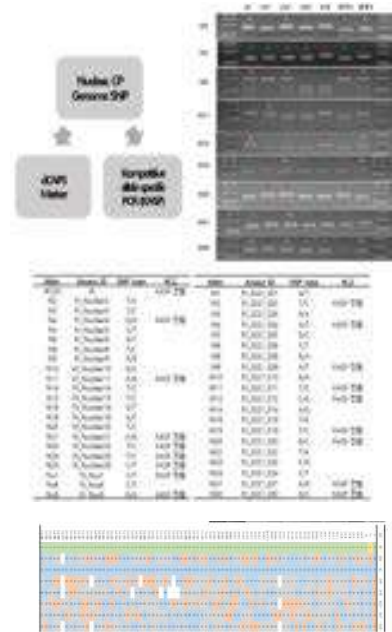
<식방풍 10계통 엽록체 게놈 완성 비교>



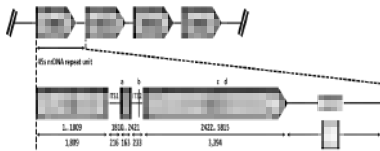
<엽록체 유래 다양성 분자마커 개발>



<핵 게놈 유래 다양성 분자마커 개발>



<식방풍 10계통 rDNA 완성 비교>



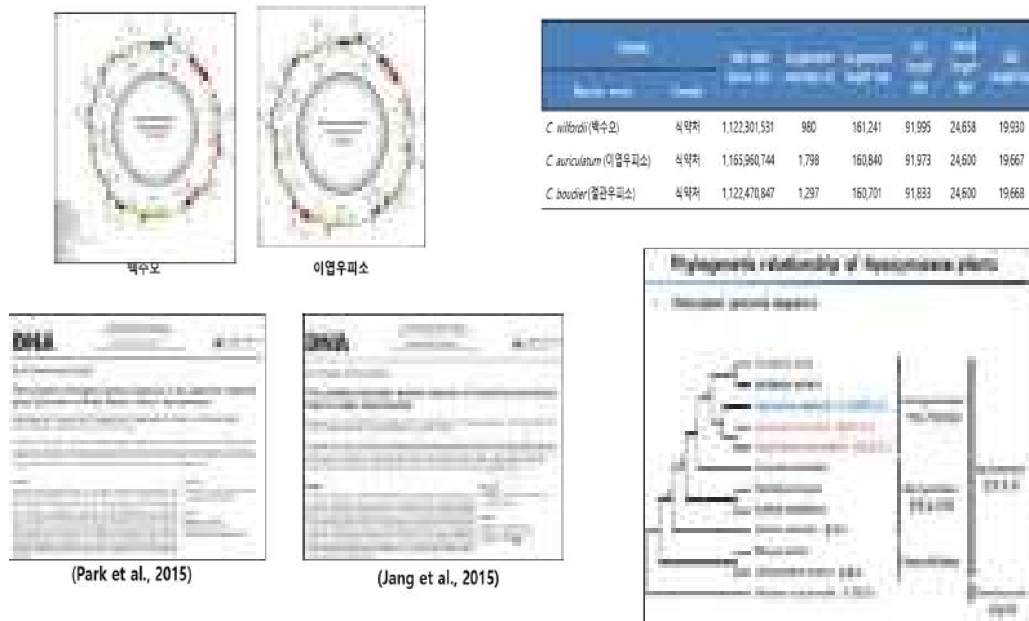
## 백수오 유전자원 수집과 육종: 자원 재배





## 백수오, 이엽우피소의 엽록체 유전체 연구

- 백수오, 이엽우피소의 엽록체, 미토콘드리아 완전장을 확보함

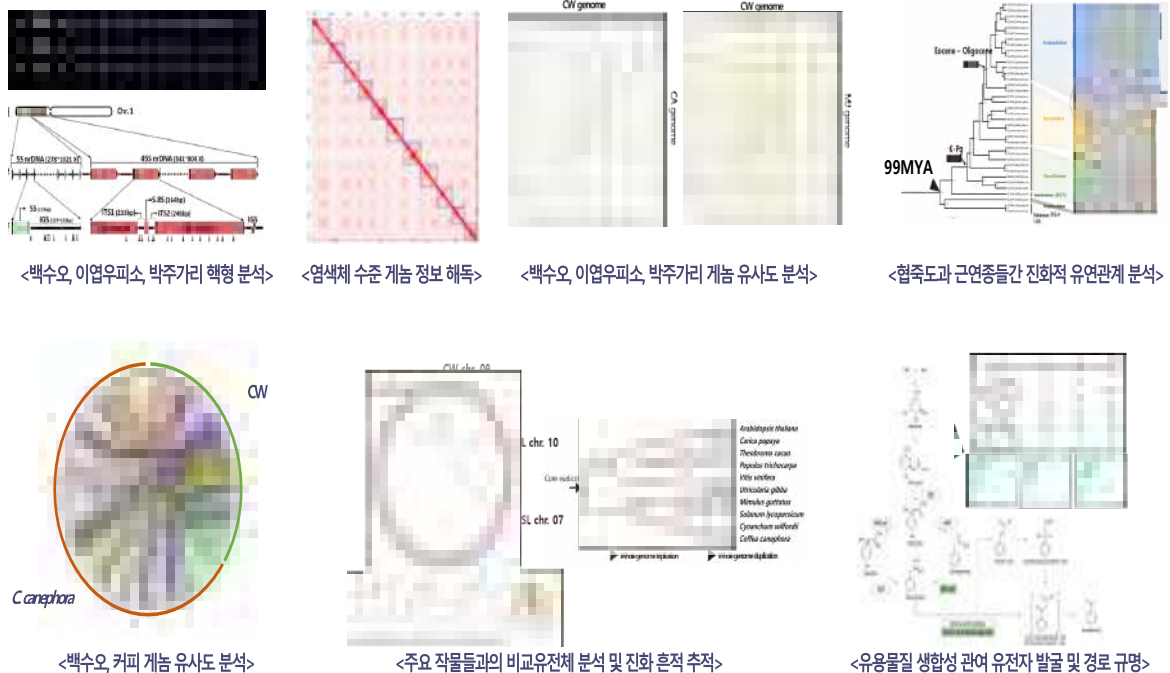


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## 백수오, 이엽우피소, 박주가리 게놈 프로젝트 진행



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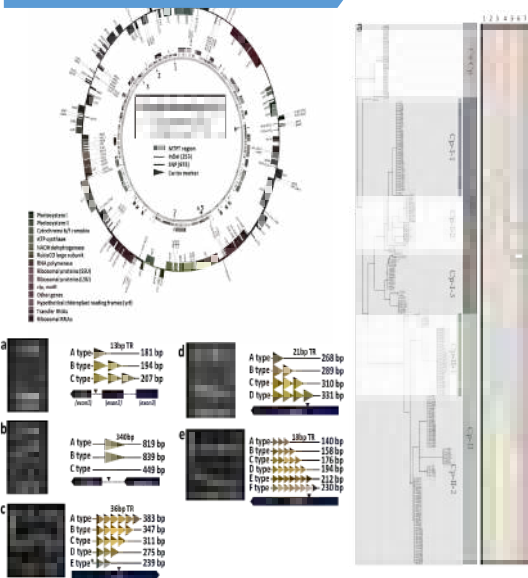
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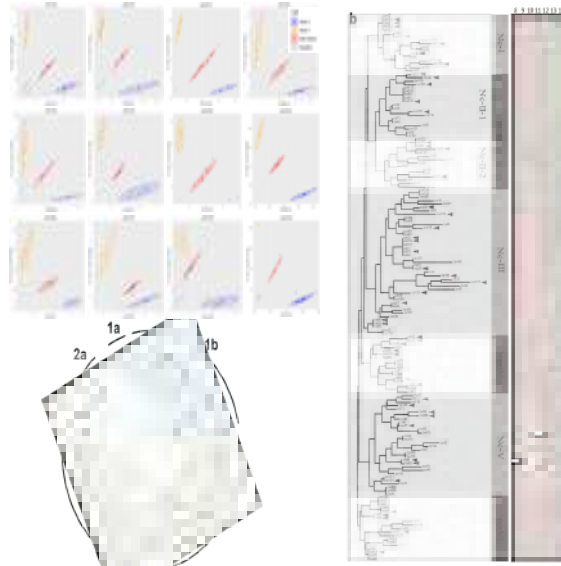
## 백수오 품종 육종을 위한 분자유종 시스템 구축



### 엽록체 게놈 유래 분자 마커 개발

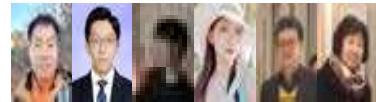


### 핵 게놈 유래 분자 마커 개발



41 CW with 18 number of markers resulted into 0.398 observed heterozygosity

## 우수 백수오 자원 및 품종개발





## 영월에서 발견된 거대 백수오의 유전체 해석과 자원 주권(2021. 3월)



**축약학유체의 활용/동향**

1. 축약학유체의 활용/동향

2. 축약학유체의 활용/동향

3. 축약학유체의 활용/동향

**백수오 연구정보**

1. 백수오의 정의 및 분류

2. 백수오의 생장 환경

3. 백수오의 성분

**백수오의 자원 주권**

1. 백수오의 자원 주권

2. 백수오의 자원 주권

3. 백수오의 자원 주권

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## 누명 벗고 부활하는 백수오 산업



2020. 12. 21. 매일경제

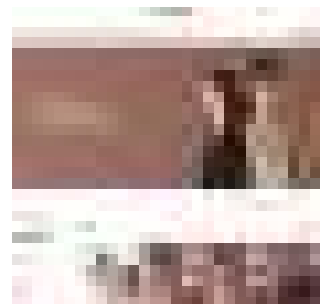
**진짜 백수오, 다중 유전자 분석법으로 구별한다**

백수오의 진위 판별이 중요해지면서, 다중 유전자 분석법이 주목받고 있다. 이 방법은 백수오의 유전적 특성을 분석하여, 진짜 백수오와 가짜 백수오를 구별할 수 있다.

백수오의 진위 판별은 백수오의 유전적 특성을 분석하는 것이다. 백수오의 유전적 특성은 백수오의 생장 환경, 생장 기간, 생장 방법 등에 따라 달라진다. 따라서, 백수오의 유전적 특성을 분석하여, 진짜 백수오와 가짜 백수오를 구별할 수 있다.

백수오의 진위 판별은 백수오의 유전적 특성을 분석하는 것이다. 백수오의 유전적 특성은 백수오의 생장 환경, 생장 기간, 생장 방법 등에 따라 달라진다. 따라서, 백수오의 유전적 특성을 분석하여, 진짜 백수오와 가짜 백수오를 구별할 수 있다.

2020. 12. 22. 중앙일보



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## Contents

1. 그린바이오산업의 전망
2. 약용식물 유전체 연구와 분자유종 기술개발
3. 인삼 유전체 해독과 진화 구명



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## 인삼 유전체 해독 및 분자유종 기반 구축

### 인삼(Panax ginseng)

Araliaceae family (두릅나무과)  
- 15 genera, 1500 species  
Panax genus (인삼속)  
- "Panax": Pan(all) + Axos(cure)  
= 만병통치(萬病痛治)  
cure all disease

- 유전적인 연구가 어려운 이유:
  - 긴 세대 (세대당 4년)
  - 적은 종자량 (개체당 40립)
  - 유지의 어려움
- 연구 의의: 최고 약용식물의 유전체 분석
- 유전체 서열 분석을 통해 알고자 하는 것:
  - 유전체의 구조
  - 음지식물의 생화학적 특징
  - 느린 성장 & 장수의 비밀
  - 약효의 숨은 기작
- 유전체 정보를 이용한 육종



### 벼 vs 인삼

		
벼	인삼	Human
표본 모델 작물	대표적인 약용식물	
빠른 성장 (4 ~ 6개월)	느린 성장 (4 ~ 6년)	
염색체 수(n) = 12개 = 0.4Gbp	염색체 수(n) = 24개 = 3.6Gbp	22+2 3.2Gbp

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## 인삼의 유전체 해독 및 진화

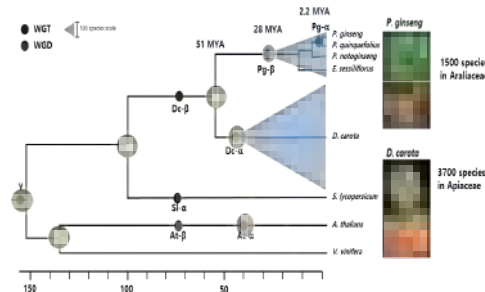
### 인삼의 유전체정보

- Statistics of draft sequence V1.0  
(<http://ginsengdb.snu.ac.kr/>)

### 인삼의 사배체 기원 규명



### 인삼의 진화 과정



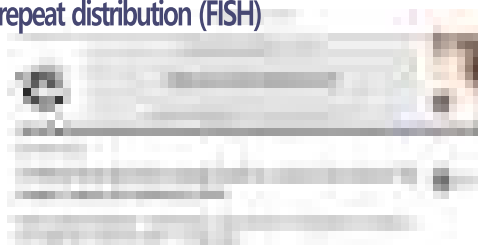
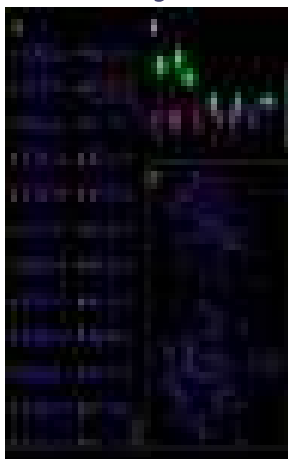
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## 인삼의 고해상도 염색체 구조 규명

- Defining of 24 chromosomes based on repeat distribution (FISH)



Five color FISH: PgDel1, PgDel2, PgTRb, PgTRa, telomere

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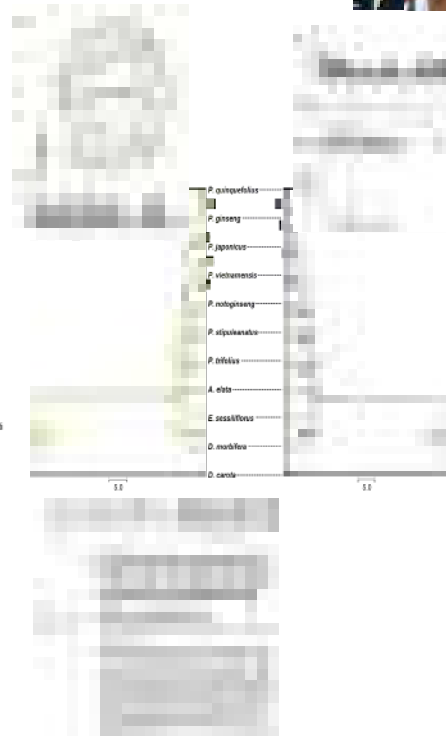
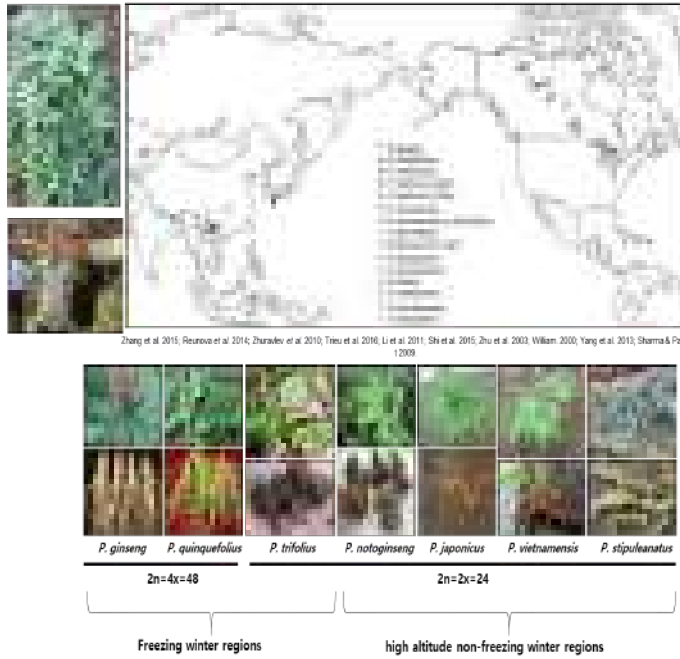
(Nomar *et al.* 2012 Comp Cytogen; 2017 JGR)LAB OF  
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## 인삼 근연종 식물의 세계 분포와 진화관계

### 인삼과 근연식물의 분포



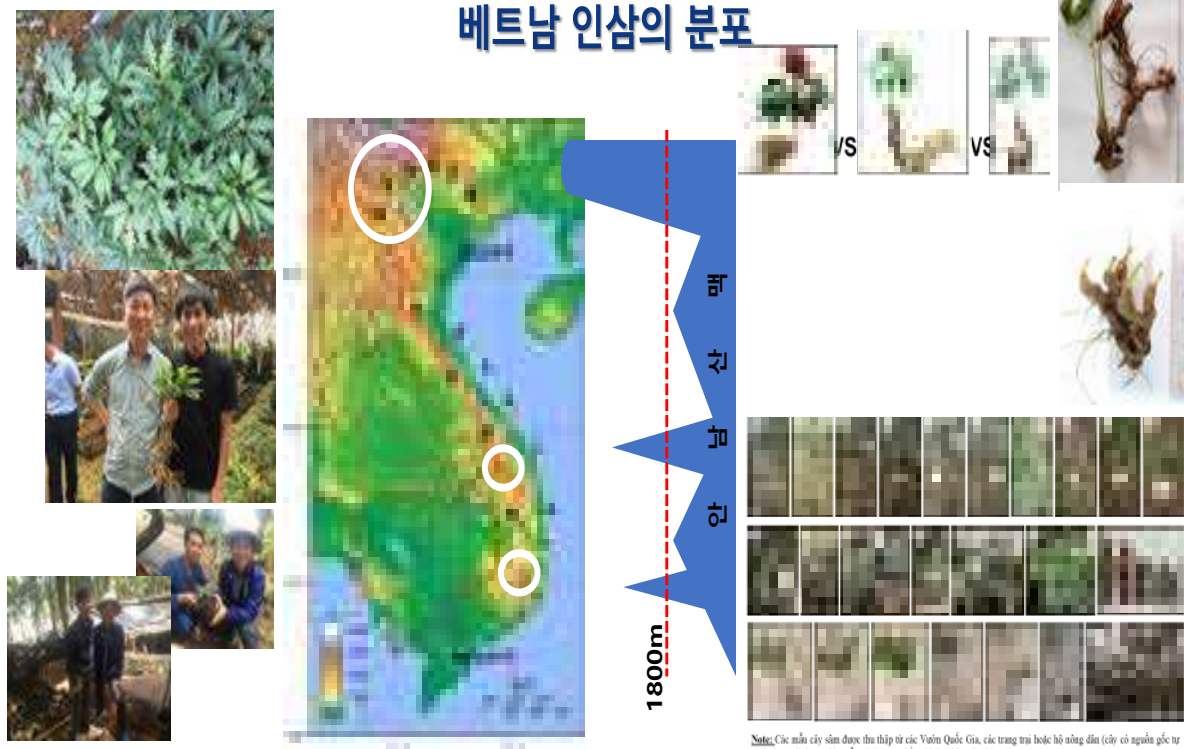
Kim et al. Scientific Reports (2017)



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## 베트남 인삼의 발견과 진화

### 베트남 인삼의 분포



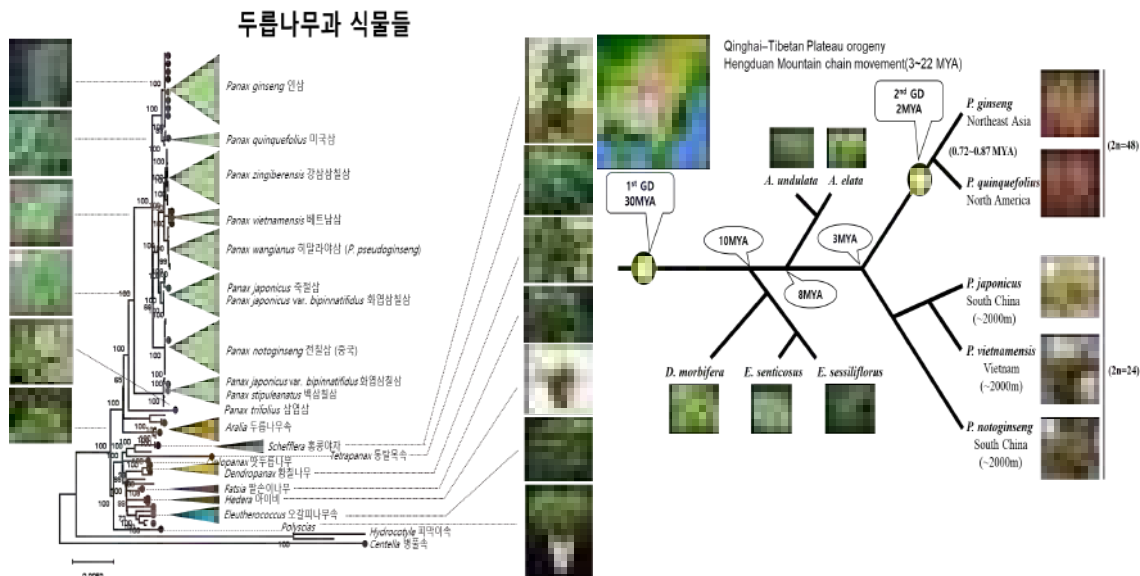
Note: Các mẫu cây sâm được thu thập từ các Vườn Quốc Gia, các trang trại hoặc hộ nông dân (cây có nguồn gốc tự nhiên hoặc di thực). Các mẫu củ được phân tích theo nguyên tắc tương tự.



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## 두릅나무과 (인삼과) 식물의 유전체 해독 및 진화 구명

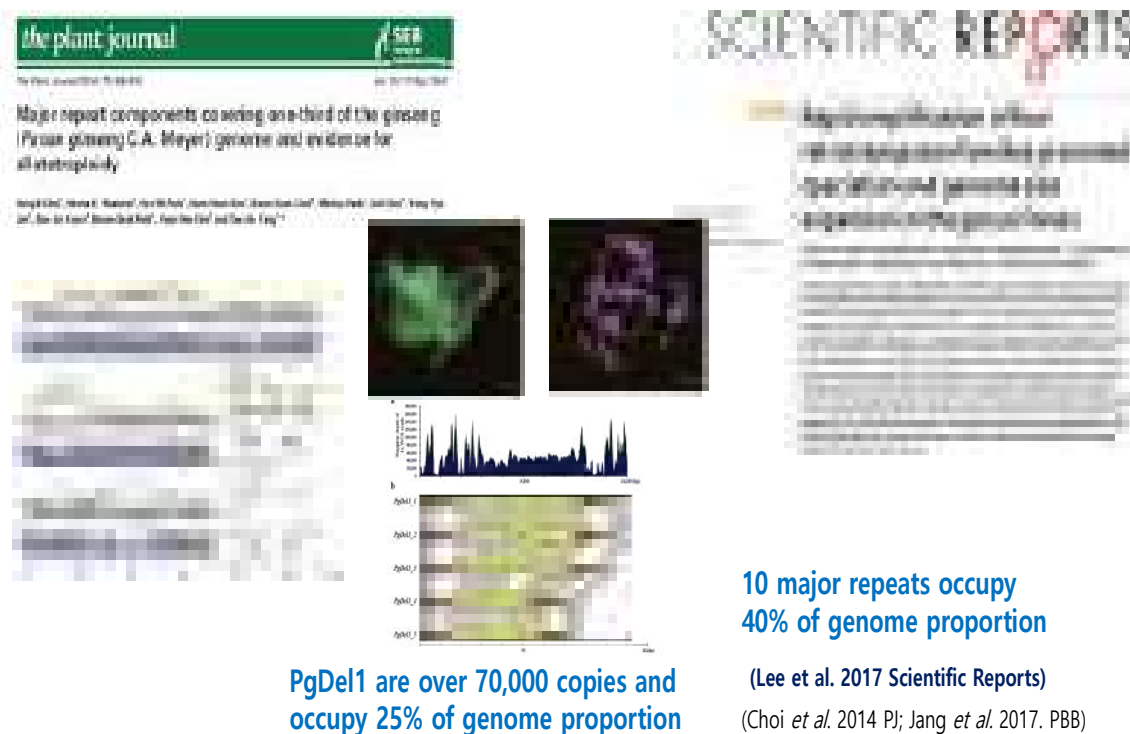


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## 인삼의 유전체 크기의 역동적 변화: TE (트랜스포존)



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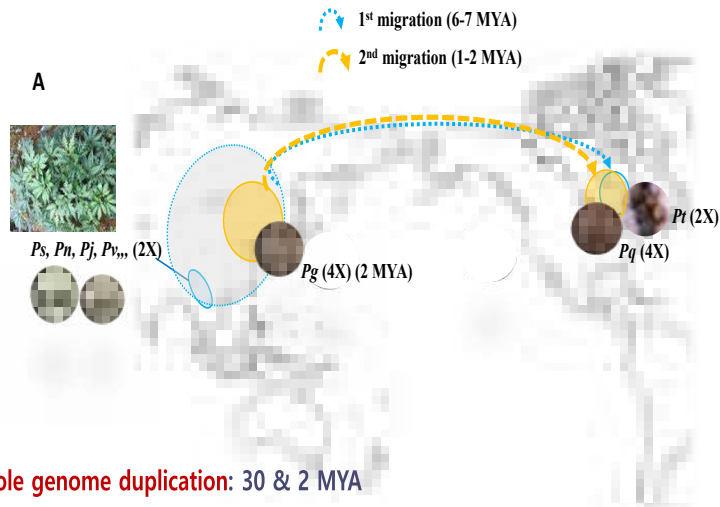
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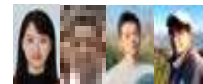
## 인삼 유전체 해독을 통해 본 인삼 종의 세계적 분포

### 인삼과 근연식물의 진화와 지리적 분포



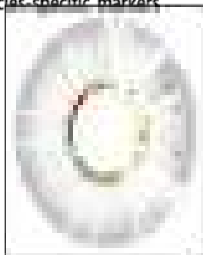
- 두번에 걸친 **whole genome duplication**: 30 & 2 MYA
- Panax 속 식물들의 **내음성화**(shade tolerance)
- 최근 이질배수체화로 **윌동** 가능해짐
- 두번에 걸친 **대륙간 이동**: 6 & 1 MYA
- PgDel retrotransposon families와 같은 TE의 급격한 증가로 Panax 속 식물들 간의 **유전체 크기 다양성과 종분화 가속**

## 인삼 유전체 해독 및 분자육종 기반 구축

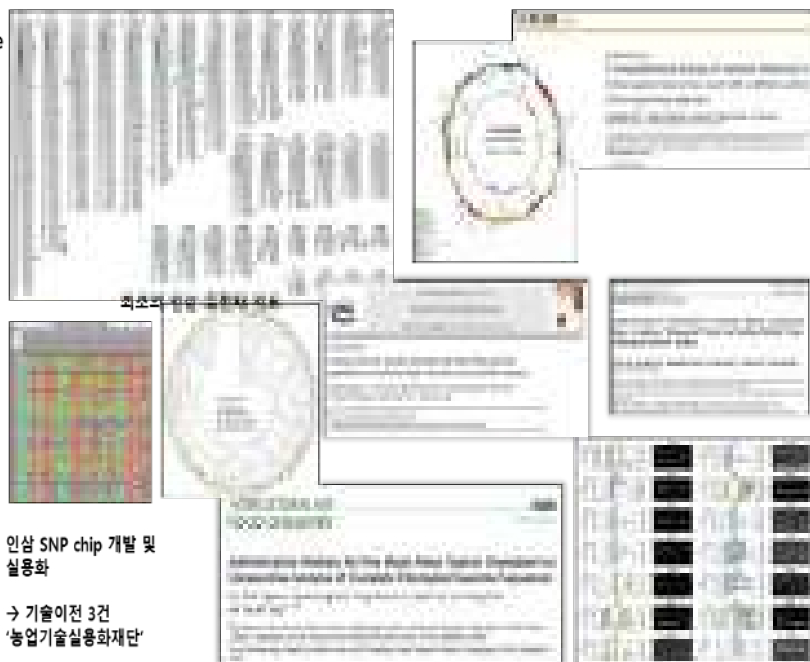


### 인삼 유전지도 및 유전체정보 이용 실용적 분자표지 및 분자육종 선발기술 개발

- 18 SNP dCAPS markers
- 1,783 SNPs in whole chloroplast genome
- 1,128 SNPs in CDS regions
- Species-specific markers



→ Escape the cp-mt genome flux



인삼 SNP chip 개발 및 실용화

→ 기술이전 3건  
'농업기술실용화재단'



## 인삼 유전적 다양성 및 품종 개발

특정 제품에 적합한 명품 품종 개발 및 적용



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Introduction

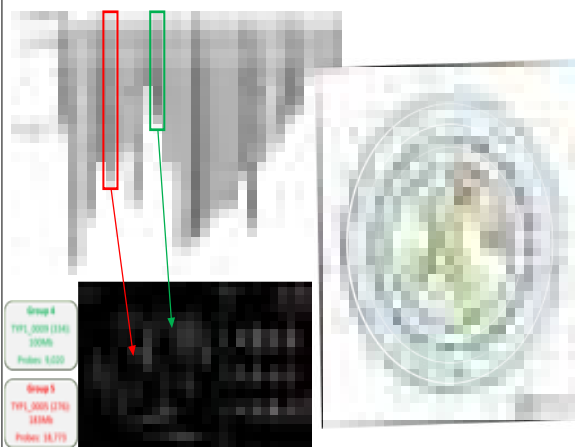
Chapter 1

Chapter 2

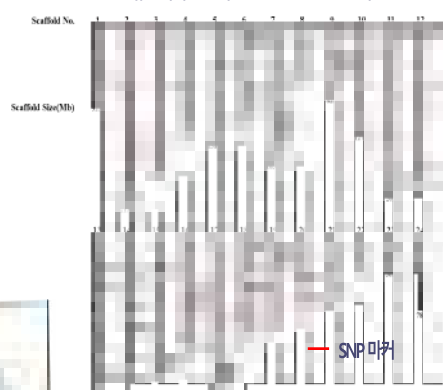
Chapter 3

Conclusion

## 인삼 유전체 해독 정보를 이용한 첨단 분자유종 기반 구축



유전체에 고르게 분포한 9696 SNP 칩 개발



- 인삼 유전체 해독 및 염색체 전반을 대변하는 고품질 SNP 칩 개발
- 다양한 인삼자원의 SNP 칩 적용
  - 인삼 품종 및 250개 인삼 계통 x 2개체
  - 국내 및 국외 수집 자원 (약 250 개체)

▶ 인삼 자원 유전자형 DB 및 분자유종 체계 구축

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Introduction

Chapter 1

Chapter 2

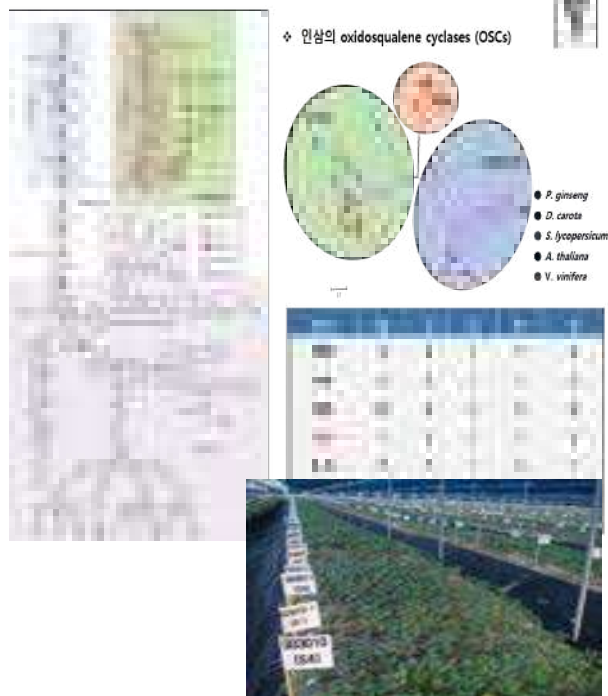
Chapter 3

Conclusion



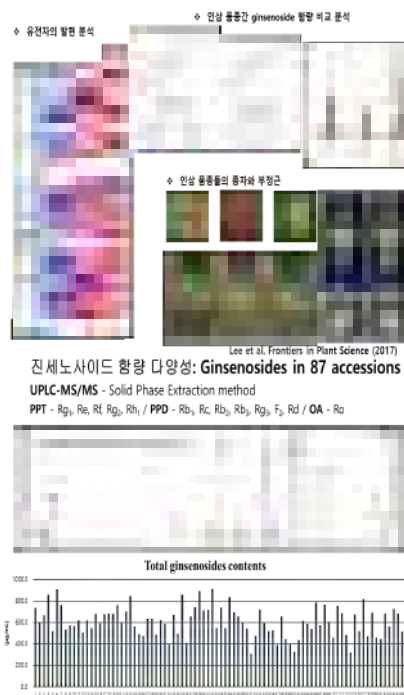
## 인삼의 진세노사이드생합성 회로 구축 및 유용 유전자 발굴

### 인삼의 Ginsenosides의 생합성 경로



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## 인삼 품종간의 Ginsenoside 함량과 관련 유전자 발현 차이



➤ Ginsenoside content from 87 accessions are different (310.0~912.3  $\mu\text{g/mL}$ )

- The ratio of PPT-type and PPD-type ginsenosides is variable

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# Contents

## 종합 제언



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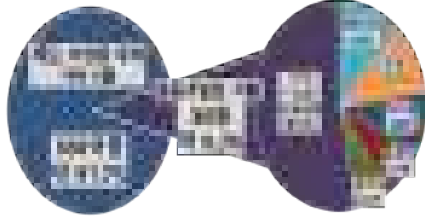
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## 식물 유전자 바코딩 및 활용 기술

한국의 약용식물 우수 품종 개발 미흡

- 국내생산 약용작물 700여종 중 90% 이상이 채집 or 야생종 재배
- 약용식물 58종 품종 개발 → 대부분 특정 종에 치중
- 약용작물 품종의 부재 → 규격화된 재배 및 품질관리가 어려움



<국내 생산 약용식물 대비 품종화 식물 수> <국내 약용작물 품종등록수 및 분포>

출처 : 국립종자원, Wikipedia 정보를 재구성함



2016, 2018 Int'l conference for Plant Barcoding  
(December, 2018, Hongkong)

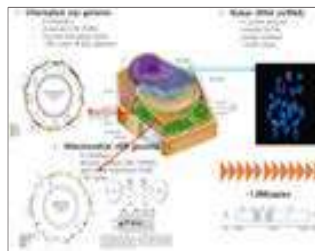
TTAGAGATACTAATA  
CCCTACCCAGTCCAT  
CTGGAAATCTTGGTT  
CAAACTCTTCGCTAC  
TGGGTAAAGATGC  
TTCTTCTTGCATTTA  
TTACGATTCTTCTC  
CACGAGTATTGTAAT



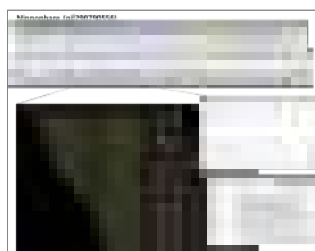
DNA barcoding

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약용작물 판별법: DNA barcoding 기술 개발

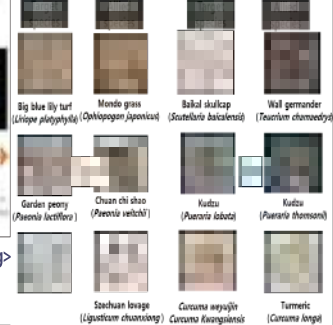


<유전체의 특정 부위를 사용하는 DNA barcoding>

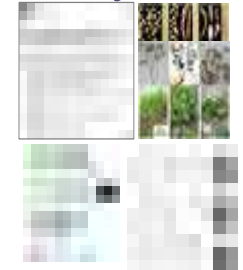


<소규모 유전체 분석을 위한 자체 개발 dnlCW 기술>

<각종 유사 한약재: 100개 이상>



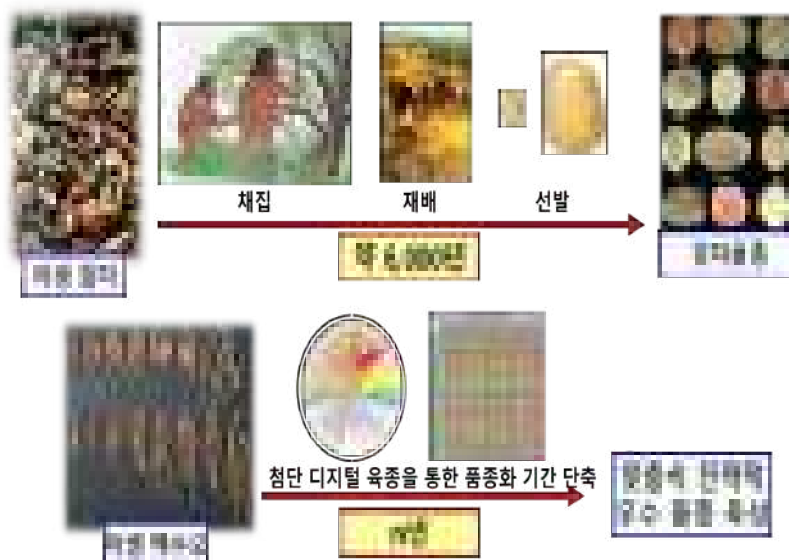
DNA barcoding 대표 사례: 방풍



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## 종합제언:



유전체 연구

식물의 기원 및 진화 구명  
생명공학의 기반  
더 우수한 종자 개발

그린바이오산업의 발전

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## Thank you



Funded by TAGC, PMBC (Next-Generation BioGreen 21);  
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박사연구원: Pappu, 유홍섭(농장)

농장 연구원: 최화춘, 박세원, 변찬우

박사과정: 조호준, Linh, 구현진, 이세현, 심현아, 박영상, 조우현, 김진태, 이연정

석사과정: 김지석, 김은비, 정용혁, 정선희, 이민영

Phyzen Genomics Institute: 이상춘, 김남훈, 이현오, 이준기

Sahmyook University: 김현희, Nomar Espinosa Waminal

서울대약대 故 성상현, 진영원, 서울과학기술대학교 김지연, 대검찰청 유전자검사와









## 2부

# 학술강연

좌장: 마경호 박사  
(국립원예특작과학원)







# 약용작물 미래전략 대응 산업화전략

■ 이용욱 소장(내츨엔도텍)









# 약용작물 미래전략 대응 산업화전략

(주)내츄럴엔도텍  
이용욱

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## 차례

1. 약용작물 현황
2. 약용작물 수요
3. 건강기능식품 산업현황
4. 건강기능식품 관련 국내외 환경변화
5. 우리나라 식품 소재 산업의 강점
6. 건강기능식품 개발동향
7. 건강기능식품 개발전략
8. 건강기능식품 개발 성공사례
9. 약용작물 수급 안정화 방안
10. 결론

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## 1. 약용작물 현황

- 약용식물
  - 생약의 원료가 되는 식물 (약초)
  - 목본, 초본, 균류
  - 건조, 가공 및 추출물로 사용
- 약용식물의 종류
  - 균조식물 : 해대, 복령
  - 태선식물 : 이끼류
  - 껍류식물 : 석위, 해금사, 관중
  - 종자식물 : 약초의 80~90%
    - 목본류 : 교목, 관목, 아관목, 등본
    - 초본류 : 1년생, 2년생, 다년생 및 만성초본

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## 1. 약용작물 현황

- 작물 : 인간이 이용하기 위하여 인위적으로 재배하는 식물
  - 식용작물, 공예작물, 사료작물, 비료작물, 원예작물, 약용작물
  - 과거 소규모 생산 및 야생채취에 의존 -> 대규모 재배단지에서 대량생산
- 약용식물(농림축산식품부, 2012 특용작물생산실적)
  - 한반도 자생 식물종 4,600종
  - 국내 약용 식물 2,100종
  - 국내 약용작물 55종

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## 2. 약용작물 수요

- 전통의약품
  - 전통의약품(한약)은 장기간 경험과 연구에 의하여 효과 증명된 전통 약초지식의 결정체
  - 동의보감, 향약집성방, 방약합편, 본초강목 등 각종 한의서로 정리되어 있는 전통지식
  - 과거 중국, 일본, 대만 등의 동아시아와 필리핀, 베트남, 타이, 인도네시아 와의 교류를 통하여 전통 약초와 요법이 전파되었음
  - 현재는 유럽, 인도, 중동, 아프리카, 북중미 등의 전통 의약품과 약용식물 들이 국제 교류에 의하여 이용가능함
- 천연물의약품
  - 전통 의약품 또는 약용식물로부터 현대 과학적 연구방법에 의하여 개발된 의약품
  - 효능성분의 연구와 분리정제에 의하여 효능과 안전성을 향상시킴
  - 택솔(주목 유래), 타미플루(팔각회향 유래), 스티렌정(강화약쑥 추출물), 조인스정(위령선, 괄루근, 하 고초 추출물)

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## 2. 약용작물 수요

- 식품/건강기능식품
  - 식약동원(食藥同原) : 음식에서 얻는 힘은 약에서 얻는 힘의 1/2 이상임
  - 약초 및 약용식물은 과거로부터 식재료로 이용되어 왔음
  - 식재료로 이용되는 약용식물의 범위와 형태가 확대되고 있음 (새싹채소)
  - 한약처방으로 부터 유래한 약선요리의 확산
  - 건강의 유지 및 질병의 예방을 위하여 식재료 및 약용식물로부터 건강기능성을 연구 개발하여 건강기능식품으로 제조
  - 평균수명 연장 및 고령화로 인하여 건강기능식품의 수요 증가
  - 건강기능식품 시장 확대에 따라 원재료인 약용식물의 홍삼, 참당귀, 헛개열매, 천궁, 백출, 백수오 등의 수요 증가

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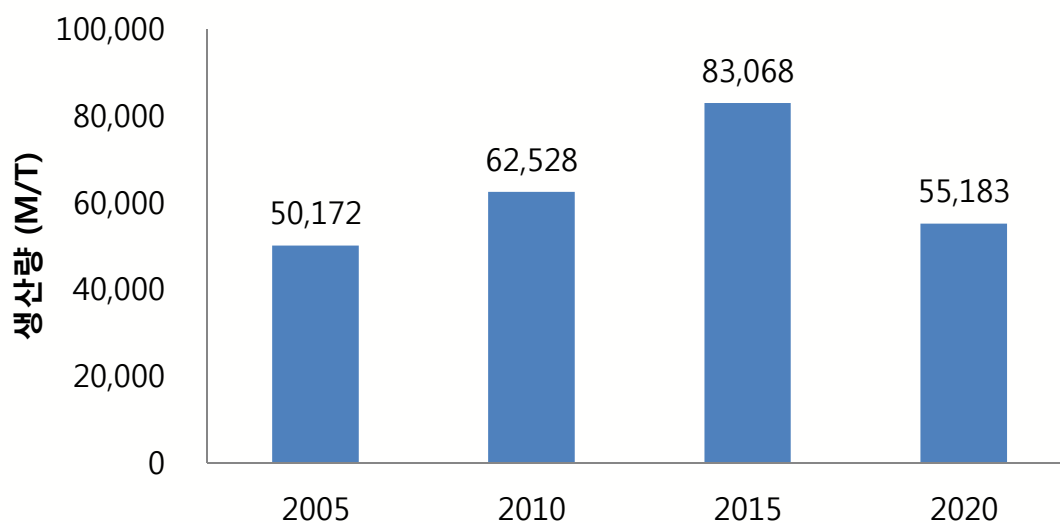
## 2. 약용작물 수요

- 한방화장품
  - 전통의약에 근거한 한방 화장품이 대중화되어 출시되었으며 국내 뿐만 아니라 해외에서 각광받고 있음
    - 설화수(아모레퍼시픽), 수려한(LG생활건강) 등
  - 화장품 소비 트렌드가 이너 뷰티로 확장됨
  - 이너 뷰티는 먹는 화장품으로 체내에서부터 건강한 피부를 가꾼다는 개념으로 화장품이 식품과 의약품으로 영역으로 확장됨
  - 식품회사와 제약회사가 이너 뷰티 개념을 도입한 제품을 출시하여 한방화장품의 가치가 상승함
  - 한방화장품은 해외에서도 인기를 얻고 있으며 소규모 화장품 회사들의 경우 해외매출이 크게 증가함
  - 국내 화장품 시장은 경쟁이 치열하여 새로운 소재를 이용한 제품의 개발요구가 증가함으로써 기존의 약용식물 뿐만 아니라 민간요법 약초 및 식물자원에서부터 개발한 신소재가 화장품으로 출시되어 국제 경쟁력이 크게 향상됨

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## 2. 약용작물 수요

국내 약용작물 생산량

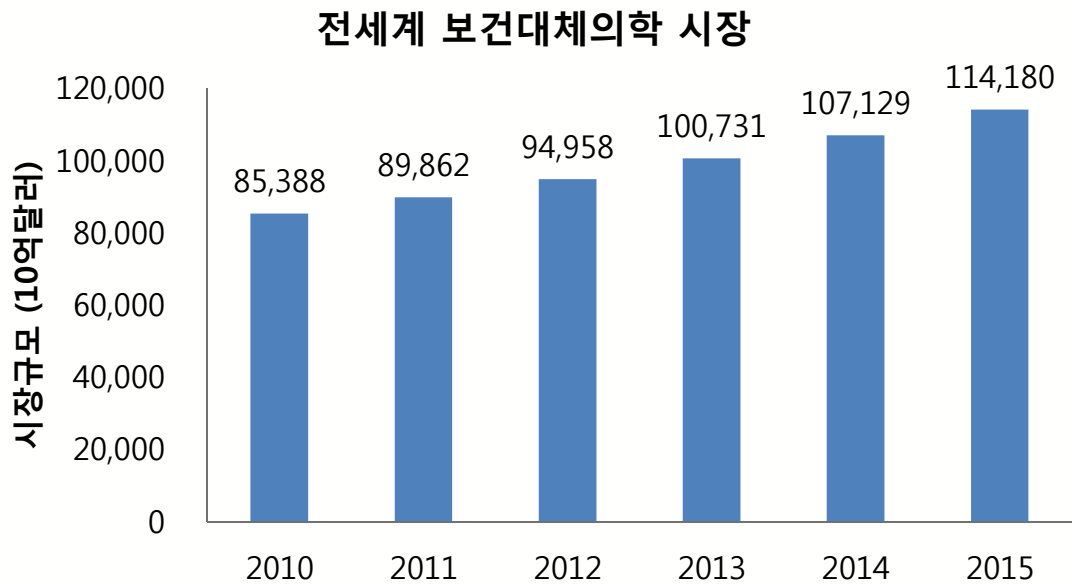


2020 특용작물생산실적, 농림축산식품부, 2021

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## 2. 약용작물 수요



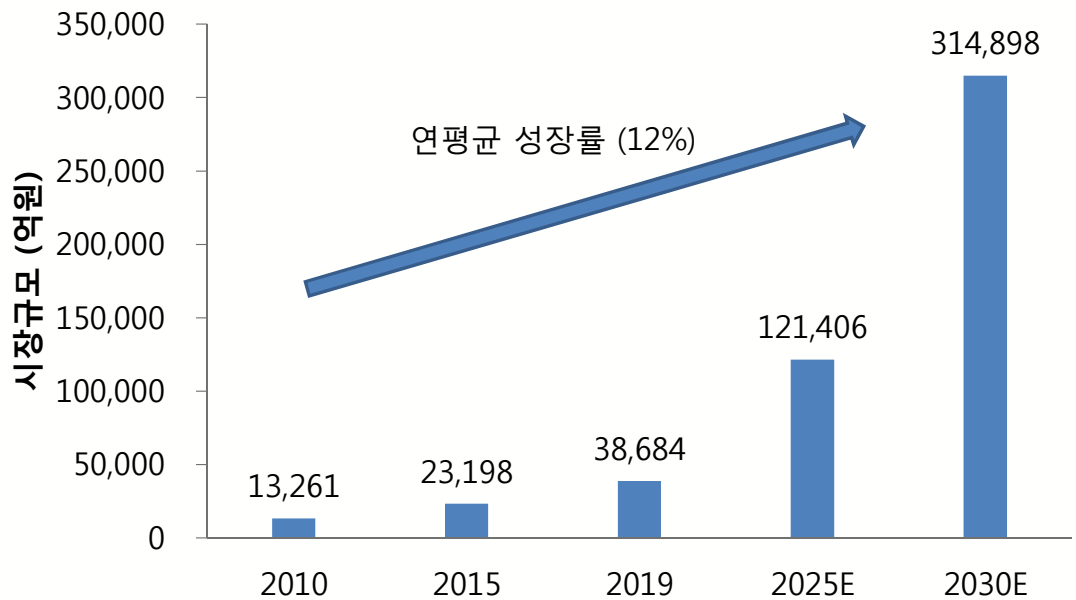
세계 보완대체의학 시장 현황 및 전망 연구보고서, 한의학연구원, 2007 <sup>9</sup>

## 3. 건강기능식품 산업현황

- 2019년 국내 건강기능식품 시장은 3.8조원으로 전년대비 11% 증가
- 최근 5년간 건강기능식품 연평균 성장률은 12%로 제조업 성장율 (3.9%) 대비 높은 성장세를 보임
- 전세계 건강식품 시장규모는 2020년 1500억달러에 달할 것으로 예상되며 연평균 6% 성장할 것으로 예상됨
- 국내외 시장규모가 성장에 따라서 국내 농업생산액 파급효과는 2021년 351억원에서 2030년에는 4,273억원으로 증가할 것임 (기능성식품 경제적 효과 분석 및 수출확대 방안 조사, 농촌경제연구원, 2021)

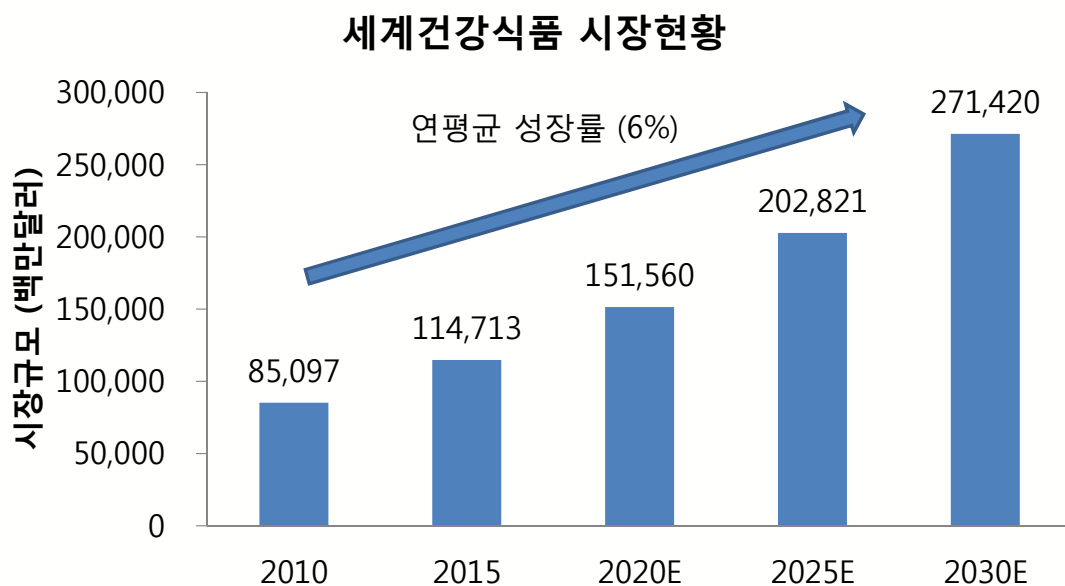


### 3. 건강기능식품 산업현황



국내산업현황, 건강기능식품 협회<sup>11</sup>

### 3. 건강기능식품 산업현황



제외국산업현황, 건강기능식품협회<sup>12</sup>



## 4. 건강기능식품 관련 국내외 환경변화

- 한국 문화의 세계화 진행 중
  - K-pop
  - K-entertainment
  - K-culture
- 한국 식문화에 대한 관심집중
- 한국 식품산업/건강기능식품산업의 기회 요인

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## 4. 건강기능식품 관련 국내외 환경변화



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## 4. 건강기능식품 관련 국내외 환경변화



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## 4. 건강기능식품 관련 국내외 환경변화



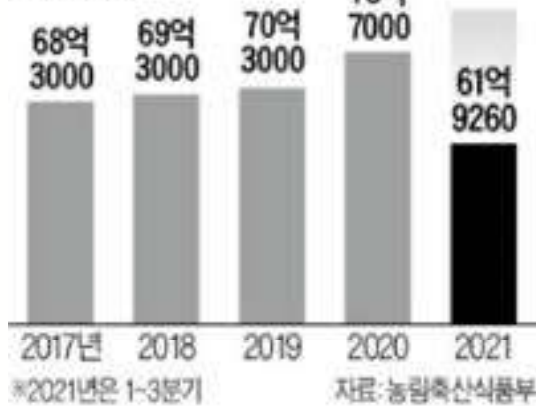
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## 4. 건강기능식품 관련 국내외 환경변화

### 늘어나는 농식품 수출액

(단위:만달러)



### 비비고 만두 주요국 수출액 및 해외 생산기지



### CJ제일제당 국내외 만두 매출(4억자가 환산) 및 글로벌 매출 비중

단위: 억 원

	2015년	2016년	2017년	2018년	2019년	2020년(전)
만두 매출	3,071	3,871	5,368	6,600	8,680	10,300
국내 매출	1,790	2,210	3,490	2,910	3,160	3,600
글로벌 매출	1,240	1,660	2,810	3,690	5,520	6,700
(%40% 환)	(41.7%)	(42.9%)	(47.6%)	(55.9%)	(63.5%)	(65%)

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## 5. 우리나라 식품 소재 산업의 강점



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## 5. 우리나라 식품 소재 산업의 강점

- 식품산업 : 국가/민족의 고유한 문화의 일부
- 한국의 식문화
  - 한상차림 : 다양한 맛과 고른 영양 섭취
  - 다양한 조리법
  - 발효식품
  - 식약동원
  - 자연에서 얻어낸 제철 재료
  - 향토음식 : 지역의 특색에 맞게 발달
  - 다양한 양념과 고명

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## 5. 우리나라 식품 소재 산업의 강점

- 건강기능식품 소재의 다변화
  - 자생식물 4,200여종 / 약초 1,000종
  - 한국 식문화로부터 비롯된 다양한 소재의 식습관을 보유
  - 다양한 제철 채소
  - 곡물 (쌀, 보리, 밀, 귀리 등)의 새싹소재
  - 발효식품에서 유래한 유산균과 유익균
  - 김치의 항코로나 연구 (독일)
  - 고추장의 다이어트효과 (??)

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## 6. 건강기능식품 개발동향

- 맞춤형 건강기능식품
  - 개인 영양건강 서비스 이용
    - 소비자 의뢰 유전자 분석 : 비만/대사증후군, 미용, 영양대사
    - 피부진단기기
    - 대사체 분석
    - 모발검사
    - 장내미생물 검사
  - 해외사례
    - 건강진단과 건강기능식품 제공
    - 건강진단과 영양/생활서비스 및 건강기능식품 제공
    - 건강진단과 영양/생활서비스 제공

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## 6. 건강기능식품 개발동향

- 기능성표시 식품
  - 과학적 근거를 갖춘 경우에 한하여 기능성 표시 가능
  - 건강기능성 원료 29종을 사용한 식품
  - 향후 미국, 일본 등과 같은 사전신고제를 도입할 예정임
  - 건강기능식품과 구별되어야 함 (표기 및 제형)
  - GMP 업체에서 제조한 원료를 사용해 HACCP 업체에서 제조

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## 6. 건강기능식품 개발동향

- 개별인정형 건강기능식품
  - 인체적용시험 지침서 확대 및 인체적용시험 자료는 국제적으로 저명한 저널에 발표되어야 함.
  - 연구개발 과정에서 기능성과 연관된 작용기전(Mode of Action) 자료를 중요시
    - 작용기전에 관련된 바이오마커들을 세포시험, 동물시험, 인체시험까지 일관되게 적용되어야 함
  - 기능(지표)물질 선정 및 관리를 통한 소재 표준화
  - 단회, 반복, 유전독성 시험 및 인체적용시험을 통한 안전성 자료 확보

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## 7. 건강기능식품 개발전략

- 천연물의약품 제도와 유사
  - 천연물의약품 소재 (약용작물)와 같은 소재를 사용
    - 식품소재로 불가한 소재는 건강기능식품으로 개발 불가함
    - 현재는 의약품 소재가 아닌 식습관 및 건강유지를 위한 일반식품소재로 개발소재가 확대되고 있음(김치, 발효식품 등)
  - 소재 표준화 기법 및 제조공정은 거의 동일함
  - 안전성(독성), 유효성(기능성) 연구개발 과정도 거의 유사함
  - 건강기능식품 제도를 제정할 때, 천연물의약품 제도를 참조

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## 7. 건강기능식품 개발전략

- 건강기능식품과 의약품의 다른점
  - 제품의 실질 소비(마케팅 대상) 집단이 다름
    - 의약품 : 의사, 약사 등 전문가 집단
    - 건강기능식품 : 일반 소비자
  - 의약품 : 질병 치료를 위한 전문적인 연구개발자료와 안전성 확인 자료를 준비
  - 건강기능식품 : 건강유지와 질병 예방을 위한 개발 타겟 선정 및 일반 소비자를 설득할 수 있는 마케팅 포인트 설정
    - 관절건강 : 관절의 통증 감소, 관절의 부드러운 느낌
    - 면역건강 : 감기 전조증상으로부터 회복
    - 간건강 : 피로한 느낌으로부터 회복
    - 여성갱년기 건강 : 안면홍조(열감) 증상 감소

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## 7. 건강기능식품 개발전략

- 차별화된 소재
  - 새로운 소재 탐색 (새싹보리, 김치유산균)
  - 소재개발과 관련된 전승 이야기 (History)
  - 기존 소재(약용작물)의 소재 재창출
    - 새로운 기능성 탐색
  - 해외 유용소재의 도입 또는 국산 유사소재 탐색

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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

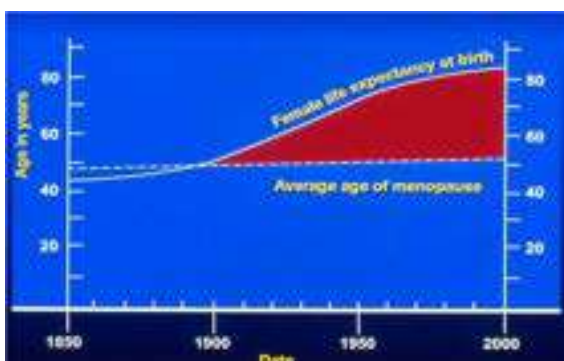
### 갱년기의 기초지식

- 폐경은 모든 여성에게 자연스러운 노화현상으로 변화가 일어나는 동안 건강유지를 위하여 일부 생활습관을 바꾸고 필요한 정보를 얻어야 함
- 폐경은 생식 호르몬 (에스트로겐 및 프로게스테론) 의 수준 감소 및 난소의 난자 생산이 중단될 때 발생
- 폐경이행기는 폐경에 이르는 단계임.
- 불규칙한 월경 (아직 생식력은 있으나), 안면홍조 그리고/또는 야간발한, 피로, 불안정한 감정, 그리고 그 외 폐경 증상이 나타나기 시작함.
- 폐경 증상은 개인별로 다양하지만 안면홍조/야간발한, 불면증, 건망증, 성욕 감소, 조울증, 불안, 질건조, 요실금 및 두통 등의 증상이 나타남.

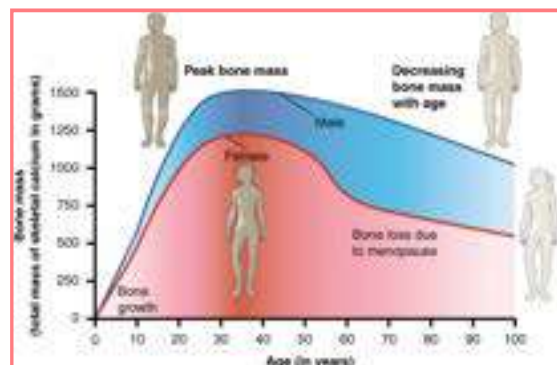
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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

- Menopause and Women's Life



$\frac{1}{3}$  of women's life post menopause



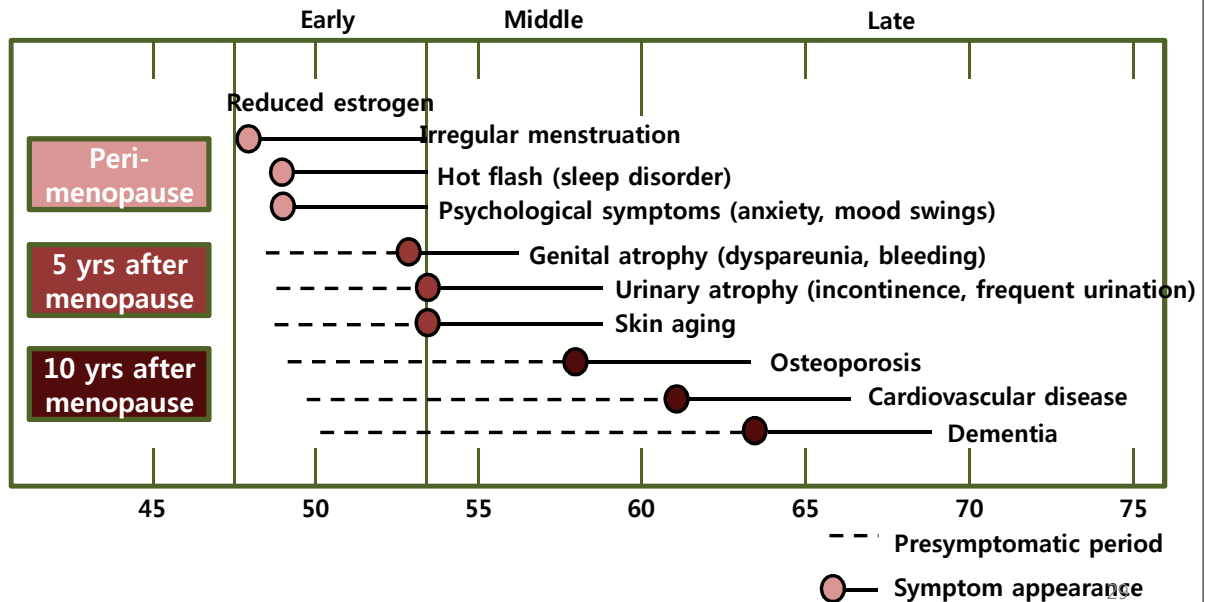
Rapid aging process after menopause

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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

### • Common Symptoms during Stages of Menopause



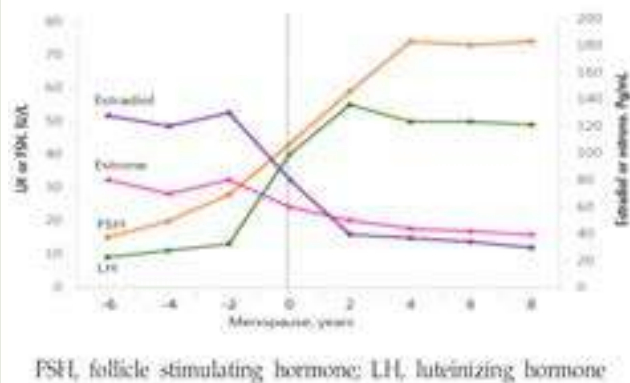
## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

### • Diagnosis of menopause

#### [Menopause Diagnostic Criteria]

- ① FSH > 20-40 mIU/mL
  - ② E2 < 20 pg/mL
- measure twice at one month interval

#### [Change of Major Hormone during Menopause]

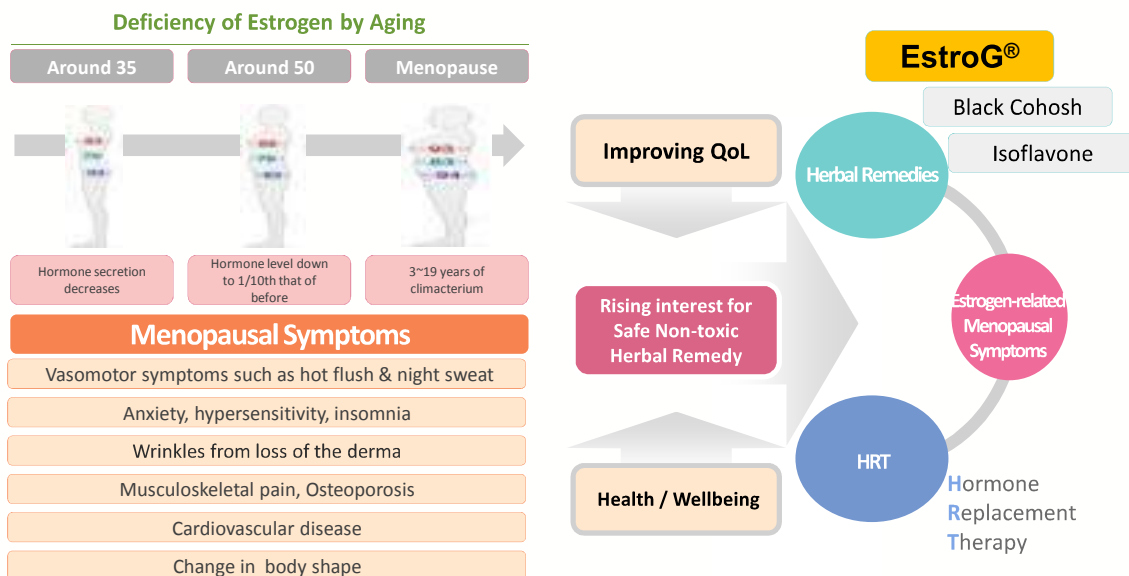


Ref: Modified from Overlie et al. Acta Obstet Gynecol Scand 84(3):281-5, 2005



## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

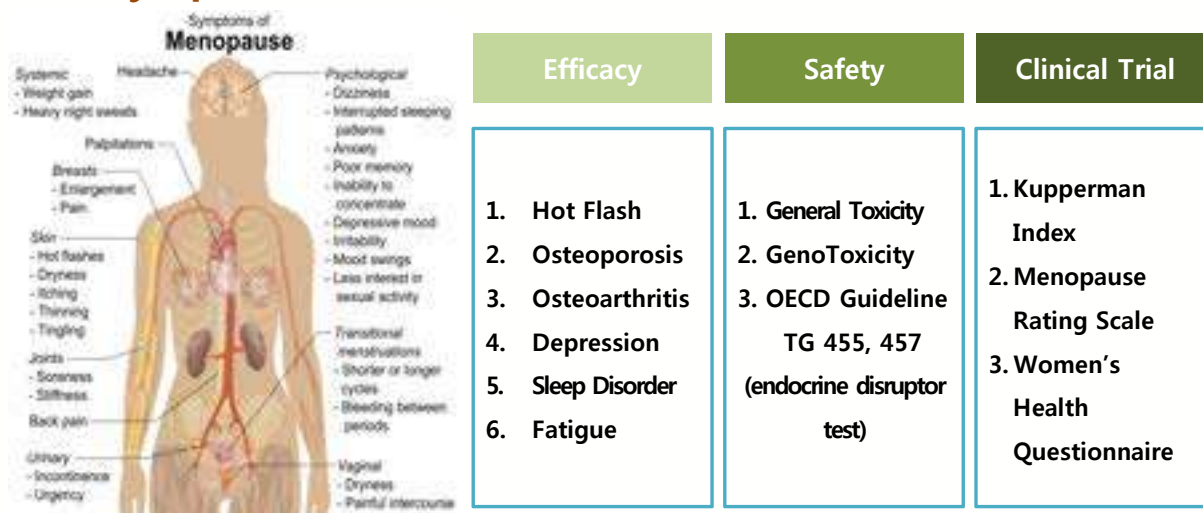
### • HRT & Herbal Remedies to Relieve Menopausal Symptoms



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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

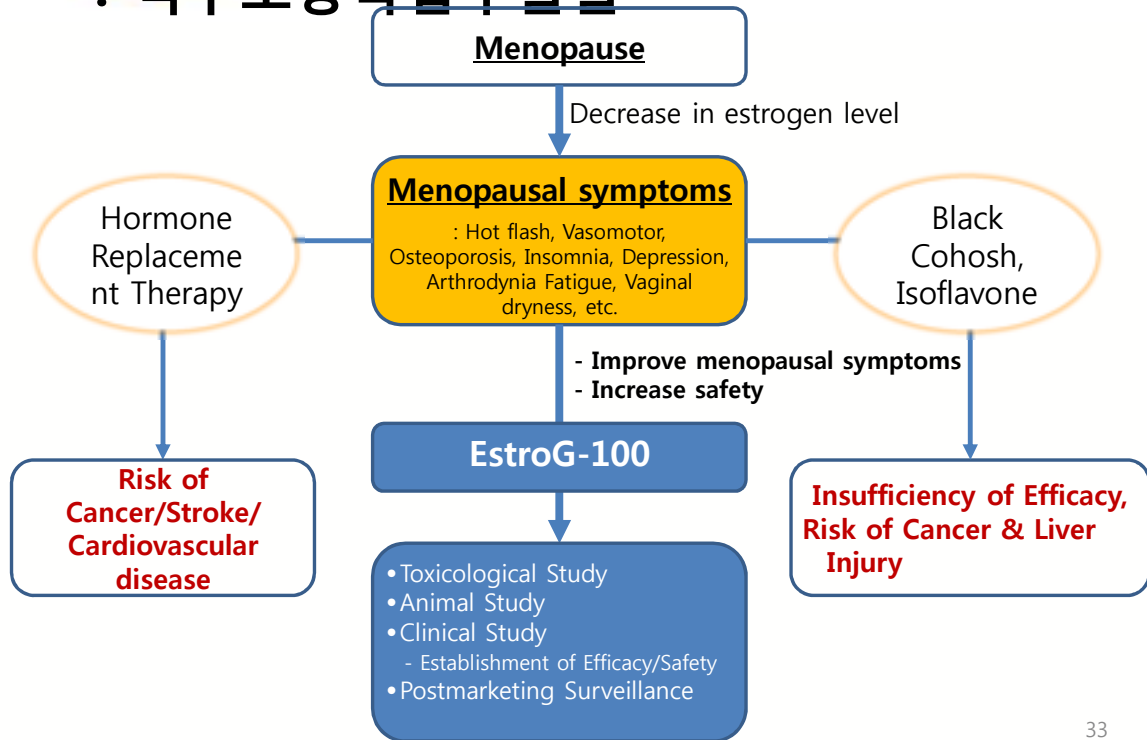
### • Research & Development for improving menopausal symptoms



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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물



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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

### ① 생약 정보

Cynanchum Wilfordii Radix	Phlomis Radix	Angelica Gigantis Radix
<i>Cynanchum wilfordii</i> Hemsley	<i>Phlomis umbrosa</i> Turczaninow	<i>Angelica gigas</i> Nakai
백수오	한속단	참당귀
滋養(자양), 剛腸(강장), 實血 (보혈), 精力增進(정력증진)	行血(행혈), 破瘀血(파어혈), 強筋骨(강근골), 續絕傷(속절상)	補血和血(보혈화혈), 潤燥活腸 (윤조활장), 調經止痛(조경지통)
wilfoside C1N, wilfoside K1N, cynauriculose A, conduritol F, cinnamic acid, ferulic acid,	shanzhiside methyl ester, phlomisine, sesamoside, umbroside, verbascoside	nodakenin, decursin, decursinol, marmesinin, umbelliferone, caffeic acid, ferulic acid
		

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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

### 백수오

- 박주가리과의 다년생 덩굴성 초본 식물
- 줄기를 자르면 흰유즙이 나온다.
- 동의보감
  - 황해도, 강원도에서 나며, 항염증, 진해거담 작용
  - 종기, 치질, 만성피로, 부인의 산후병, 대하 등을 치료
  - 기(氣)와 혈(血)을 도우며 근골을 튼튼하게 하고 골수를 충실하게 하고 머리카락을 까맣게 하고 오래 먹으면 늙지 않는다.”
- 본초비요
  - 간과 신장을 보호하고 피를 맑게 한다.
  - 정력을 세게 하고 아이를 낳게 한다.
  - 근육과 뼈를 튼튼하게 하고 머리카락을 검게 한다.”

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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

### 백수오

- 동의학 사전
  - 간경락, 신경락에 작용
  - 간과 신을 보하며 뼈와 힘줄을 튼튼하게 한다
  - 대변을 통하게 하고 혈은 것을 낮게 한다.
  - 강장작용, 조혈기능 강화작용, 피로회복 촉진작용, 진정작용이 밝혀졌다.
  - 허약한 데, 병후쇠약, 혈허증, 간과 신장이 허해서 허리와 무릎에 힘이 없는 데,
  - 가슴 두근거림, 불면증, 신경쇠약, 머리카락이 일찍 희어지는 데,
  - 변비, 학질, 헌 데, 치질 등에 쓴다.

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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

### 한속단

- 꿀풀과에 딸린 여러해살이풀
- 우리나라의 북부 산악지대를 빼고는 산기슭 어디서나 흔하게 자란다.
- **동의보감**
  - 경맥을 잘 통하게 하고 기를 도와주고 혈액을 고르게 하며,
  - 해산 후의 일체 병에 쓴다.
  - 아픈것을 잘 멎게하고 살이 살아나오데 하며, 힘줄과 뼈를 이어준다
  - 봉루, 대하, 피오줌을 누는 것 등 부인병에 매우 좋다.
- **동의학사전**
  - 아픈 것을 잘 멎게 하고 태아를 안정시킨다.
  - 신허로 인한 허리 아픔, 허리와 다리에 힘이 없는데,
  - 자궁 출혈, 마비, 태동불안,
  - 타박상, 골절상처 등에 쓴다.

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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

### 참당귀

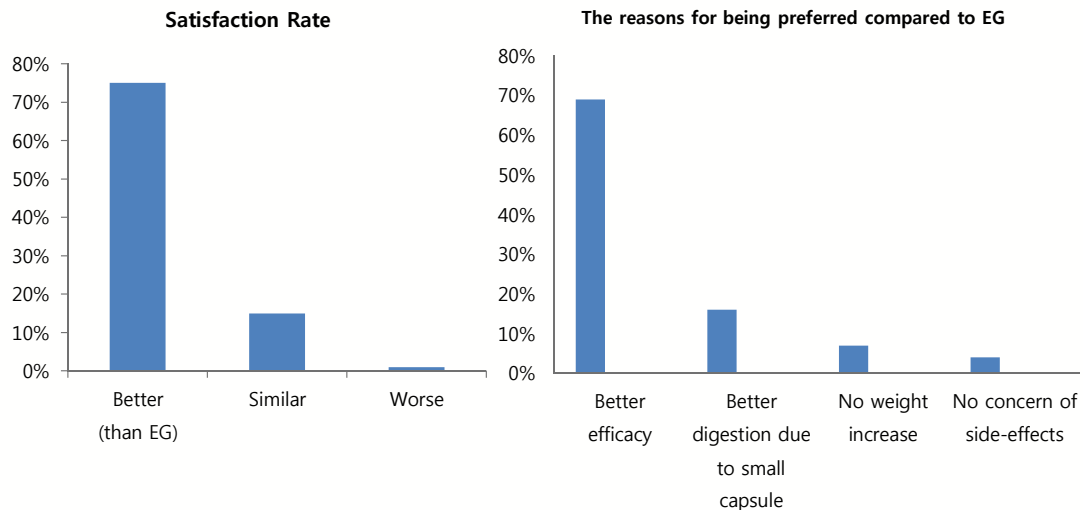
- 보혈조경(補血調經 : 부족한 피를 보충하고 월경이상을 조절)·활혈지통(活血止痛 : 피를 활발하게 순환시켜 통증을 멈추게 함)·윤장(潤腸 : 대장을 윤택하게 하여 부드럽게 함) 등으로 대별된다.
- **동의보감**
  - 모든 풍병, 혈병, 허로를 낫게 하며, 굳은 피를 헤치고 새 피를 생겨나게 한다.
  - 징벽과 부인의 봉루와 임신 못하는 것에 주로 쓰며,
  - 여러 가지 나쁜 창상과 어혈을 낫게 한다.
  - 부인과의 주약(主藥)이며, 주로 월경조정에 사용한다.
  - 생리통에도 효과가 있으며, 무월경, 생리불순에도 효과가 있다.

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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

- 75% higher satisfaction rate compared to the existing Isoflavone product
- 69% picked "Better Efficacy" for the top reason for the higher satisfaction

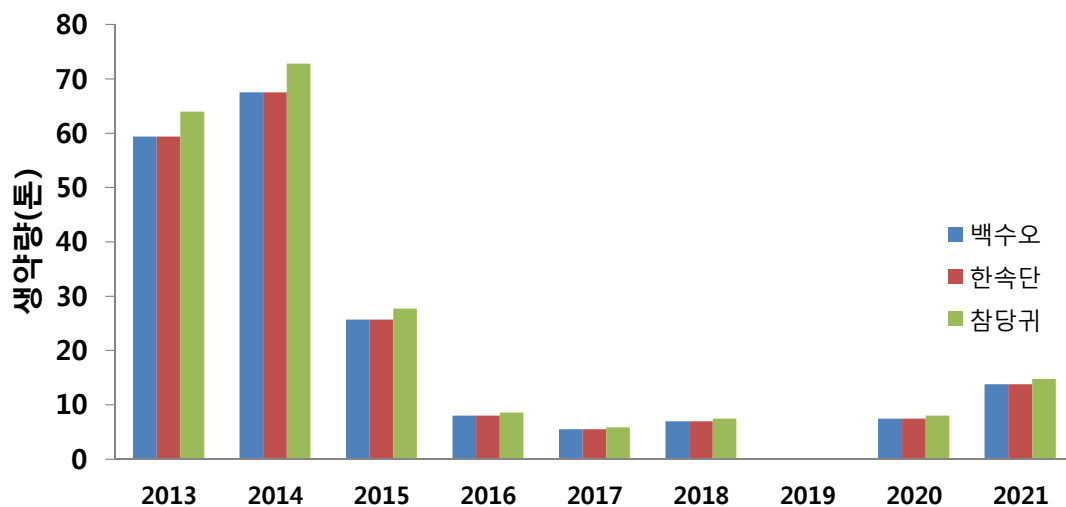


\* One month Open Label Clinical Study by Hiliving, with 119 participants

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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

연도별 생약 사용량

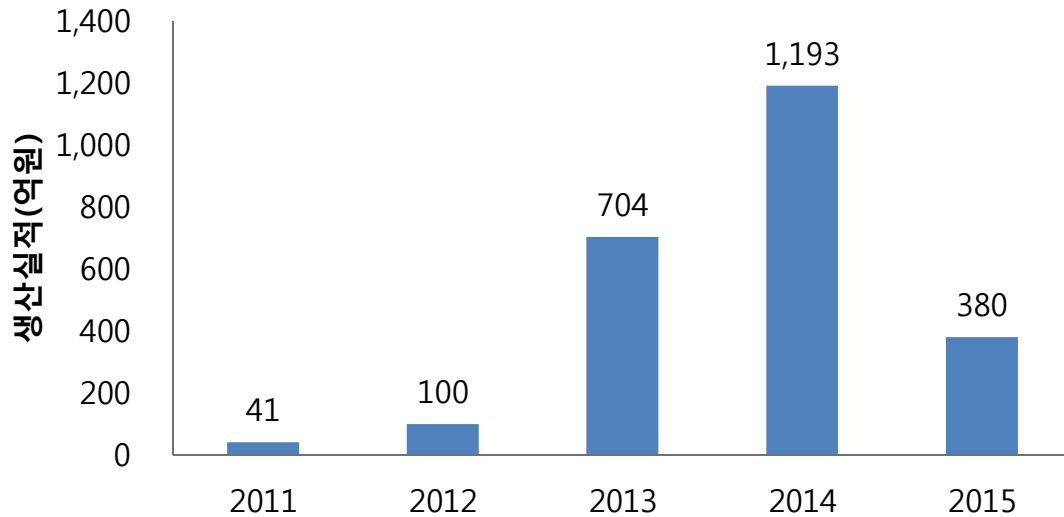


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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

백수오등복합추출물 생산실적



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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

### • 해외진출 현황

Market Release	Coming Soon	In Progress
<ul style="list-style-type: none"> <li>▪ Korea</li> <li>▪ USA     ▪ Canada</li> <li>▪ EU</li> <li>▪ India     ▪ Iran</li> <li>▪ Malaysia ▪ Thailand</li> <li>▪ Vietnam ▪ Philippines</li> <li>▪ Indonesia</li> <li>▪ Egypt     ▪ South Africa</li> <li>▪ Nigeria   ▪ Uganda</li> <li>▪ Australia</li> <li>▪ New Zealand</li> </ul>	<ul style="list-style-type: none"> <li>▪ China</li> <li>▪ Japan</li> <li>▪ Russia</li> <li>▪ Brazil</li> <li>▪ Colombia</li> <li>▪ Indonesia</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ecuador</li> <li>▪ Mexico</li> <li>▪ Argentina</li> <li>▪ Venezuela</li> </ul>

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## 8. 건강기능식품 개발 성공사례 : 백수오등복합추출물

### • 생약수급

- 당귀, 백수오는 생약재배농가와 계약재배를 통하여 수급안정
- 백수오 생산량은 2009년 이전에는 거의 집계되지 않았다가 백수오등복합추출물 사업이 활성화된 이후 폭발적으로 증가하여 2017년 900톤에 이르렀고 이후 감소추세임
- 한속단은 국내 생산량은 연간 10톤 미만으로 중국에서 야생 채취/수집하여 수입함
  - 나고야의정서 및 종다양성협약 문제로 국내에서 재배를 시도함

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## 9. 약용작물 수급 안정화 방안

- 국내 약용작물의 최대수요는 건강기능식품 산업임
- 특정 약용작물의 수요는 이를 원료로 사용되는 건강기능식품의 종류가 다양해야 하고 해당 사업의 성패에 의하여 약용작물 농업을 좌우함.
- 백수오의 사례에서 보듯이 관련 산업과 약용작물에 대하여 사업자, 농민 뿐만 아니라 기관 담당자의 이해가 산업과 농업의 성패에 중요하게 작용함

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## 9. 약용작물 수급 안정화 방안

- 약용작물 재배에서 한반도 기후변화는 중요한 변수로 작용함
  - 일부 생약의 재배적지는 계속 북상하고 있음
- 우리나라 재배 생약은 아직 작물화 정도가 낮아서 안정된 품질의 생약을 생산하지 못함
  - 야생성이 강하고 품종화 정도가 낮음
  - 당귀의 경우 지표성분함량이 매년 변동하고 있음
- 재배, 육종을 통하여 품종화 정도를 높여야 함

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## 9. 약용작물 수급 안정화 방안

- 약용작물 생산지의 경운, 시비, 관수, 농약 사용 등을 표준화한 GAP 도입이 필요함
- GAP 도입목적
  - 생산단계에서 판매단계까지 농산식품 안전관리체계 구축
  - 국내 소비자 신뢰제고 및 국제시장에서 경쟁력 강화
  - 저투입 지속가능한 농업을 통한 농업환경 보호
- 약용작물의 경우 품종화와 함께 일정한 품질(지표,유효성분 유지)의 생약을 생산하기 위한 표준 경작법이 개발되어야함

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## 10. 결론

- 우리나라에서 약용작물의 최대 수요처는 건강기능식품 산업임
- 약용작물을 원재료로 사용하는 건강기능식품 개발을 적극 독려할 필요가 있음
  - 국가연구개발자금 중 일부를 특정 약용작물을 테마로 하는 정책사업을 편성하여 다양한 제품 개발
  - 과학기술정보통신부, 산업자원부, 농림축산식품부

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## 10. 결론

- 주요 약용작물을 대상으로 품종화를 위한 육종이 필요함
  - 일정수준의 지표성분 및 유효성분 함유
  - 대사유전체 기반 품종 육종 및 관리
- GAP 확산 및 표준경작법 도입

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**Trifupalol**  
**A isolated from**  
***Agarum cribrosum***  
**inhibits allergic**  
**inflammation**

■ 김수남 박사(KIST 한국과학기술연구원)



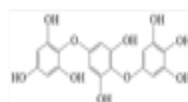




2021 한국약용작물학회 추계 학술발표대회



# Trifuhalol A isolated from *Agarum cribrosum* inhibits allergic inflammation



한국과학기술연구원 천연물연구소

김 수 남

2021.11.4

## 목차



- 해조류 이용현황
- 갈조류 (Brown Algae)
- Allergic Inflammation (알레르기 염증)
- 천연물 소재 정보 (구멍쇠미역)
- 추출 및 성분에 대한 정보
- 추출물의 탈과립 저해, 아나필락시스 쇼크, 가려움증에 대한 효능
- 추출물의 혈관수축에 대한 효능
- 천식에 대한 효능
- 성분의 알레르기 염증 매개인자에 대한 효능
- 성분(Trifuhalol A)의 탈과립 저해, 아나필락시스 쇼크, 가려움증에 대한 효능
- 성분의 아토피 피부염에 대한 효능
- 결론



## 해조류 이용 현황

### 한방에서의 사용

- 곤포(昆布) : 다시마(*Laminaria japonica*), 감태(*Ecklonia kurome*), 미역(*Undaria pinnatifida*)
- 해조(海藻) : 모자반류(*Sargassum* spp.)

적 용	주요 성분
식 용	알긴산염, 해초유, 파래류, 모란갈파래, 갈갈파래, 구렁갈파래, 솜손염수말, 찰라, 곡염갈, 해, 전가지말, 케이역채, 고리채, 미역, 다시마, 갈매산갈, 날미역, 곤갈, 구렁치미역, 미역채사촌, 골미, 대황, 해가다시마, 툴부기, 모자반, 팽팽이모자반, 파래가모자반, 적중미, 툴나모자반, 툴, 김, 갈매골보, 팜손이름, 토시레기름, 파다고리올 툴부기름, 다시마유, 후코스루, 알라라유, 오자만유, 갈매산갈, 미스모탈염류, 미크로시스스루, 툴부말, 툴손이름
사 료 용	다시마유, 갈매유, 오자만유, 갈매탈염류, 툴탈라유, 툴기시비, 도박유, 미미포리산유, 툴산로말, 낫은지노미라, 알지다유, 칼로그로사, 디게나아, 툴라
미 료 용	김, 툴가미, 툴가사리, 토시레기, 후코스, 다시마, 데카시스스루, 모자반, 파래
의약용 추출액	모자반, 파래, 갈매유, 김
갈절된 치료제	툴가사리, 툴가사리, 구렁전두말, 데카시스스루, 가시파래, 김, 툴가미
해열 - 진통제	모시레기, 툴중갈대, 다시마, 미역, 모자반, 데카시스스루, 미미포리산라아, 툴라, 갈매유
변동성 - 기침치료제	툴가미, 구렁전두말, 데카시스스루, 툴가사리, 툴가사리, 모시레기, 툴중갈대, 후코스, 다시마, 미역
비뇨기병 치료제	김, 툴손이름
위장 치료제	김, 다시마, 툴중갈대
고혈압 예방제	툴가사리
고혈압 예방제	무문가사리, 개우루루, 툴라다에라유, 데카시스스루, 툴라다에라유, 모시레기유, 가시우루루, 툴라, 툴부말, 툴가미, 툴라라아유, 툴가사리유, 툴가사리유, 가시우루루, 미미포리산, 툴로로라유
동맥경화 예방제	갈매유, 툴중갈대, 다시마유, 미크로시스스루, 미스모탈염류, 오자만유, 구렁치미역, 툴지, 툴부기
골밀도 증가원료	
캐러기난원료	
알진원료	

약용해양생물학 p118 (2009)

## 갈조류 효능

종 류	종 류	종 류
가온열매질말	미역	한색로물갈
참고물리말	동해, 거해, 남해	황갈
빈가지말	남해	연해, 황갈, 송고물갈
고리채	동해, 거해, 남해	식물, 미근가미, 후부말, 할미이리스
갈산갈	동해, 남해	황색로물갈, 툴로물갈
서포라산갈	미역, 남해	송고물갈
미역	연지역	니로탄물갈, 수물, 치갈, 고혈압, 위장질환, 비뇨기질환, 할미이리스
갈매	제주	고혈압, 황갈, 알진산
대황	울릉도	황갈갈파래, 알진산
다시마	통영해	수물, 고혈압, 황갈, 비뇨기질환, 위장질환, 갈산갈질환, 연주갈, 지갈
해가다시마	통영해	생리통증, 황갈, 할미생물
꽃	서해, 남해, 제주	황갈, 황갈, 황갈, 황갈
모자반	연지역	미역
파달포자반	남해, 제주	갈산갈질환, 연주갈
팽팽이모자반	전 지역	연주갈
미아래모자반	동해, 남해, 제주	미역, 알진산
미미포자반	동해	알진산, 할미생물
지출미	전 지역	구렁채, 황갈

- 구멍쇠미역???

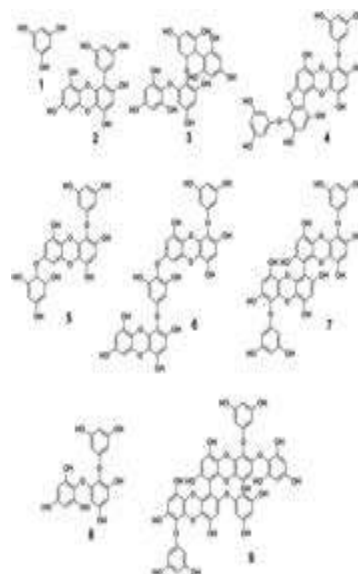
약용해양생물학 p128 (2009)



## 갈조류 (Brown Algae), 성분

### Phlorotannin

Sr. no.	Name of brown algae	Name of phlorotannins
1.	<i>Cystophora zongata</i>	Phloroglucinol triacetate, diphlorethol pentacetate, triphlorethol-A-heptacetate
2.	<i>Cystaria nudicaulis</i>	Beckol, fucophlorethol, 7-phloroeckol, and phlorofucuroeckol
3.	<i>Cystaria tamarefolia</i>	Beckol, fucophlorethol, 7-phloroeckol and phlorofucuroeckol
4.	<i>Ecklonia bicyclis</i>	Phloroglucinol, eckol
5.	<i>Ecklonia cava</i>	Fucodiphlorethol G, phloroglucinol, eckol, deckol
6.	<i>Ecklonia kuzume</i>	Phloroglucinol
7.	<i>Ecklonia stolonifera</i>	Eckol, deckol, phlorofucuroeckol A
8.	<i>Eisenia arborea</i>	Phlorofucuroeckol B
9.	<i>Himantalia elongata</i>	Phloroglucinol
10.	<i>Isige okamuroae</i>	Diphlorethohydroxycarmukol

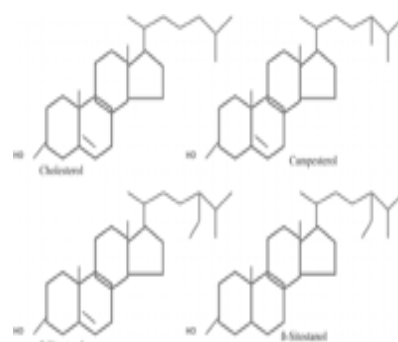


Future Journal of Pharmaceutical Science 6:129

## 갈조류 (Brown Algae), 성분

### Phytosterol

Sr. no.	Name of brown algae	Name of phytosterol
1.	<i>Cystaria foeniculacea</i>	Fucosterol
2.	<i>Dictyota ciliolata</i>	Fucosterol
3.	<i>Himantalia elongata</i>	Fucosterol
4.	<i>Homophysa triquetra</i>	Fucosterol, stigmasterol, campesterol
5.	<i>Laminaria echinulata</i>	Fucosterol, cholesterol
6.	<i>Padina gymnocarpa</i>	Fucosterol, brassicasterol, cholesterol, stigmasterol
7.	<i>Padina pavonica</i>	Fucosterol, $\beta$ -sitosterol, campesterol
8.	<i>Padina sanctae-cruci</i>	Fucosterol
9.	<i>Pilayella littoralis</i>	Fucosterol
10.	<i>Sargassum angustifolium</i>	Fucosterol
11.	<i>Sargassum asperifolium</i>	Fucosterol, stigmasterol, saringosterone, saringosterol
12.	<i>Sargassum fusiforme</i>	Phytol, fucosterol
13.	<i>Undaria pinnatifida</i>	Fucosterol, cholesterol



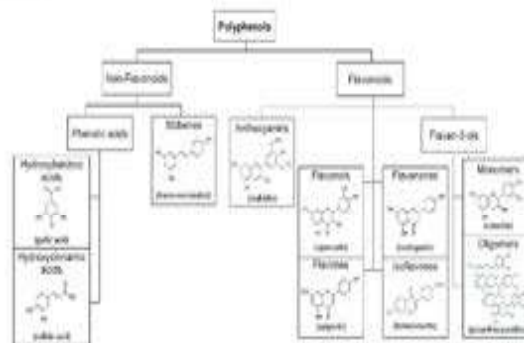
Future Journal of Pharmaceutical Science 6:129



## 갈조류 (Brown Algae), 성분

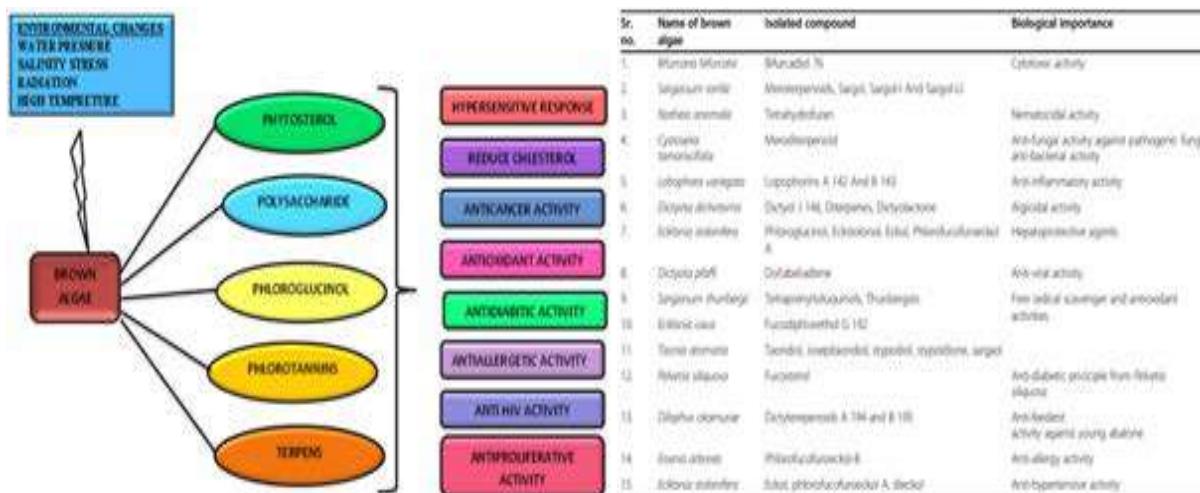
### Polyphenol

Sr. no.	Name of brown algae	Name of polyphenols
1.	<i>Dictyota dichotoma</i>	Gallic acid, protocatechuic acid, genistein, vanillic acid
2.	<i>Fucus distichus</i>	Gallic acid, protocatechuic acid, genistein, caffeic acid
3.	<i>Fucus semina</i>	Gallic acid, protocatechuic acid, genistein, vanillic acid, caffeic acid
4.	<i>Fucus spiralis</i>	Gallic acid, protocatechuic acid, genistein, vanillic acid, caffeic acid
5.	<i>Fucus vesiculosus</i>	Gallic acid, protocatechuic acid, genistein, vanillic acid, caffeic acid
6.	<i>Himantothalia elongata</i>	Gallic acid, chlorogenic acid, caffeic acid, ferulic acid, quercetin
7.	<i>Laminaria digitata</i>	Gallic acid, protocatechuic acid, genistein, vanillic acid, caffeic acid
8.	<i>Padina boerhaavi</i>	Gallic acid, caffeic acid, rutin, quercetin, ferulic acid
9.	<i>Padina pavonica</i>	Kaempferol, uranic acid, caffeic acid, quercetin, epigallocatechin
10.	<i>Sargassum laminaria</i>	Gallic acid, protocatechuic acid, genistein, vanillic acid
11.	<i>Sargassum crinale</i>	Gallic acid, P-hydroxybenzoic acid
12.	<i>Sargassum dicolatum</i>	P-hydroxybenzoic acid
13.	<i>Sargassum muticum</i>	Gallic acid, protocatechuic acid, genistein, vanillic acid, caffeic acid, syringic
14.	<i>Sargassum swartzii</i>	Gallic acid
15.	<i>Sargassum thenerum</i>	Gallic acid, P-hydroxybenzoic acid



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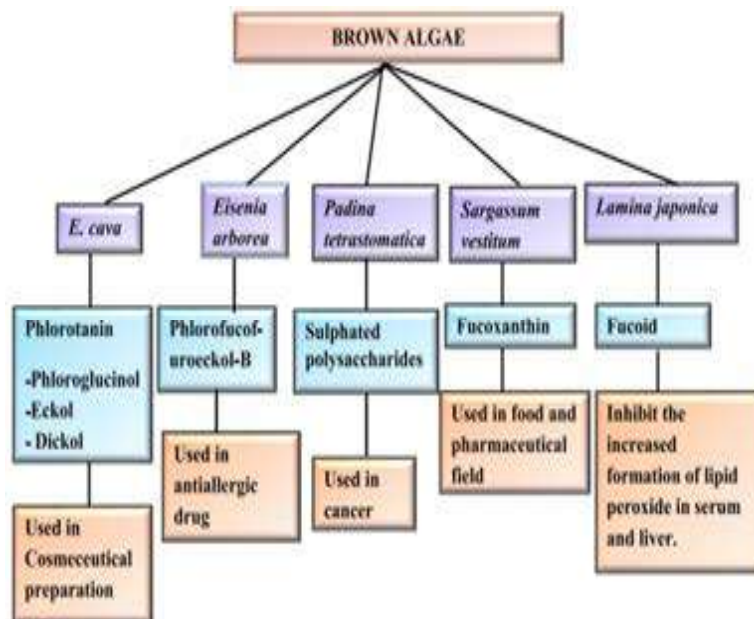
## 갈조류 (Brown Algae), 성분, 활성



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## 갈조류 (Brown Algae), 성분, 용도



Future Journal of Pharmaceutical Science 6:129

## 해조류 연구



Future Journal of Pharmaceutical Science 6:129

Sargaquinoic acid and sargahydroquinoic acid from *Sargassum jezeouense* stimulate adipocyte differentiation through PPAR $\alpha/\gamma$  activation in 3T3-L1 cells

Su-Nam Kim<sup>1,†</sup>, Hye Young Choi<sup>2,†</sup>, Woojung Lee<sup>3</sup>, Gab Man Park<sup>4</sup>, Woon Seob Shin<sup>5</sup>, Yong Kee Kim<sup>3,\*</sup>

지질대사 조절, 항당뇨



Anti-diabetic and hypolipidemic effects of *Sargassum jezeouense* in db/db mice

Su-Nam Kim<sup>1,†</sup>, Woojung Lee<sup>3</sup>, Gyu-Um Bae<sup>2,†</sup>, Yong Kee Kim<sup>3,\*</sup>

지질대사 조절, 항당뇨



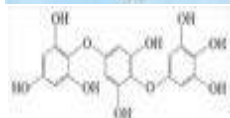
Sargahydroquinoic acid inhibits TNF $\alpha$ -induced AP-1 and NF- $\kappa$ B signaling in HaCaT cells through PPAR $\alpha$  activation

Youngho Jeon<sup>1</sup>, Yujang Jung<sup>1</sup>, Min Cheol Kim<sup>2</sup>, Hak Cheol Kwak<sup>3</sup>, Ki Sung Kang<sup>3</sup>, Yong Kee Kim<sup>1,†</sup>, Su-Nam Kim<sup>1,\*</sup>

피부미용, 주름개선



## 천연물 소재 정보 (구멍쇠미역)



**Origin Plant** : 구멍쇠미역

**Scientific name** : *Agarum cribrosum*

**Parted used** : 전초

**Family** : Costariaceae (쇠미역과)

**Genus** : Agarum 구멍쇠미역속

**Efficacy** : 장기능 개선, 퇴행성뇌질환 예방

**Components** : trifuhalol A

**분포** : 일본 홋카이도, 쿠릴열도, 아메리카 태평양연안, 베링해, 우리나라 동해안 중부이북지방

**Registration**

1. 식품공전
2. 국제화장품원료집 (ICID)
3. 화장품성분사전

## 추출 및 성분에 대한 정보



Original Article

**Anti-Inflammatory Activity of the Phlorotannin Trifuhalol A Using LPS-Stimulated RAW264.7 Cells Through NF-κB and MAPK Main Signaling Pathways**

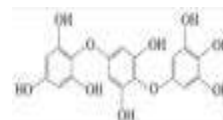
Kasira Phasanasophon<sup>1</sup> and Sang Moo Kim<sup>1</sup>

**NPC Natural Product Communications**

**Antioxidant and Cosmeceutical Activities of *Agarum cribrosum* Phlorotannin Extracted by Ultrasound Treatment**

Kasira Phasanasophon and Sang Moo Kim\*

Natural Product Communications  
May 2018, 1-8  
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DOI: 10.1177/1045786118481988  
journals.npc.sagepub.com/home/npc



### Trifuhalol A

Light brown powder

<sup>1</sup>H NMR (400 MHz, CD<sub>3</sub>OD): 5.89 (d, 2H, J = 2.6 Hz, Ph-H), 5.90 (s, 2H, Ph-H), 5.92 (s, 2H, Ph-H).

<sup>13</sup>C NMR (150 MHz, CD<sub>3</sub>OD): 95.54 (2C, CH), 95.54 (2C, CH), 98.11 (2C, CH), 123.33 (2C, C), 125.78 (1C, C), 147.99 (1C, C), 152.48 (2C, C), 152.62 (2C, C), 152.71 (2C, C), 158.77 (2C, C), 158.78 (1C, C), 160.75 (1C, C).  
HPLC-DAD-QMS m/z: 413.1 (M+Na<sup>+</sup>).

(추출일드 : 9.9%)



## 구멍쇠미역의 효능에 대한 정보



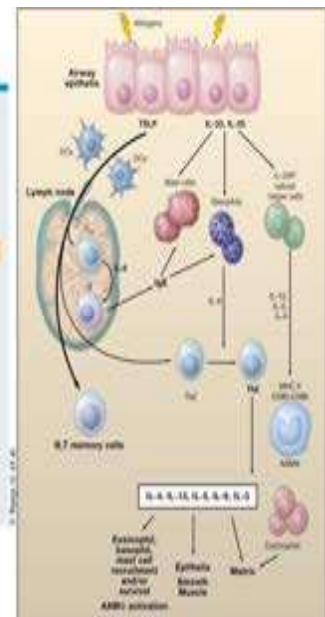
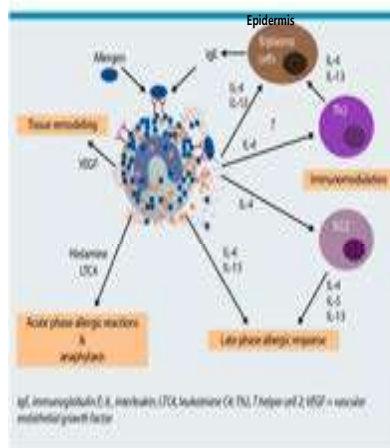
- Antioxidant activity : DPPH, ABTS, reducing power, hydrogen peroxide
- Collagenase inhibitory activity
- Elastase inhibitory activity
- Tyrosinase inhibitory activity
- Hyaluronidase inhibitory activity
- Antiinflammatory activity : NO, iNOS, COX-2, IL-6, TNF- $\alpha$ , IL-1 $\beta$
- Sulfated fucan (Fucoidan) : Immunomodulatory activity

## Allergic inflammation (알레르기 염증)



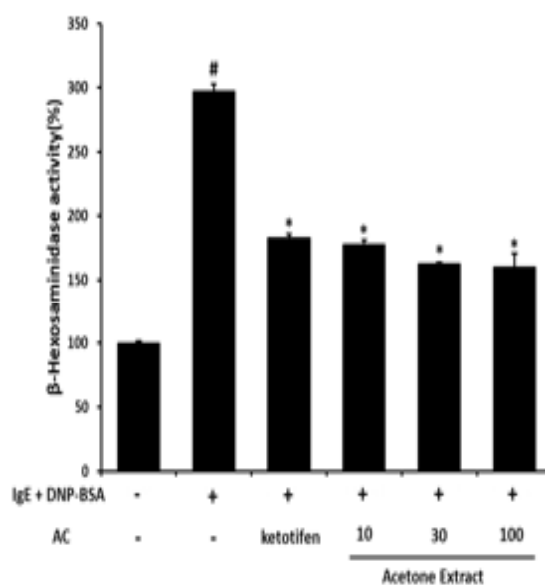
### 알레르기 염증이란

- 정의 : 아나필락시스, 알레르기 천식, 아토피 피부염, 알레르기 비염, 안구 알레르기 질환을 비롯한 여러 장애 또는 의학적으로 중요한 병태 생리학적 특징
- 구성요소 : 초기단계 반응, 후기 단계 반응
- 초기 단계 반응 : 아나필락시스 쇼크, 가려움증
- 후기 단계 반응 : 알레르기 천식, 아토피 피부염, 알레르기 비염, 안구 알레르기 질환
- 탈 과 립 : 알 레 르 기 경 로 (IgE-Fc $\epsilon$ RI), 유사알레르기 경로 (IL-33-MRGPX2)

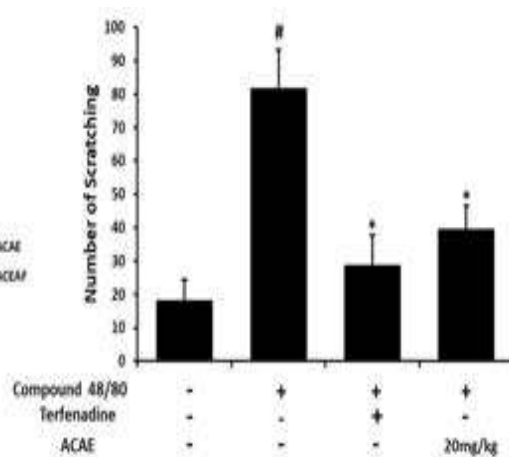
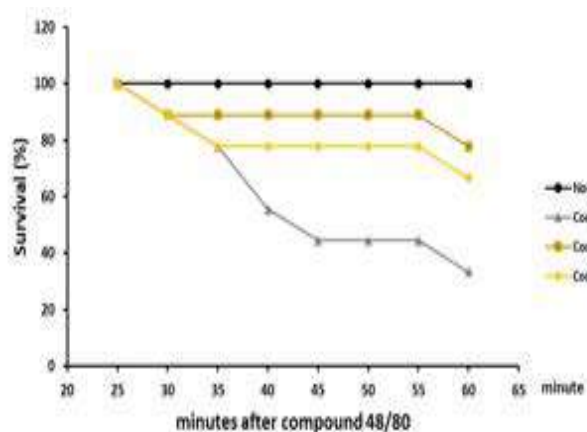




## 구멍쇠미역 : 탈과립 저해



## 구멍쇠미역 : 아나필락시스 쇼크, 가려움증 감소



ACAE: 70% 아세톤 추출물  
ACEAF: EA 분획  
50% 이하로 감소시킴

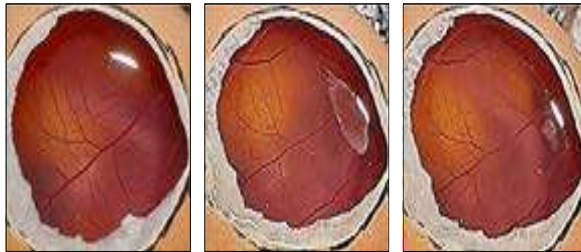
1시간 동안 긁는 횟수 측정  
50% 이하로 감소시킴



## 구멍쇠미역 : 혈관 수축



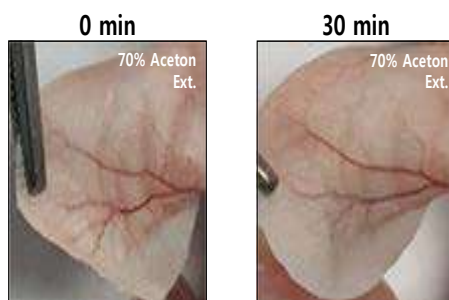
HET CAM assay



처리 '전'

처리 '후' 30s

처리 '후' 300s



0 min

30 min

70% Aceton  
Ext.

70% Aceton  
Ext.

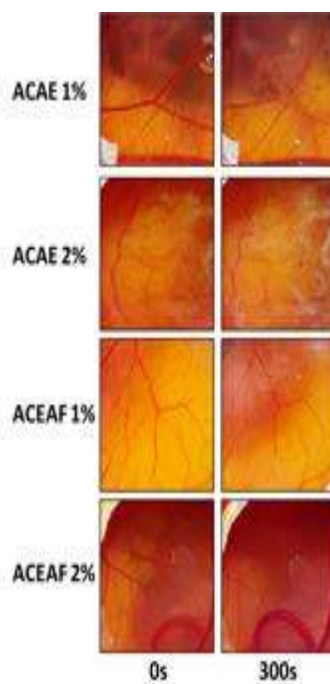
혈관수축???

1. 저혈압, 안면홍조 등 혈관확장에 의한 질환에 적용 가능
2. 비충혈 제거제 - 알레르기 비염 등에 적용 가능

## 구멍쇠미역 : 혈관 수축

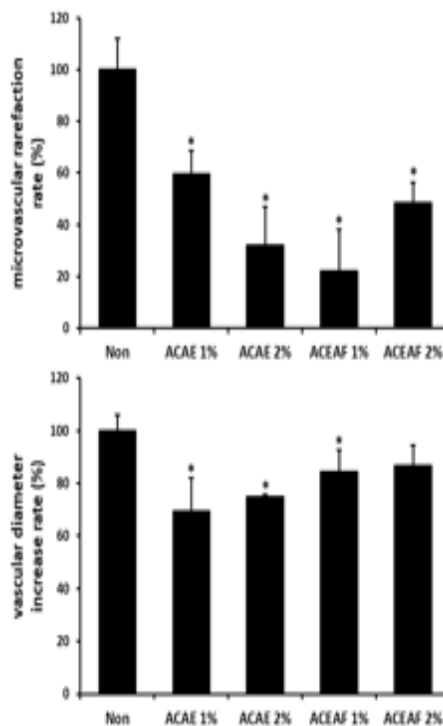


일반모델



0s

300s



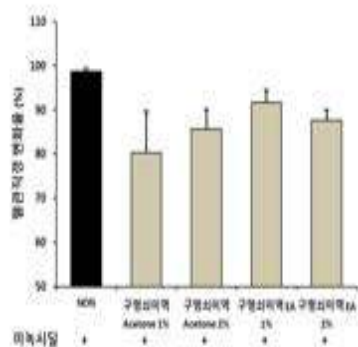
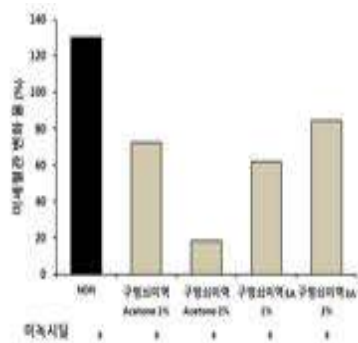
혈관 직경 감소, 모세혈관 수 감소



## 구멍쇠미역 : 혈관 수축



혈관 확장 모델

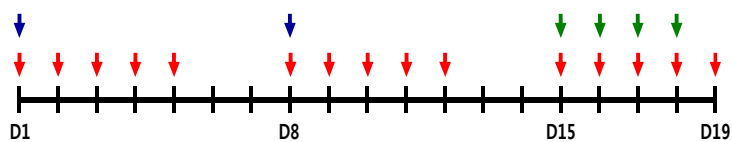


혈관 직경 감소, 모세혈관 수 감소

## 구멍쇠미역 : 천식

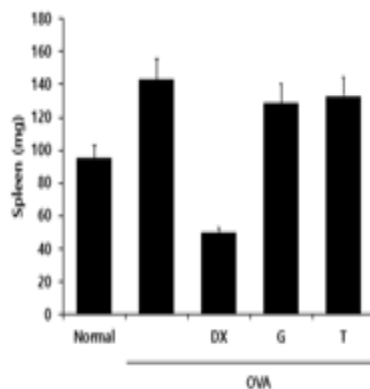


Ovalbumin 유도 천식 모델



↓ OVA 복강투여 (50 ug)    ↓ OVA 흡입 (5%)    ↓ 시료투여

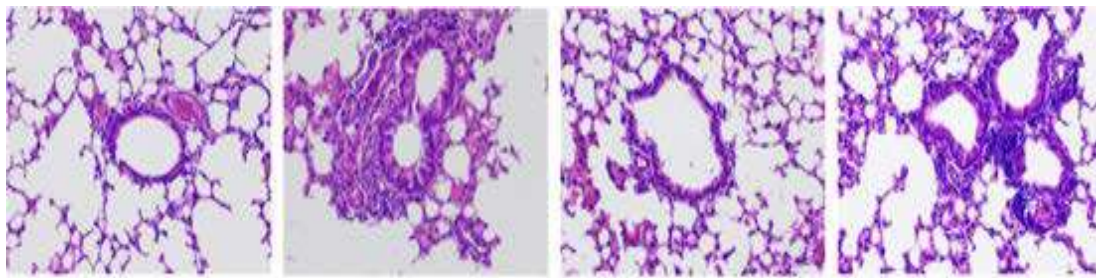
면역기관 : 비장



스테로이드 : 면역기관 위축  
구멍쇠미역 : 면역기관 정상



## 구멍쇠미역 : 천식

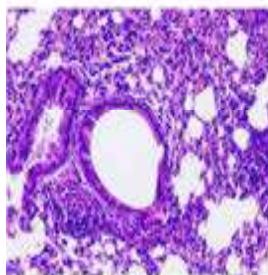


Normal

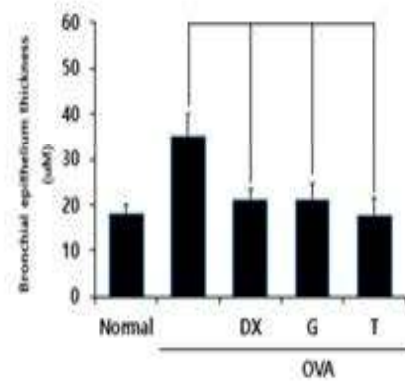
OVA

OVA + DX

OVA + G



OVA + T



기관지 내피 두께 감소시킴

## 구멍쇠미역 : 천식



Normal

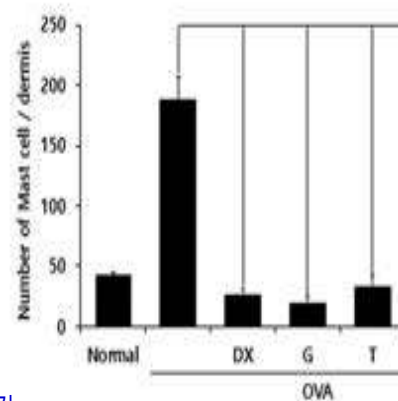
OVA

OVA + DX

OVA + G



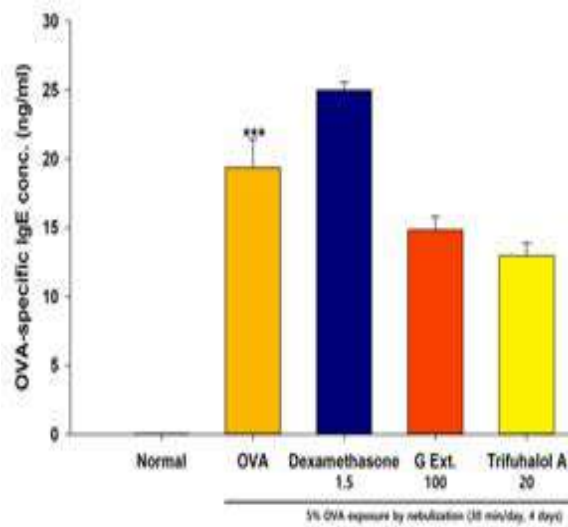
OVA + T



기관지 염증세포 침윤 감소시킴

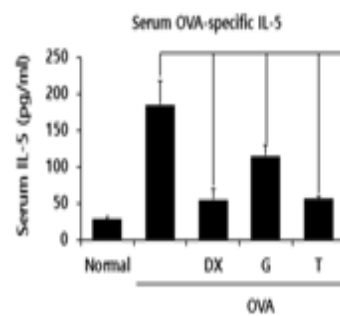
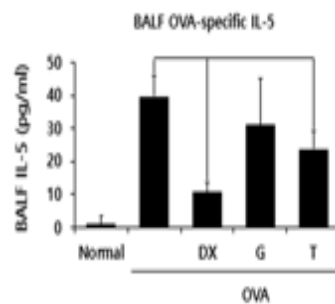
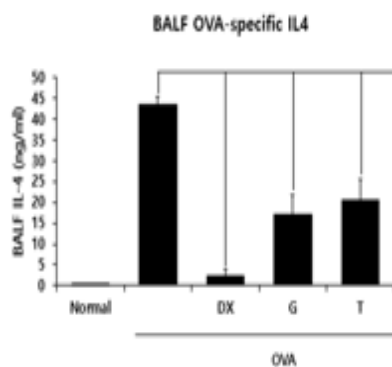


## 구멍쇠미역 : 천식



혈액 중 IgE의 양을 감소시킴

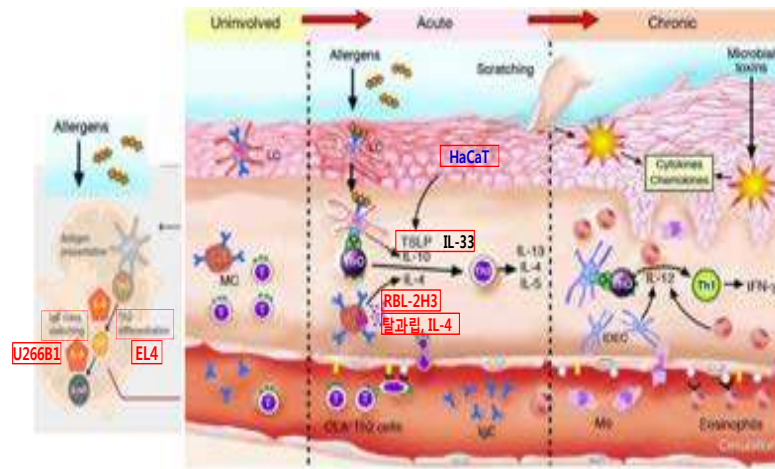
## 구멍쇠미역 : 천식



- BALF 중 IL-4, IL-5 의 양을 감소시킴
- 혈액 중 IL-5 의 양을 감소시킴  
(BALF: 기관지 폐포 세척액)

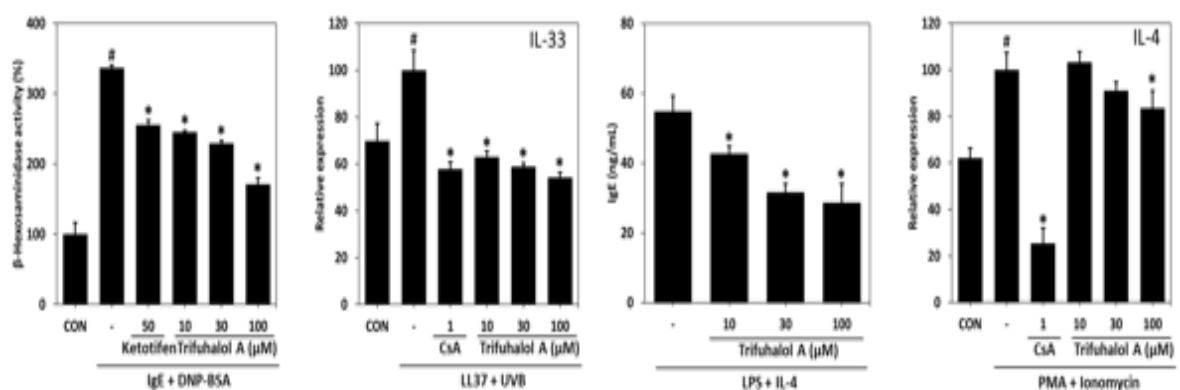


## 알레르기 염증의 주요 타겟



- Th0 → Th2 : EL4
- B cell class switch : U266B1
- Degranulation (+ IL-4) : RBL-2H3
- Epithelium, epidermis : HaCaT

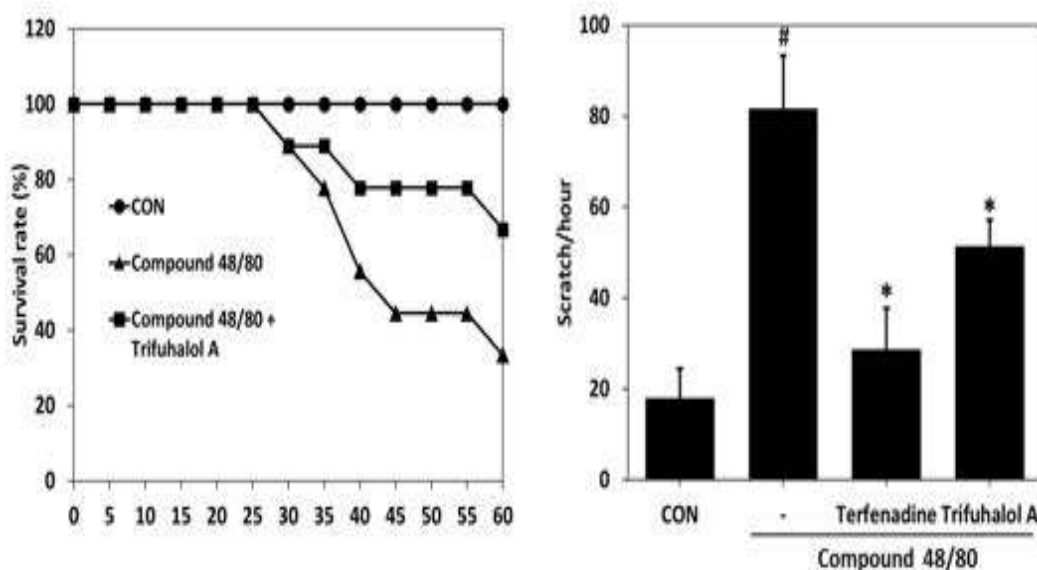
## Trifuhalol A : 알레르기염증 매개인자에 대한 효능



- IL-33과 IgE를 경유하여 알러지와 유사 알러지 경로로 탈과립을 저해할 수 있음
- IL-4는 상대적으로 약하게 저해함

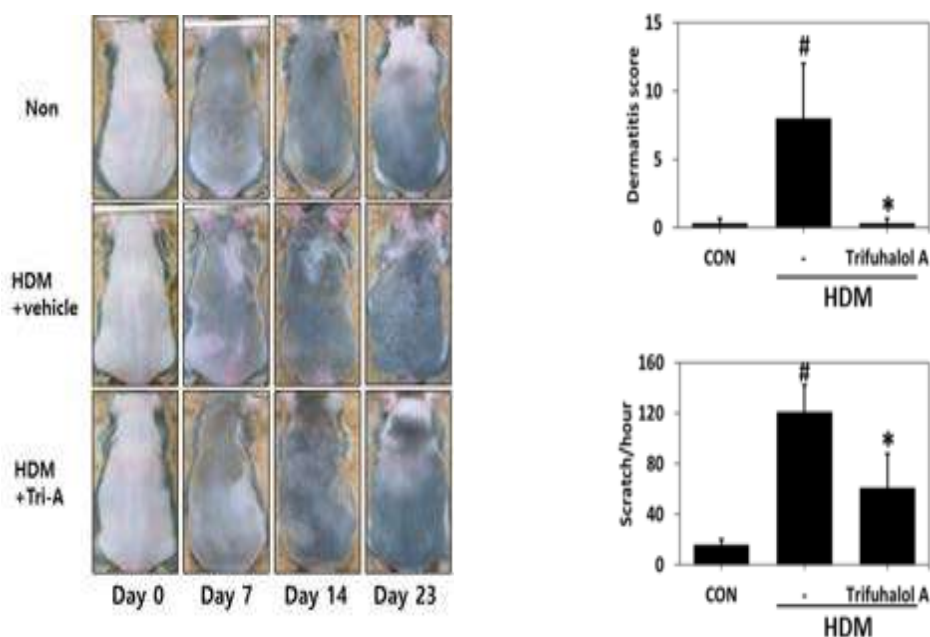


## Trifuhalol A : 아나필릭시스 쇼크, 가려움증



- 아나필락시스로 인한 사망률은 50% 감소시킴
- 긁기 횟수를 50% 이하로 감소시킴

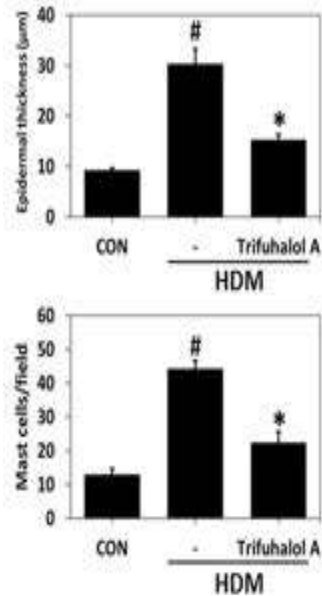
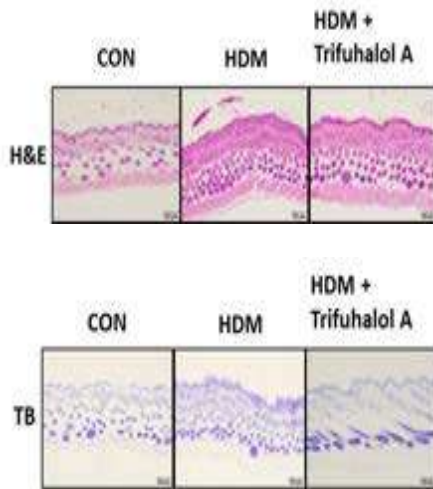
## Trifuhalol A : 아토피 피부염에 대한 효능



- 아토피 피부염의 외견상 증상을 개선시킴 (발적, 홍반, 부종 등)
- 피부염 지수를 개선시킴
- 가려움증을 50% 개선 시킴

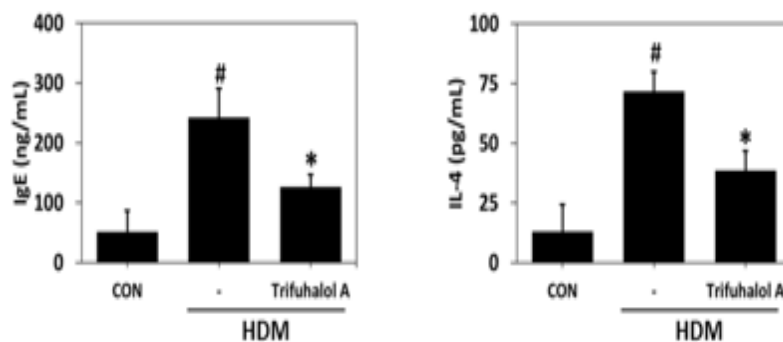


## Trifuhalol A : 아토피 피부염에 대한 효능



표피의 비후 및 증식을 개선시킴  
염증세포의 침윤을 개선시킴

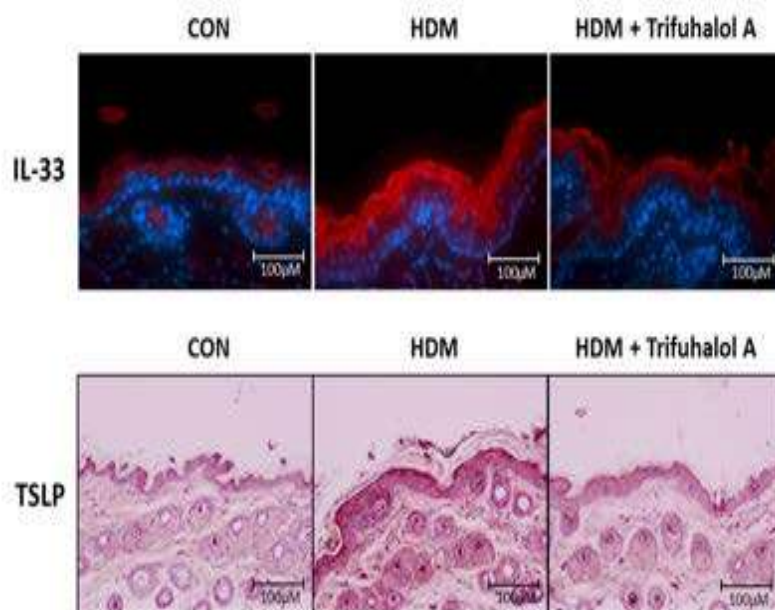
## Trifuhalol A : 아토피 피부염에 대한 효능



혈액 중 알레르기 반응의 지표인 IgE와 IL-4의 농도를 감소시킴

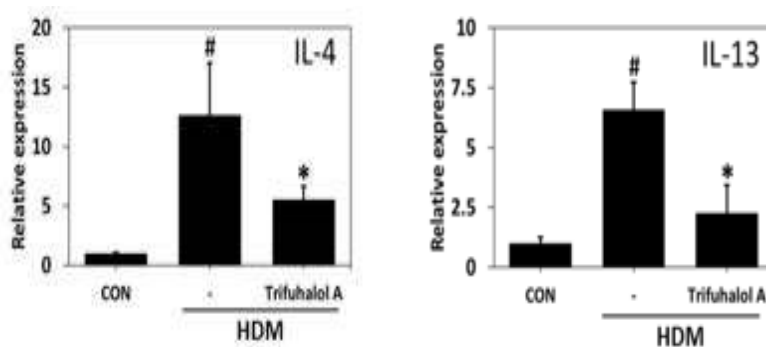


## Trifuhalol A : 아토피 피부염에 대한 효능



표피층에서 아토피 피부염에서 증가하는 IL-33과 TSLP가 감소함  
(탈과립 및 가려움증에 효능이 있음)

## Trifuhalol A : 아토피 피부염에 대한 효능



피부 조직 중 알레르기 반응의 지표인 IL-4와 IL-13의 발현을 감소시킴



## 결론 (특허)



- 소재 : 구멍쇠미역 추출물, Trifuhalol A
- 용도 1: 과민성 알레르기 반응 완화 (아나필락시스, 가려움증, 아토피 피부염, 천식, 알레르기 비염)
- 용도 2: 혈관 수축 작용 (안면홍조, 비출혈, 저혈압)
- 특허현황 : 10-2020-0171621 (2020.12.9)

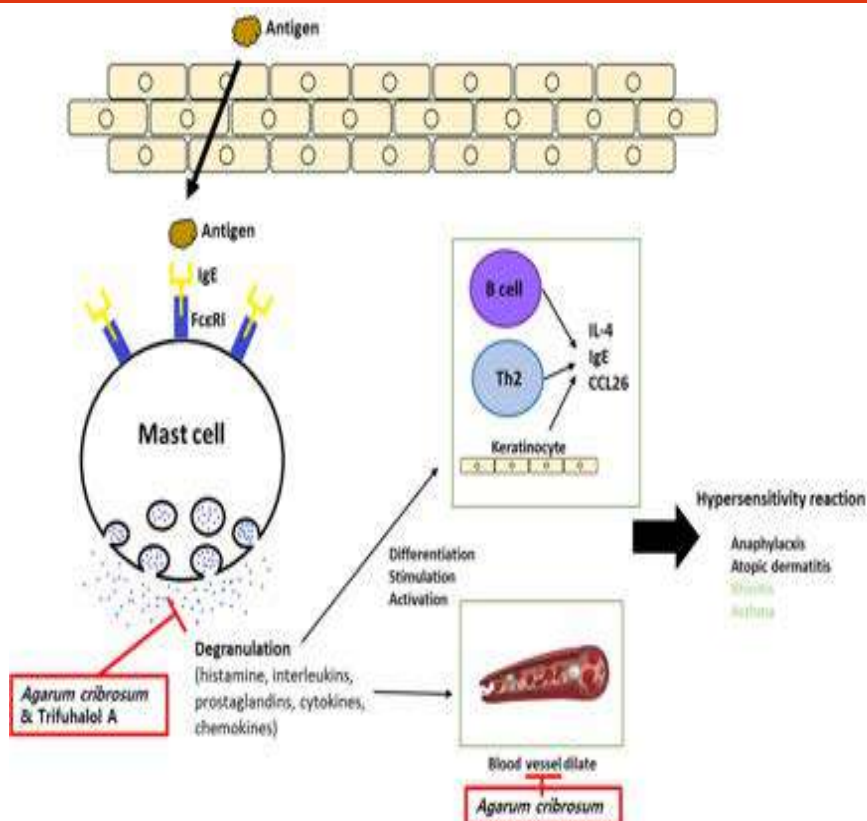
## 결론



- 구멍쇠미역의 알레르기 염증 질환인 아나필락시스, 가려움증, 알레르기 비염, 천식, 아토피 피부염에 대한 예방 및 치료효능을 최초로 밝힘
- 혈관수축 효능을 최초로 밝힘, 안면홍조, 저혈압, 비출혈 제거 등에 적용 가능함
- 구멍쇠미역 및 활성성분인 Trifuhalol A는 IL-33과 IgE를 경유한 탈과립을 저해함으로써 알레르기 염증을 저해함
- 구멍쇠미역 추출물은 혈관 수축 효능이 있음
- 구멍쇠미역 추출물은 아나필락시스로 인한 사망과 가려움증을 50% 감소시킴
- 구멍쇠미역 추출물 및 Trifuhalol A는 천식 동물모델에서 기관지 수축을 감소시키는 효능이 있음
- 구멍쇠미역 추출물 및 Trifuhalol A는 혈액 및 BALF에서 IgE, IL-4, IL-5 등 인자들을 감소시킴
- Trifuhalol A는 아나필락시스로 인한 사망과 가려움증을 50% 감소시킴
- Trifuhalol A는 아토피 피부염의 외견상 소견을 회복시킴 (홍반, 발적, 부종)
- Trifuhalol A는 피부염지수와 가려움증을 개선시킴
- Trifuhalol A는 표피 두께 및 염증세포의 침윤을 개선시킴
- Trifuhalol A는 혈액과 조직에서 IgE, IL-4, IL-13의 발현을 감소시킴
- Trifuhalol A는 표피층에서 아토피 피부염에서 과발현되는 IL-33과 TSLP의 발현을 감소시켜 탈과립 및 가려움증을 예방함



## 결론





**젊은 과학자 세션/  
네트워크 약리학을 활용하여  
대사 증후군을 억제하는 약용  
식물의 신호 전달 경로, 표적  
단백질 및 생리 활성 물질의 규명**

■ 오기광 박사과정생(강원대학교)







▶ 2021년 한국약용작물학회 추계학술발표회 젊은 과학자 세션

## 네트워크 약리학을 활용하여 대사 증후군을 억제하는 약용 식물의 신호 전달 경로, 표적 단백질 및 생리 활성 물질의 규명

▶ 이름: 오기광

▶ 소속: 강원대학교 의생명과학대학 바이오헬스융합학과

▶ 일자 및 시간: 2021년 11월 4일(목) 14:10~14:45

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9. Network pharmacology Diagram
10. THREE components of drug discovery or food nutrition for humans
11. Applicable field



## 1. Background

- ▶ System biology, Pharmacology, Bioinformatics, Cheminformatics...
- ▶ A flagship of bioscience
- ▶ ONE compound for ONE target for ONE disease !!!--- Traditional thinking
- ▶ ONE compound for Multiple targets for ONE disease --- Network pharmacology
- ▶ Multiple compounds for Multiple targets for ONE disease --- Network pharmacology

## 2. Why is significant?

### ▶ Drug repurposing

Ex> Network pharmacology approach to decipher signaling pathways associated with target proteins of NSAIDs against

**COVID-19**; Scientific Reports | (2021) 11:9606

Drug-repurposing against **COVID-19** by targeting a key signaling pathway: An *in silico* study; Medical Hypotheses

155 (2021) 110656

### ▶ The screening of bioactive compounds in herbal plants

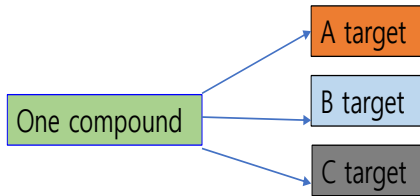
### ▶ Application of diverse diseases

### ▶ Scalability !!!!!

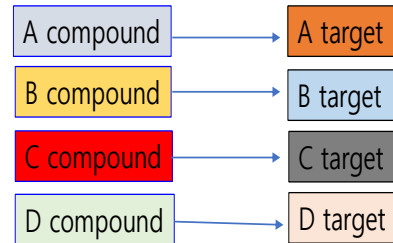


### 3. Network pharmacology schematic diagram

(A) ONE compound- Multiple targets



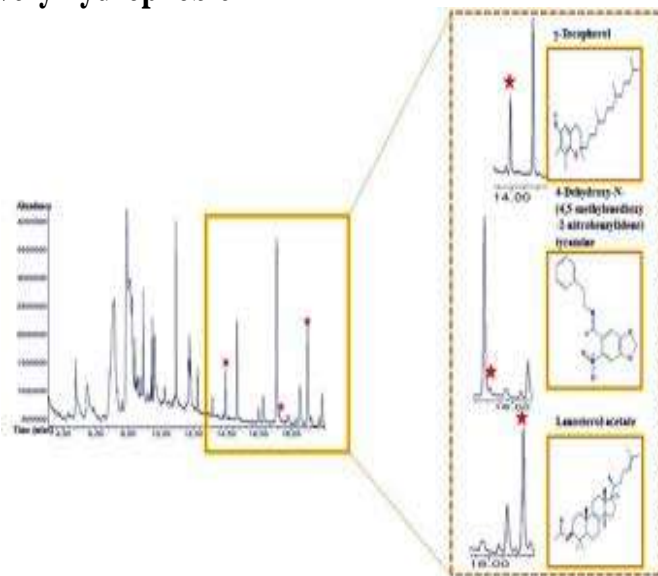
(B) Multiple compounds- Multiple targets



### 4. GC-MS

Very hydrophilic  
**X**  
Very hydrophobic

Cell permeability 

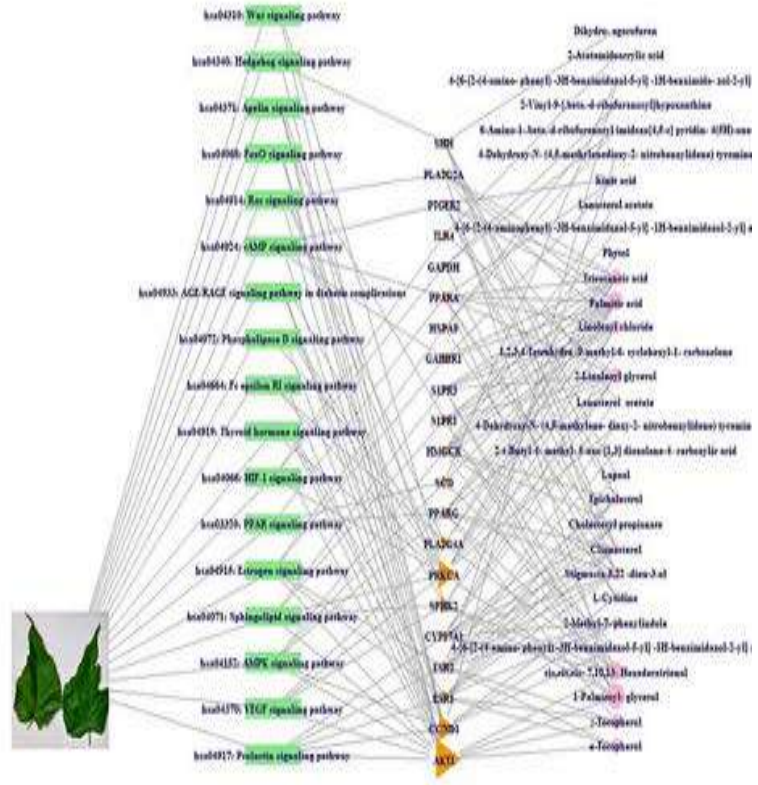




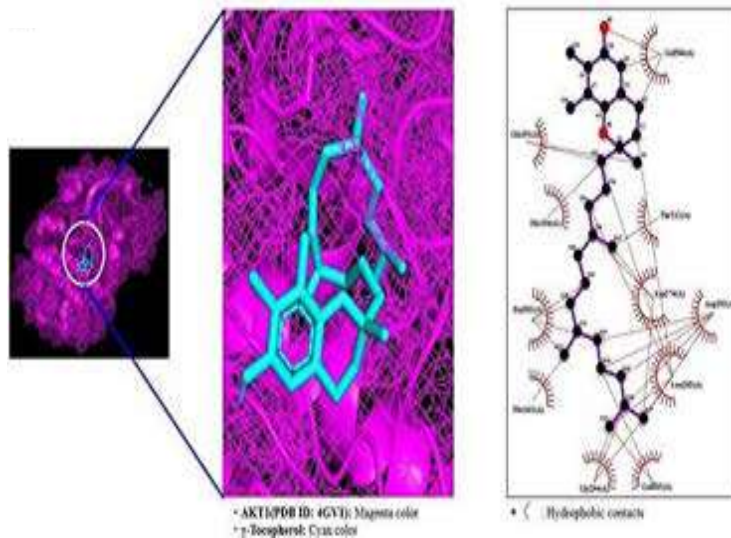
## 6. Bubble chart



## 7. Signaling pathways Targets- Compounds

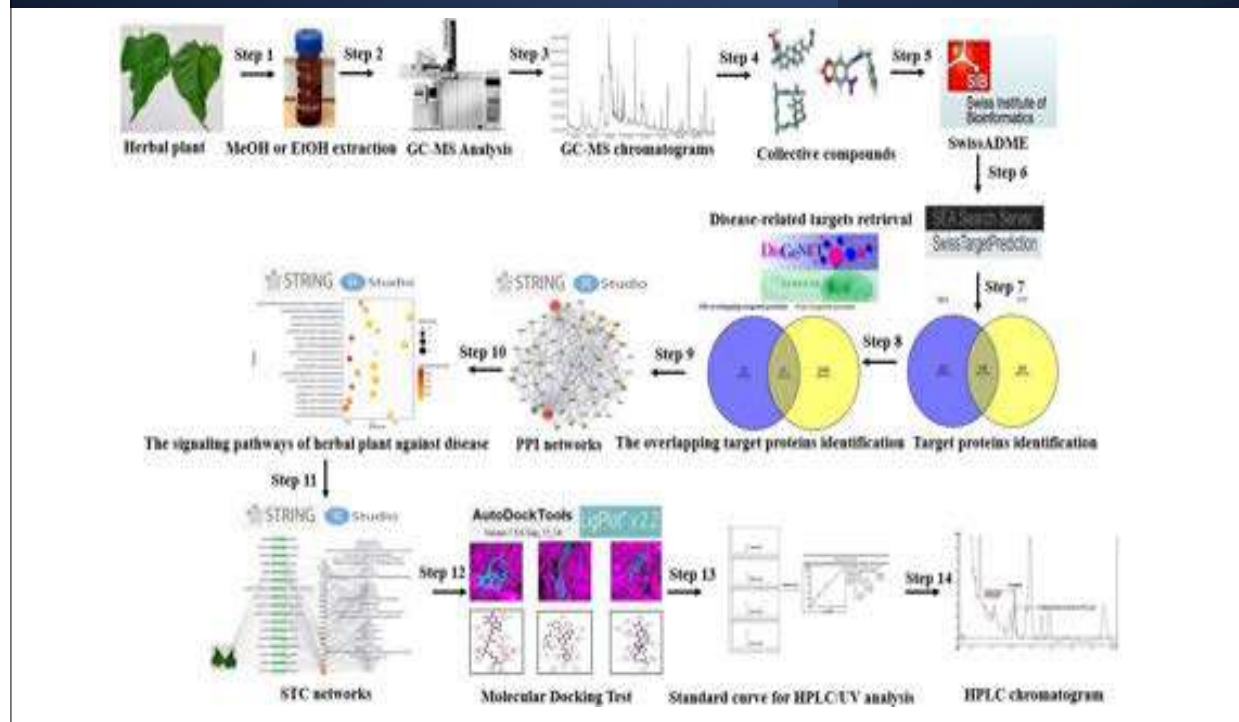


## 8. Molecular Docking Test





## 9. Network Pharmacology Diagram



## 10. THREE components of drug discovery or food nutrition for humans

AI, Machine learning

Network pharmacology

Traditional Experiment



## 11. Applicable field

### ▶ Natural products research

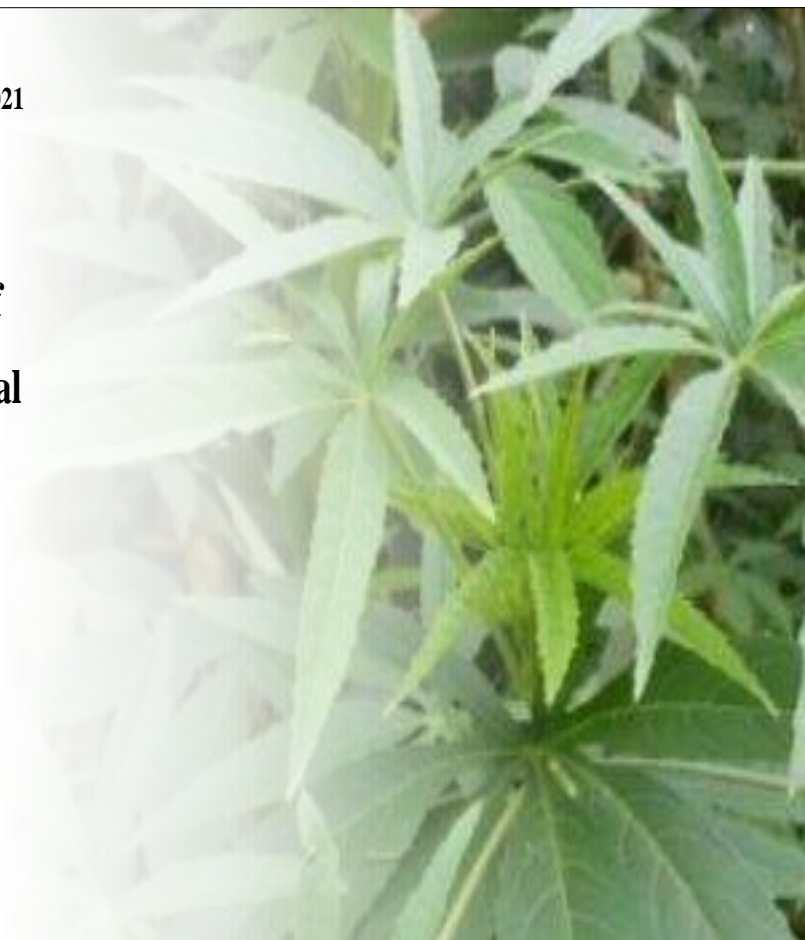
Drug repurposing or discovery or design

### ▶ Uncovering of complex pharmacological mechanism of Korean herbal medicine

Provides scientific evidence of its medicinal values

RSC Advances; accepted 3rd, March, 2021

**Network pharmacology of  
study on the main chemical  
compounds of *Hibiscus  
cannabinus* L. leaves  
against obesity**

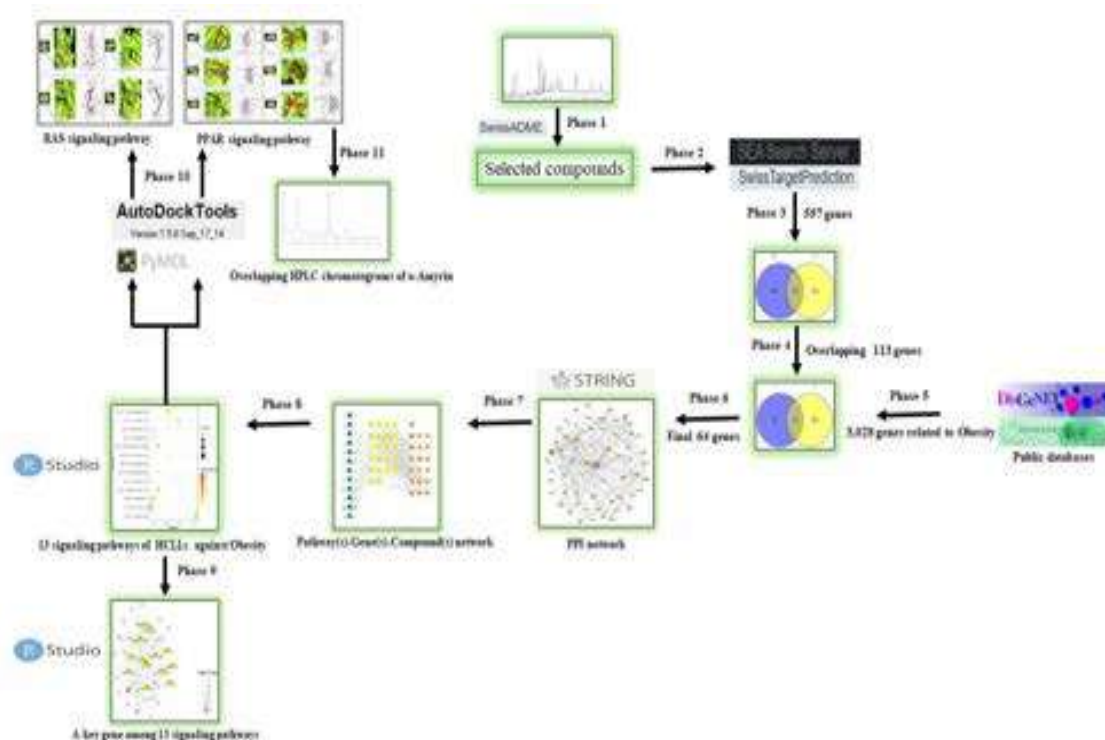




# Contents

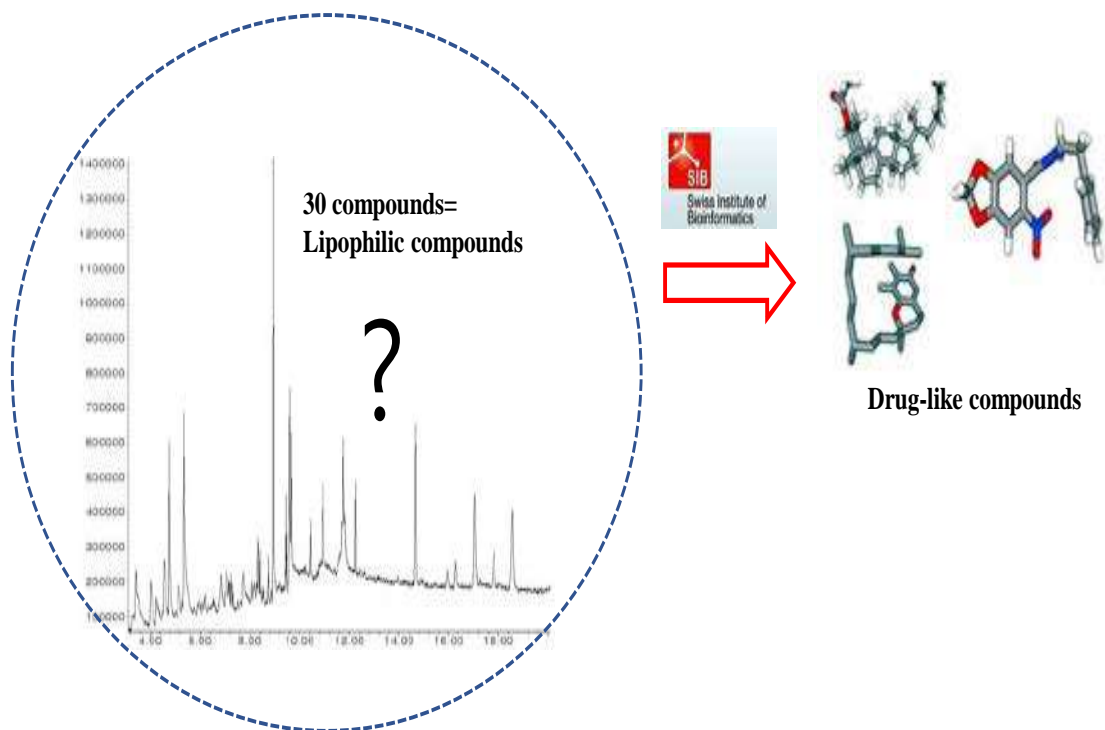
1. Analytical processing steps of HCLs against obesity
2. GC-MS analysis
3. The 30 Drug Like Compounds from HCLs
4. Obesity targets related to Drug-like compounds
5. PPI network against obesity
6. Pathway(s) -Target protein(s) - compound(s) network
7. A bubble chart
8. Target genes in 13 signaling pathways enrichment related to obesity
9. Molecular docking interaction on RAS signaling pathway
10. Molecular docking interaction on PPAR signaling pathway
11. Comparative binding energy between positive controls and  $\alpha$ -Amyrin
12. Indication of  $\alpha$ -Amyrin on GC-MS
13.  $\alpha$ -Amyrin (blue curve; Standard) and  $\alpha$ -Amyrin (red curve) in HCLs
14. A key description in this study

## 1. Analytical processing steps of HCLs against obesity





## 2. GC-MS analysis



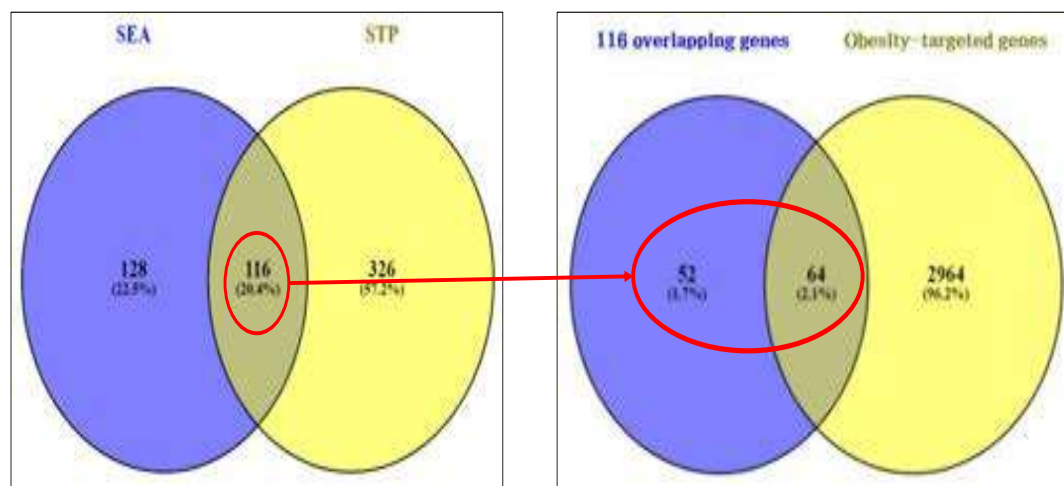
## 3. The 30 Drug Like Compounds from HCLLs

No.	Compounds	Lipinski's Rules				Lipinski's Violations	Bioavailability Score
		MW	HBA	HBD	MLog P		
		< 500	< 10	≤ 5	≤ 4.15	≤ 1	> 0.1
1	1-Methoxycyclohexa-1,3-diene	110.15	1	0	1.24	0	0.55
2	1-Methyl-3-piperidinol	115.17	2	1	0.21	0	0.55
3	2,4-Diamino-6-pyrimidinone	126.12	2	3	-1.82	0	0.55
4	3,4-Pentadienal	82.10	2	1	0.81	0	0.55
5	3-Hydroxy-2,3-dihydromaltol	144.13	4	2	-1.77	0	0.85
6	5-(Hydroxymethyl)furfural	126.11	3	1	-1.06	0	0.55
7	1-Octanamine	129.24	1	1	2.22	0	0.55
8	Propanoic acid, 3-hydroxy-	90.08	3	2	-0.85	0	0.85
9	2-Thio-6-azauracil	129.14	2	2	-1.25	0	0.55
10	4-Ethyl-2,5-dimethylisoxazolidine, (E)-	129.20	2	0	1.38	0	0.55
11	2,5-Dimethoxy-4-methylbenzaldehyde	180.20	3	0	1.13	0	0.55
12	N-Hydroxymethylacetamide	89.09	2	2	-0.85	0	0.55
13	2-Furanone	84.07	2	0	-0.01	0	0.55
14	2,3-Dihydro-5H-1,4-dioxepine	100.01	2	0	-0.31	0	0.55
15	Oleic acid	282.46	2	1	4.57	1	0.85
16	Loliodide	196.24	3	1	1.49	0	0.55
17	Citronellylacetone	196.33	1	0	3.43	0	0.55
18	Cyclopentaneundecanoic acid, methyl ester	268.43	2	0	4.04	0	0.55
19	Palmitic acid	256.42	2	1	4.19	1	0.85
20	Methyl elaidolinolenate	292.46	2	0	4.61	1	0.55
21	Phytol	296.53	1	1	5.25	1	0.55
22	Linolenyl alcohol	264.45	1	1	4.59	1	0.55
23	Stearic acid	284.48	2	1	4.67	1	0.85
24	Octyl adipate	370.57	4	0	4.55	1	0.55
25	Monopalmitin	330.50	4	2	3.18	0	0.55
26	9,12,15-Octadecatrienol	264.45	1	1	4.59	1	0.55
27	Squalene	410.72	0	0	7.93	1	0.55
28	Vitamin E	430.71	2	1	6.14	1	0.55
29	Cionasterol	414.71	1	1	6.73	1	0.55
30	α-Amyrin	426.72	1	1	6.92	1	0.55

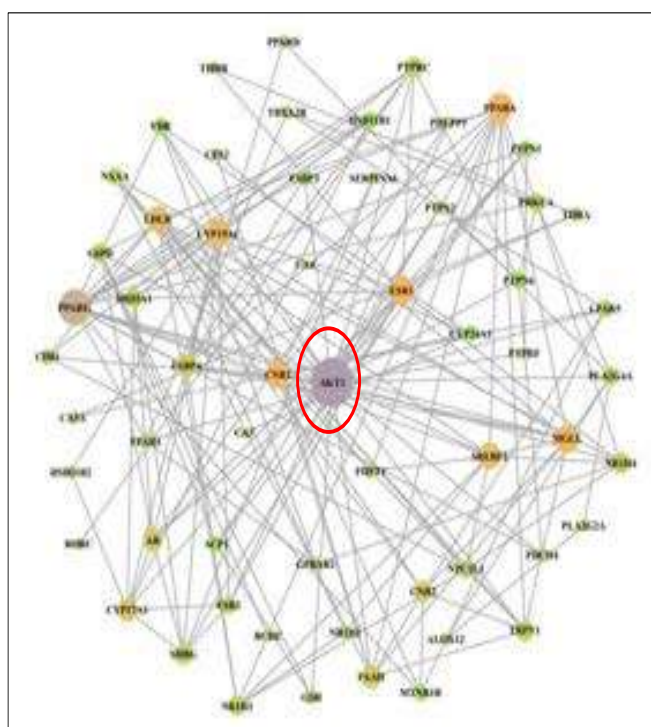
All Accepted !!!



#### 4. Obesity targets related to Drug-like compounds



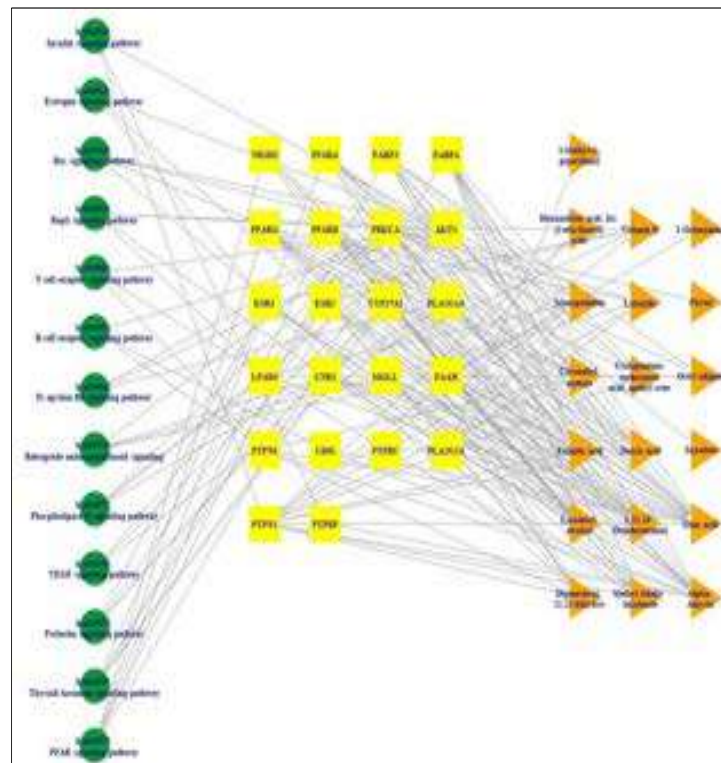
#### 5. PPI network against obesity



No.	Gene symbol	Degree	No.	Gene symbol	Degree
1	AKT1	24	31	NAAA	5
2	PPARG	16	32	ACPI	4
3	ESR1	12	33	CD81	4
4	PPARA	12	34	CYP24A1	4
5	CNR1	11	35	FABP3	4
6	CYP19A1	11	36	FFAR4	4
7	MGLL	11	37	MTNR1B	4
8	LDLR	10	38	FDFT1	3
9	SREBF2	10	39	GPBAR1	3
10	AR	8	40	NR1H2	3
11	CYP17A1	8	41	PDCD4	3
12	FAAH	8	42	PTPN2	3
13	FABP4	8	43	THRA	3
14	CNR2	7	44	GSR	3
15	TRPV1	7	45	TBXA2R	3
16	NR1H4	7	46	ALOX12	2
17	PTPRC	7	47	CA5A	2
18	SHBG	7	48	CES2	2
19	G6PD	6	49	PLA2G2A	2
20	NR1H3	6	50	SERPINA6	2
21	PLA2G4A	6	51	PHLPP1	2
22	PRKCA	6	52	PTPRF	2
23	SRD5A1	6	53	HSD11B2	2
24	ESR2	5	54	THRB	2
25	HSD11B1	5	55	PPARD	2
26	LPAR5	5	56	BCHE	1
27	NPC1L1	5	57	CA3	1
28	PTPN1	5	58	CA4	1
29	PTPN6	5	59	RORC	1
30	VDR	5			

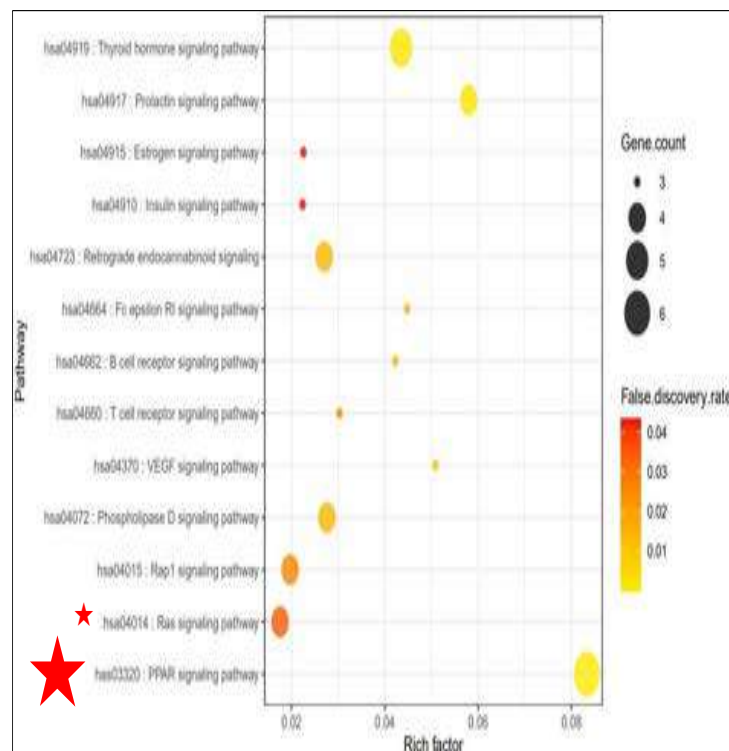


## 6. Pathway(s) -Target protein(s) - compound(s) network



13 signaling pathways, 22 target proteins, and 19 bioactives

## 7. A bubble chart

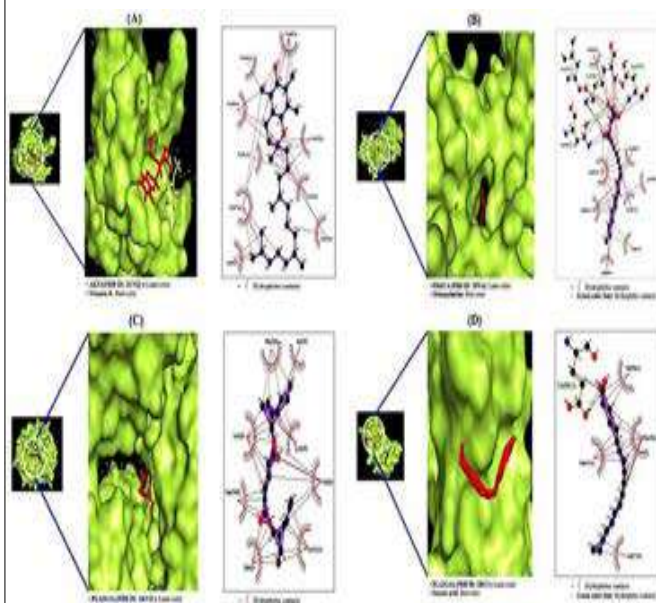




## 8. Target genes in 13 signaling pathways enrichment related to obesity

KEGG ID & Description	Target genes	False discovery rate
<b>hsa03320 : PPAR signaling pathway</b>	NR1H3,PPARA,FABP3,FABP4,PPARG,PPARD	0.0000333
hsa04919 : Thyroid hormone signaling pathway	PRKCA,AKT1,ESR1,THRA,THRB	0.0012000
hsa04917 : Prolactin signaling pathway	AKT1,ESR1,ESR2,CYP17A1	0.0019000
hsa04370 : VEGF signaling pathway	AKT1,PRKCA,PLA2G4A	0.0120000
hsa04072 : Phospholipase D signaling pathway	AKT1,PRKCA,PLA2G4A,LPAR5	0.0138000
hsa04723 : Retrograde endocannabinoid signaling	PRKCA,CNR1,MGLL,FAAH	0.0140000
hsa04664 : Fc epsilon RI signaling pathway	AKT1,PRKCA,PLA2G4A	0.0140000
hsa04662 : B cell receptor signaling pathway	AKT1,PTPN6,CD81,	0.0143000
hsa04660 : T cell receptor signaling pathway	AKT1,PTPRC,PTPN6	0.0259000
hsa04015 : Rap1 signaling pathway	AKT1,PRKCA,CNR1,LPAR5	0.0259000
<b>hsa04014 : Ras signaling pathway</b>	<b>AKT1</b> ,PRKCA,PLA2G4A,PLA2G2A	0.0347000
hsa04915 : Estrogen signaling pathway	AKT1,ESR1,ESR2	0.0433000
hsa04910 : Insulin signaling pathway	AKT1,PTPN1,PTPRF	0.0433000

## 9. Molecular docking interaction on RAS signaling pathway

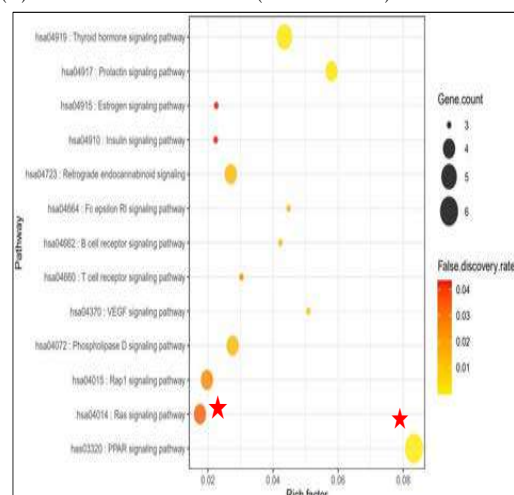


(A) Vitamin E on AKT1 (PDB ID: 1UNQ) : -5.5 kcal/mol

(B) Monopalmitin on PRKCA (PDB ID: 3IW4) : -6.7 kcal/mol

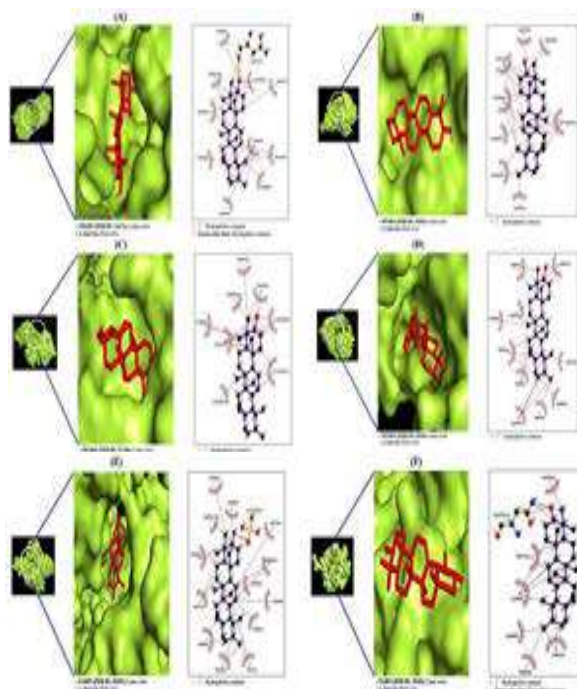
(C) Octyl adopate on PLA2G2A (PDB ID: 1KVO): -6.2 kcal/mol

(D) Stearic acid on PLA2G4A (PDB ID: 1BCI): -4.4 kcal/mol





## 10. Molecular docking interaction on PPAR signaling pathway



(A)  $\alpha$ -Amyrin on NR1H3 (PDB ID: 2ACL): **-9.7 kcal/mol**

(B)  $\alpha$ -Amyrin on PPARA (PDB ID: 3SP6): **-7.4 kcal/mol**

(C)  $\alpha$ -Amyrin on PPARB (PDB ID: 5U3Q): **-8.5 kcal/mol**

(D)  $\alpha$ -Amyrin on PPARG (PDB ID: 3E00): **-8.4 kcal/mol**

(E)  $\alpha$ -Amyrin on FABP3 (PDB ID: 5HZ9): **-10.0 kcal/mol**

(F)  $\alpha$ -Amyrin on FABP4 (PDB ID: 3P6D): **-8.5 kcal/mol**

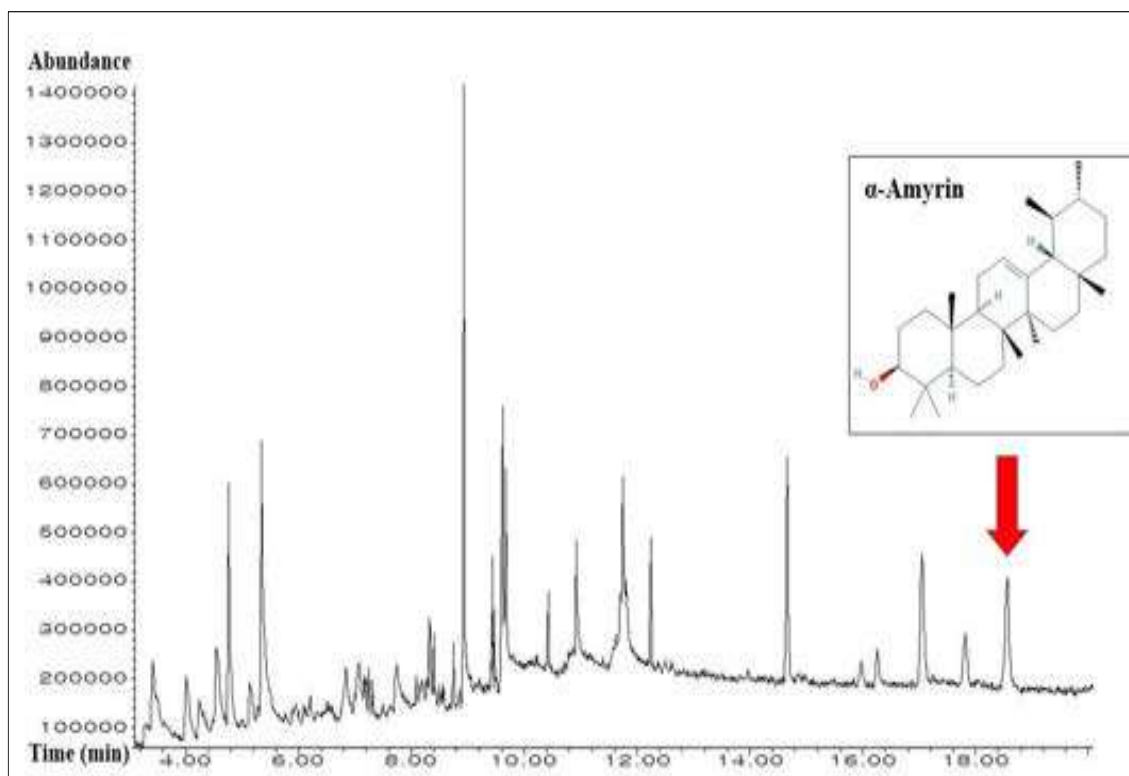
## 11. Comparative binding energy between positive controls and $\alpha$ -Amyrin

Compounds	PubChem ID	Docking Score (kcal/mol)					
		NR1H3 (PDB ID:2ACL)	PPARA (PDB ID:3SP6)	PPARB (PDB ID:5U3Q)	PPARG (PDB ID:3E00)	FABP3 (PDB ID:5HZ9)	FABP4: (PDB ID:3P6D)
$\alpha$ -Amyrin	225688	<b>-9.7</b>	—	—	—	—	—
<sup>1</sup> GW3965	16078973	-11.9	—	—	—	—	—
$\alpha$ -Amyrin	225688	—	<b>-7.4</b>	—	—	—	—
<sup>2</sup> Clofibrate	2796	—	-6.4	—	—	—	—
<sup>3</sup> Gemfibrozil	3463	—	-6.3	—	—	—	—
<sup>4</sup> Ciprofibrate	2763	—	-5.4	—	—	—	—
<sup>5</sup> Bezafibrate	39042	—	-5.8	—	—	—	—
<sup>6</sup> Fenofibrate	3339	—	-5.4	—	—	—	—
$\alpha$ -Amyrin	225688	—	—	<b>-8.5</b>	—	—	—
<sup>7</sup> Cardarine	9803963	—	—	-8.5	—	—	—
$\alpha$ -Amyrin	225688	—	—	—	<b>-8.4</b>	—	—
<sup>8</sup> Pioglitazone	4829	—	—	—	-7.7	—	—
<sup>9</sup> Rosiglitazone	77999	—	—	—	-7.4	—	—
<sup>10</sup> Lobeglitazone	9826451	—	—	—	-7.3	—	—

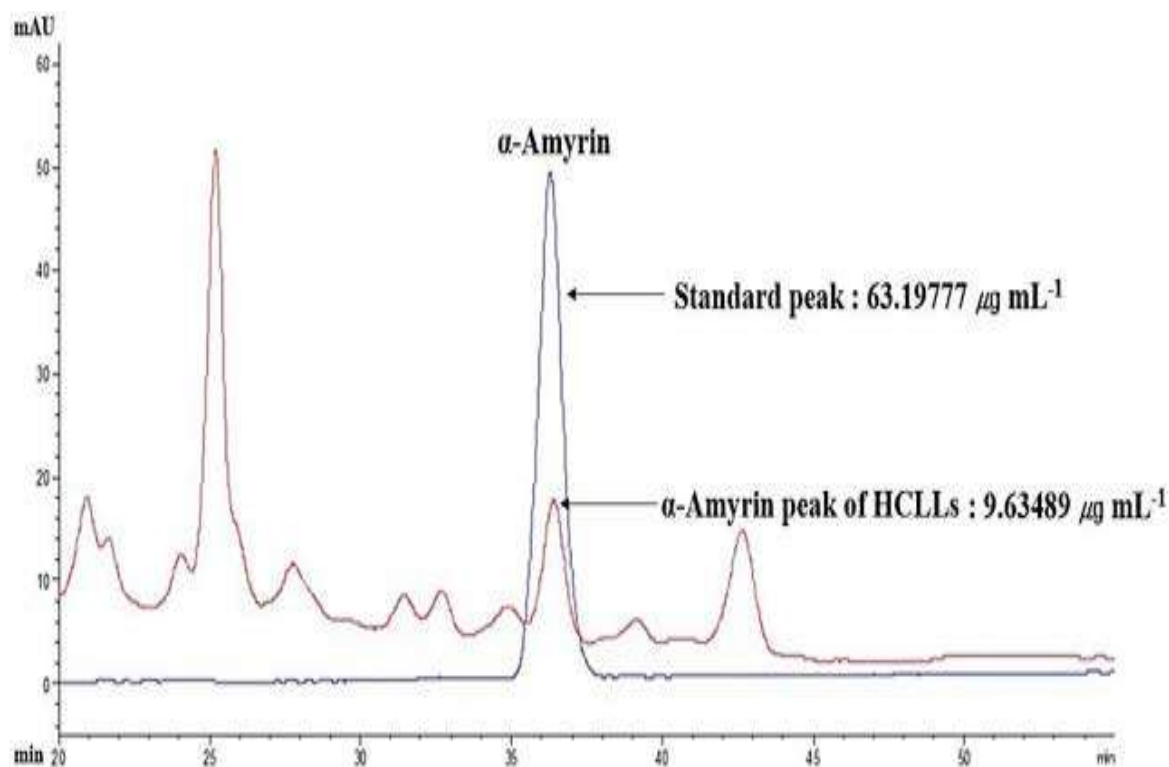
1): NR1H3 agonist; 2), 3), 4), 5), 6): PPARA agonist; 7): PPARG agonist; 8), 9), 10): PPARG agonist



## 12. Indication of $\alpha$ -Amyrin on GC-MS

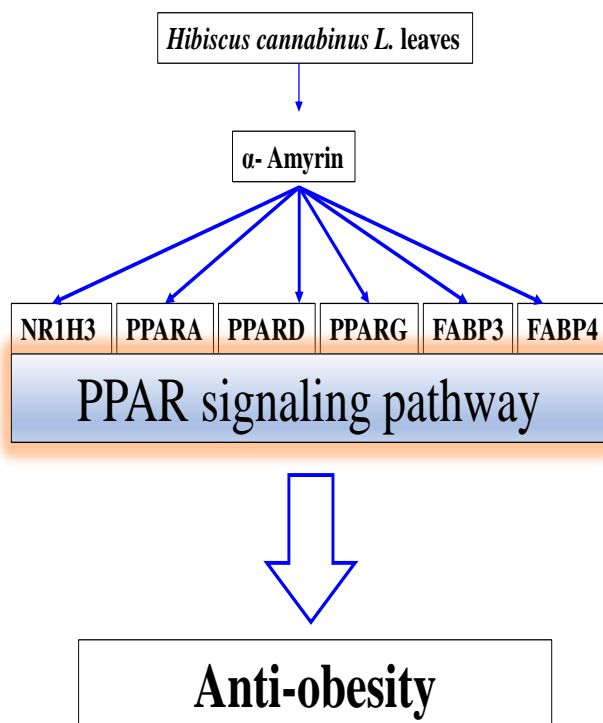


## 13. $\alpha$ -Amyrin (blue curve; Standard) and $\alpha$ -Amyrin (red curve) in HCLLs





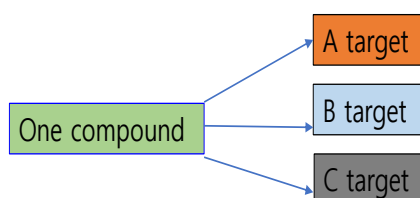
## 14. A key description in this study



## The findings of this study

- ▶ A key signaling pathway: **PPAR signaling pathway**
- ▶ Key targets: **NR1H3, PPARA, PPARD, PPARG, FABP3, FABP4**
- ▶ A key compound:  **$\alpha$ -Amyrin**

ONE compound- Multiple targets





## Academic performances of network pharmacology

No.	Journal	Disease	Classification	Impact factor	JCR	1st author	Co-author	Corresponding Author	The number of authors
1	Gene reports	Hepatitis	SCOPUS		Scopus	Ki Kwang Oh	Md.Adnan	Dong Ha Cho	3
2	Life		SCIE	3.817	Q2	Ki Kwang Oh, Md.Adnan		Dong Ha Cho	6
3	Gene	Diabetes	SCI	3.688	Q2	Ki Kwang Oh	Md.Adnan	Dong Ha Cho	3
4	PLOS ONE	Diabetes	SCIE	3.24	Q2	Ki Kwang Oh	Md.Adnan	Dong Ha Cho	3
5	Life		SCIE	3.817	Q2			Dong Ha Cho	15
6	RSC Advances	Obesity	SCIE	3.36	Q2	Ki Kwang Oh	Md.Adnan, In-Seok Ju	Dong Ha Cho	4
7	Scientific Reports	COVID-19	SCI	4.379	Q1	Ki Kwang Oh	Md.Adnan	Dong Ha Cho	3
8	Journal of Ethnopharmacology		SCI	3.69	Q1			Dong Ha Cho	8
9	Processes	Obesity	SCIE	2.753	Q2	Ki Kwang Oh	Md.Adnan	Dong Ha Cho	3
10	Biology	Rheumatoid arthritis	SCIE	5.079	Q1	Ki Kwang Oh	Md.Adnan	Dong Ha Cho	3
11	Medical Hypotheses	COVID-19	SCI	1.538	Q4	Ki Kwang Oh	Md.Adnan	Dong Ha Cho	3
12	Journal of Food Biochemistry	Atherosclerosis	SCI	2.72	Q3	Ki Kwang Oh	Md.Adnan	Dong Ha Cho	3
13	International Journal of Molecular Sciences	Gout	SCIE	5.923	Q1	Ki Kwang Oh	Md.Adnan	Dong Ha Cho	3
14	Molecules	Cancer	SCIE	4.441	Q2	Ki Kwang Oh	Md.Adnan	Dong Ha Cho	3

▶ Network pharmacology : 11 publications (1<sup>st</sup> author); ▶ others: 3 publications (1<sup>st</sup> author:1; co-author: 2)



# THANK YOU



**학술발표회**

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**일반 구두  
(OP-1~6)**

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**좌장: 이이 교수  
(충북대학교)**







감초 신품종 공정서 (KP) 등재를 위한 안전성 및 효능 연구

이정훈<sup>1)\*</sup>, 진종식<sup>2)</sup>, 안효진<sup>3)</sup>, 이종현<sup>4)</sup>, 김원남<sup>5)</sup>, 김용일<sup>1)</sup>, 이윤지<sup>1)</sup>, 구성철<sup>1)</sup>, 박우태<sup>1)</sup>

<sup>1)</sup>국립원예특작과학원, <sup>2)</sup>전북대학교, <sup>3)</sup>상지대학교, <sup>4)</sup>동덕여자대학교, <sup>5)</sup>Cnh암의학연구소

**Study on Safety and Efficacy of New *Glycyrrhiza* Cultivar Classified as *G. korshinskyi* Grig. for Listing in Official Compendia**

Jeong Hoon Lee<sup>1)\*</sup>, Jong Sik Jin<sup>2)</sup>, Hyo Jin An<sup>3)</sup>, Jong Hyun Lee<sup>4)</sup>, Won Nam Kim<sup>5)</sup>, Yong Il Kim<sup>1)</sup>, Yun Ji Lee<sup>1)</sup>, Sung Cheol Koo<sup>1)</sup> and Woo Tae Park<sup>1)</sup>

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<sup>2)</sup>Department of Oriental Medicine Resources, Jeonbuk National University, Iksan 54596, Korea.

<sup>3)</sup>Department of Pharmacology, Sangji University, Wonju 26339, Korea.

<sup>4)</sup>Department of Pharmacy, Dongduk Women's University, Seoul 02748, Korea.

<sup>5)</sup>Cnh Center for Cancer Research, Seoul 06154, Korea.

**ABSTRACT**

**Background :** We have developed new *Glycyrrhiza* cultivar suitable for cultivation in domestic environment. However, it is difficult to supply because it is a hybrid cultivar (*Glycyrrhiza glabra* × *G. uralensis*) classified as *G. korshinskyi* Grig (GK). To compare the species, we conducted identification of imported licorice and distribution of licorice hybrid species in nature. Furthermore, morphological characteristics, equivalence of efficacy, safety of *G. korshinskyi* were studied for registration on official compendia.

**Methods and Results :** Interspecific hybrid was detected in licorice from China, Kazakhstan and Kyrgyzstan by DNA analysis. GK has been identified as hybrid of the two species and distributed as *Glycyrrhiza* Radix et Rhizome in the medicinal herb market. In field study, it is confirmed that licorice interspecific hybrid has been grown throughout Central Asia. Especially, GK is widely distributed in China (Xinjiang), Kazakhstan, Kyrgyzstan, and Southern Russia. We have identified the distribution natural community of licorice hybrids from Kazakhstan. GK can be distinguished from origin plants (*G. uralensis* and *G. glabra*) by considering pod shape and the presence of pod hair, the form and number of leaflet. New *Glycyrrhiza* cultivar showed a safety through genotoxicity tests including an *in vitro* bacterial reverse mutation test, an *in vitro* chromosome aberration test, and an mouse bone marrow micronucleus test. Furthermore, in a 13 week repeated oral dose toxicity study using Spague-Dawley rats, no mortality or toxicological changes involving ophthalmology, water consumption, or hematology were observed up to 5,000 mg/kg/day. And the new cultivar did not show drug-drug interaction like *G. uralensis* and *G. glabra*. Many of biological activities such as anti-inflammatory, anti-bacterial, anti-oxidant, anti-cancer, anti-allergic, and immune-modulatory effects of the cultivar were evaluated to confirm an equivalence of efficacy.

**Conclusion :** Genetic and field study shows high possibility of distribution and consumption of GK in Korea for a long time. Based on our studies of safety and efficacy, GK need to be listed in official compendia for utilization and stable supply for medicinal resource by cultivation in Korea.

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\*\* (Acknowledgement) This study was supported by a grant PJ014246012021 from Rural development administration, Korea.



미세먼지 유도 동물모델에서 GF37의 호흡기 염증 개선 효과

최고우<sup>1)</sup>, 소주영<sup>1)</sup>, 김민정<sup>1)</sup>, 이유진<sup>1)</sup>, 조윤호<sup>1)</sup>, 김세정<sup>1)</sup>, 김단희<sup>1)</sup>, 이상훈<sup>1)</sup>, 박은영<sup>1)</sup>, 유대석<sup>1)</sup>,  
김진성<sup>1)</sup>, 조상원<sup>1)</sup>, 김영수<sup>1)</sup>, 최학주<sup>2)</sup>, 표미경<sup>1)\*</sup>  
<sup>1)</sup>(재)금산인삼약초산업진흥원, <sup>2)</sup>대구한의대학교

**Effects of GF37 on Respiratory Inflammation in Fine Dust-induced Animal Models**

Go Woo Choi<sup>1)</sup>, Min Jung Kim<sup>1)</sup>, Ju Yeong So<sup>1)</sup>, You Jin Lee<sup>1)</sup>, Yun Ho Jo<sup>1)</sup>, Se Jeong Kim<sup>1)</sup>,  
Dan Hui Kim<sup>1)</sup>, Sang Hun Lee<sup>1)</sup>, Een Yeong Park<sup>1)</sup>, Dae Seok Yoo<sup>1)</sup>, Jin Seong Kim<sup>1)</sup>,  
Sang Won Cho<sup>1)</sup>, Young Soo Kim<sup>1)</sup>, Hak Joo Choi<sup>2)</sup> and Mi Kyung Pyo<sup>1)\*</sup>

<sup>1)</sup>Geumsan Ginseng & Herb Development Agency, Geumsan 32724, Korea.

<sup>2)</sup>Daegu Haany University, Gaegu 42158, Korea.

**ABSTRACT**

**Background :** Increased exposure to fine dust is known to cause various acute and chronic diseases. The purpose of this study is to evaluate the improvement of respiratory inflammation in a fine dust-induced animal model of GF37, a mixed material of ginseng and perilla leaves, which are local specialties of Geumsan.

**Methods and Results :** Seven-week-old male mouse (C57BL/6) was prepared as an animal model for respiratory damage and the sample was administered through oral administration for 11 days. Dilute the fine dust mixture (PM10D) with aluminum hydroxide (Alum) and use the Intra-Nazal-Tracheal (INT) injection method 3 times at 3-day intervals (3 days after drug administration, 6 days after, and 9 days after intra- nasaltracheal injection) was injected directly into the lungs through the airway, and sacrificed 3 days after the final fine dust (PM10D) injection. As a result of analyzing the total cell number, GF37 significantly inhibited the increase in the total cell number induced by fine dust in BALF, Lung, and Spleen, and also significantly decreased the number of inflammatory neutrophils in BALF than the control group. In addition, GF37 significantly reduced inflammatory cytokines such as IL-17, TNF-a, MIP2, and CXCL-1, in BALF than in the control group. It was confirmed that administration of GF37 in peripheral blood also improved lung function and suppressed cough induction by significantly inhibiting SDMA, which is an index of lung function raised by fine dust, and cough-related genes MUC5AC, TRPV1, and TRPA1.

**Conclusion :** Considering the above results, GF37, a composite material of ginseng and perilla leaves, is judged to be useful as a material for improving respiratory inflammation induced by fine dust.

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[OP-003]

## 산양삼 4, 7, 13년근의 생육특성과 진세노사이드 함량간의 상관관계 분석

윤영배, 허정훈, 전권석, 엄유리\*

국립산림과학원 산림약용자원연구소

### Correlation Analysis between Growth Characteristics and Ginsenoside Content of 4-, 7- and 13-year-old Wild-simulated Ginseng (*Panax ginseng* C. A. Meyer)

Yeong Bae Yun, Jeong Hoon Huh, Kwon Seok Jeon and Yurry Um\*

Forest Medicinal Resource Research Center, National Institute of Forest Science, Yeongju 36040, Korea.

#### ABSTRACT

**Background** : Wild-simulated ginseng is a specially managed forest product of the Korea Forest Service, and it is a ginseng of the Araliaceae family, *Panax* genus *Panax ginseng* C.A. Meyer. It is defined as ‘ginseng that is grown in a natural state without installing artificial facilities by directly sown and transplanting seeds or seedlings in the mountains’.

**Methods and Results** : The growth characteristics of wild-simulated ginseng collected from 7 wild-simulated ginseng collection sites in 2020 are investigated, and the content of 20 types of ginsenoside is analyzed by HPLC after grinding, and correlation with the growth characteristics is analyzed. It was confirmed that the growth characteristics (rhizome length, root length, root diameter, fresh weight of root) of wild-simulated ginseng in the entire cultivation area were significantly higher in 7-year and 13-year-old ginseng than in 4-year-old. As a result of analyzing the ginsenoside content of wild-simulated ginseng, the content of top part (Rb1, Rb3, Rc, Rd-p, Re-p, Rg2-s, Rg3, Rh1) and the root part (Rb1, Rb3, Ro) was significantly increased in the older roots than in the lower years. On the other hand, higher content of F2-AS was detected in the root part of 4-year-old roots. In the top part, all indicators showing a significant difference in the correlation between the growth characteristics of wild-simulated ginseng and ginsenoside showed a negative correlation. In the root part, ginsenoside Rf-p, Rg1, Rk1, and Ro showed significant positive correlations according to rhizome length and weight.

**Conclusion** : The growth of wild-simulated ginseng showed a significant difference as the older root, but the content of 20 kinds of ginsenosides was not proportional to the growth. In particular, there is a case of ginsenoside F2-AS, which is detected with a significantly high ginsenoside content in the root part of young wild-simulated ginseng. This study is expected to provide useful information for establishing quality standards according to the age of wild-simulated ginseng by examining the correlation between growth characteristics and ginsenoside content for 4, 7, and 13-year-old wild-simulated ginseng.

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\*\* (Acknowledgement) 본 연구는 국립산림과학원 일반연구사업(과제번호: FP0802-2017)의 지원에 의해 이루어진 결과로 이에 감사드립니다.



[OP-004]

생약재 및 생약 가공품에 함유된 thiamine, riboflavin 및 niacin 함량

전진수<sup>1)</sup>, 장영현<sup>1)</sup>, 김희재<sup>1)</sup>, 신유빈<sup>1)</sup>, 이상훈<sup>2)</sup>, 최용민<sup>2)</sup>, 정명근<sup>1)\*</sup>

<sup>1)</sup>강원대학교 생약자원개발학과

<sup>2)</sup>농촌진흥청 국립농업과학원 식생활영양과

**Contents of Thiamine, Riboflavin, and Niacin in Herbal Medicines and Their Products**

Jin Soo Jeon<sup>1)</sup>, Young Hyeon Jang<sup>1)</sup>, Hee Jae Kim<sup>1)</sup>, Yu Bin Shin<sup>1)</sup>, Sang Hoon Lee<sup>2)</sup>, Young Min Choi<sup>2)</sup> and Myoung Gun Choung<sup>1)\*</sup>

<sup>1)</sup>Department of Herbal Medicine Resource, Kangwon National University, Samcheok 25949, Korea.

<sup>2)</sup>Department Agrofood Resources, NAAS, RDA, Wanju 55365, Korea.

**ABSTRACT**

**Background :** In Korea, various food materials use herbal medicines, which means the importance of research on general nutritional components and vitamin content of food materials for using herbal medicine. However, the contents of thiamine, riboflavin, and niacin in raw materials of herbal medicine and their processed products are insufficient. Therefore, this study was conducted to know the contents of thiamine, riboflavin, and niacin in herbal medicines using HPLC.

**Methods and Results :** Thiamine and niacin were extracted by ultrasonication, and riboflavin was extracted by the reflux extraction method. We reviewed the reproducibility and accuracy of the analysis method and confirmed that the method was sufficient for routine analysis. The herbal medicine containing the highest thiamine content was red ginseng ( $0.5154 \pm 0.0103$  mg/100g), and the riboflavin was the highest in Cordyceps (silkworm pupa;  $0.2880 \pm 0.0114$  mg/100g). In the case of niacin, ginger contained the highest at  $1.5207 \pm 0.0065$  mg/100g. In general, processed herbal foods had a lower vitamin content than raw materials, but in the case of Korean plum syrup, the niacin content was higher than that of raw materials.

**Conclusion :** The contents of thiamine, riboflavin, and niacin in various herbal medicine materials and their processed foods were evaluated, and the results of this study will be used for publication of the 10th revision of the Korean Food Composition Table.

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\*\* (Acknowledgement) 본 연구는 농촌진흥청 연구사업(과제번호: PJ0133982021)의 지원에 의해 이루어진 결과로 이에 감사드립니다.



국내산 강황 추출물의 비알코올성 지방간 질환 개선 효과

이영섭<sup>1)</sup>, 오선민<sup>1)</sup>, 김관우<sup>1)</sup>, 윤다혜<sup>1)</sup>, 김금숙<sup>1)</sup>, 권동렬<sup>2)</sup>, 강옥화<sup>2)</sup>, 이대영<sup>1)\*</sup>

<sup>1)</sup>농촌진흥청 국립원예특작과학원 인삼특작부

<sup>2)</sup>원광대학교 약학대학 한약학과

Improvement Effect of Non-alcoholic Fatty Liver Disease by Domestic

*Curcuma longa* L. Extract

Young Seob Lee<sup>1)</sup>, Seon Min Oh<sup>1)</sup>, Kwan Woo Kim<sup>1)</sup>, Da Hye Yoon<sup>1)</sup>, Geum Soog Kim<sup>1)</sup>, Dong Yeul Kwon<sup>2)</sup>, Ok Hwa Kang<sup>2)</sup> and Dae Young Lee<sup>1)\*</sup>

<sup>1)</sup>Department of Herbal Crop Research, NIHHS, RDA, Eumseong 27709, Korea.

<sup>2)</sup>Department of Oriental Pharmacy, Wonkwang University, Iksan 54538, Korea.

ABSTRACT

**Background :** The medicinal plant *Curcuma longa* L. (Turmeric) is widely distributed in Asia and has been reported to have many biological functions. Curcumin (CM), demethoxycurcumin (DMC), and bisdemethoxycurcumin (BDMC) are major curcumin derivatives found in the rhizome, and have yielded impressive properties to halt various diseases. Non-alcoholic fatty liver disease (NAFLD) is a disease associated with metabolic syndromes such as diabetes and obesity, regardless of alcohol consumption, and refers to the accumulation of triacylglycerols in the liver. In this study, we evaluate turmeric on an NAFLD and elucidate the mechanism of action.

**Methods and Results :** Turmeric was purchased from Jindo Turmeric Farming Association Corporation (Jindo, Korea). C57BL/6J mice fed a methionine-choline deficient diet (MCD) were treated with turmeric 50% EtOH extract (CE) or milk thistle, and changes in inflammation and steatosis were assessed. Body weight, liver weight, liver function, and histological changes were assessed in experimental animals. Quantitative real-time polymerase chain reaction and western blot analyses were performed on samples collected after 4 weeks of treatment. We observed that CE administration improved MCD-diet-induced lipid accumulation, and triglyceride and total cholesterol levels in serum. Treatment with CE also decreased hepatic lipogenesis through modulation of the sterol regulatory element binding protein-1 (SREBP-1), CCAAT-enhancer binding protein  $\alpha$  (C/EBP  $\alpha$ ), fatty acid synthase (FAS), and peroxisome proliferator-activated receptor  $\gamma$  (PPAR $\gamma$ ) expression. In addition, the use of CE increased adenosine monophosphate-activated protein kinase (AMPK) phosphorylation and inhibited the up-regulation of toll-like receptor (TLR)-2 and TLR-4 signaling and the production of inflammatory mediators.

**Conclusion :** In this report, we observed that CE regulated lipid accumulation in an MCD diet-induced NAFLD model by decreasing lipogenesis. These data suggest that CE could effectively protect mice against MCD-induced NAFLD, by inhibiting the TLR-2 and TLR-4 signaling cascades.

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\*\* (Acknowledgement) 본 연구는 ‘강황 추출물의 간 건강개선 원료 표준화 연구’ 과제 (과제번호: PJ01327501)의 지원에 의하여 이루어진 결과로 이에 감사드립니다.



[OP-006]

인삼뿌리썩음병 발병 예측 기술 개발 및 생태연구를 통한 병 억제 기술 확립  
이승호\*

농촌진흥청 국립원예특작과학원 인삼특작부 인삼과

**Development for Forecast System and Disease Control Technology through  
Ecological Research of Root Rot in Ginseng**

Seung Ho Lee\*

Ginseng Research Division, Department of Herbal Crop Reserch, NIHHS, RDA, Eumseong 27709,  
Korea.

**ABSTRACT**

**Background :** Ginseng root rot, caused by the soil-borne pathogenic fungi *Cylindrocarpon destructans*, severely impacts the quality of ginseng. Despite economic losses due to ginseng root rot, the use of chemical and biological control agents to prevent this disease is apparently limited. We have developed a technology for the isolation and detection of *C. destructans* from soil and investigated the genetic diversity and pathogenic factors of the fungal populations to provide base technology for disease control.

**Methods and Results :** In this study, we have successfully applied the qPCR to detect *C. destructans*, a major pathogen causing root rot disease from soil. The qPCR using specific primer set maintained the specificity in soils containing various microorganisms. In several naturally infested field soils, qPCR estimates of *C. destructans*-DNA concentration were significantly correlated with disease severity. A selective medium for isolating ginseng root rot fungus was developed using radicicol produced by the fungus. We also established the enrichment culture method to check the density of the fungus in soil using this selective medium. Also, we applied biochar to soil and monitored the effect of biochar on ginseng pathogens and diversity of soil microbiome, ultimately observing the effect of biochar on the survival of ginseng. Biochar supplementation reduced the density of *C. destructans* in soil by 63% and enriched the bacterial diversity in soil. Moreover, biochar supplementation to soil increased the survival rate of ginseng.

**Conclusion :** The qPCR method will be utilized as a reliable and rapid tool for detecting and monitoring *C. destructans* in ginseng fields. And the microbiota analyses suggested that biochar is a good candidate to manage ginseng root rot disease in ginseng fields and guaranties sustainable ginseng production. The approach outlined here allows the quantification of current populations of *C. destructans* in soil many years after ginseng cultivation and the prediction of disease severity in future crops.

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# 학술발표회

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## 포스터발표

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1. 재배, 생리	(P01-001~P01-031)
2. 유전, 육종	(P02-001~P02-022)
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## 양분 수준에 따른 3년생 인삼의 시기별 뿌리 생육 비교

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농촌진흥청 국립원예특작과학원 인삼특작부

### Root Growth Comparison of 3-year-old Ginseng by Period according to Nutrient Levels

Jin Yu\*, Su Jeoung Suh, In Bok Jang and Young Chang Kim  
Department of Herbal Crop Research, NIHHS, RDA, Eumseong 27709, Korea.

#### ABSTRACT

**Background** : Ginseng (*Panax ginseng* C. A. meyer) is highly affected by soil environment, especially nutrients in soil. There is a tendency to excessively use organic matter when managing the preplanting field to provide nutrients for ginseng. However, it causes a lot of physiological disorders and diseases. This study was aim to find an appropriate nutrient level in soil using organic matter to cultivate ginseng stably.

**Methods and Results** : This field was managed by treating rice straw and livestock manure for a year after cutting the ground. Livestock manure was treated for 1, 2, 3, 5 ton/10a respectively at the field. In April 2020, ginseng seedlings of an average of 0.8g were transplanted into the field. 1ton/10a showed a relatively longer root length compared to other treatments initially, but 2ton/10a showed the largest value in September. 1ton/10a had the largest value of root weight during March-June, but it increased significantly at 2ton/10a and 3ton/10a in July. Finally Root weight was excellent at 3ton/10a in September.

**Conclusion** : From the above results, 3ton/10a treatment was proper for 3-year-old ginseng. However, soil chemistry and the incidence of physiological disorders should be further investigated. We plan to continue investigating the appropriate nutrient levels in soil.

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[P01-002]

인위적 동해 처리 후 피해 면적에 따른 3년생 인삼의 지하부 생육 조사

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## Investigation of Root Growth of 3-year-old Ginseng according to the Damage Area after Artificial Freezing Stress

Su Jeoung Suh\*, Jin Yu and In Bae Jang

Department of Herbal Crop Research, NIHHS, RDA, Eumseong 27709, Korea.

### ABSTRACT

**Background :** In spring, abrupt temperature decline to freezing temperature results in severe damage to ginseng. Here we applied freezing stress artificially on 3-year-old ginseng in the field and examined the effects on the root growth.

**Methods and Results :** Freezing stress was treated either by cooling with a cold airflow from dry ice or by direct contact with ice cubes to the leaves in April. After 1 month of freezing treatment, the damage rate of the shoot was evaluated as '1. dead', '2. damage more than 50%', '3. damage less than 50%', and '4. healthy'. Roots were harvested in summer and the growth of roots was examined according to the rate of leaf damage. In both experiments, there was a clear difference in root length, root diameter, and root weight, in the order of '4' > '3' > '2' > '1'. For cold airflow treatment, the root weights of '3', '2' and '1' were 63%, 34% and 24% in compared to 'healthy', respectively. For ice contact treatment, root weight of '3', '2' and '1' were 82%, 38% and 21%, respectively, in compared to 'healthy'. The number of lateral roots and side roots also dependent on the leaf damage rate. Interestingly, the number of stolon of '3' was higher than the healthy control.

**Conclusion :** Freezing in the early stage of ginseng had a great effect on root growth according to the remaining leaf area. We expect that these results could be used as basic information for the evaluation and measures for damage caused by freezing stress.

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재배 시 양분조건이 인삼의 침수피해에 미치는 영향

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**Effects of Nutritional Status on Damage Patterns of Ginseng after Waterlogging**

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**ABSTRACT**

**Background** : Successful management of nutrient status could increase tolerance to abiotic stresses. Here, we examined the waterlogging stress of ginseng (*Panax ginseng* C. A. meyer) grown under different nutrient conditions.

**Methods and Results** : Two-year-old ginseng was grown under low, optimum, and high nutrient conditions. In early August, ginseng was immersed in water for 3 days up to the lower part of the rhizome. The loss of leaf chlorophyll and turgor was evident in the low nutrient condition and the damage was lowest in the high nutrient conditions than in the others. Root growth characteristics were measured after 14 days of drainage. Root rot and fine root loss were observed in waterlogging treated ginsengs. Root rot was 3.5 times and 2 times higher in low and high nutrient conditions, respectively than optimum conditions. Root length and root weight decreased in all conditions by waterlogging treatment, and those were highest in optimal conditions among them. However, root diameter and hardness were not affected by waterlogging.

**Conclusion** : Waterlogging caused root rot, loss of fine root and root weight, and damage was less under optimum conditions than under low or high nutrient conditions. Therefore, we suggest that proper soil nutrient regulation is important to counter waterlogging stress.

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[P01-004]

# 배수불량 논에 무굴착 암거배수 적용에 따른 인삼 해가림 시설 내 토양 환경 변화

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## Changes of Soil Environment under the Ginseng Shading Facility due to No-excavation Culvert Drainage Technology in Poorly Drained Paddy Fields

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### ABSTRACT

**Background :** The available area for ginseng paddy cultivation is limited to 38% based on drainage grade. To expand the cultivable area, we applied the cost effective (about 75% of culvert drainage) no-excavation culvert drainage technology (NCDT) to poorly drained paddy fields, and compared the changes of soil moisture content in the shading facility.

**Methods and Results :** After poorly drained paddy fields were selected, 50 mm perforated pipes with 50 cm wide filter mats were buried (5 m intervals) at a depth of 80 cm. Ginseng seeds were sown and A-4 type facility (four layered shading nets) was installed in March 2021. Data were received from sensors that measure the moisture content, salt concentration, and temperature in the soil. Soil moisture content was 2 - 13% lower than that of control. The volatility difference in soil moisture content on rainy days compared to sunny days was larger, and even if the NCDT was applied, the value did not fall below 20%. The soil temperature did not differ between treatments and the salt concentration was higher in the NCDT with low moisture content.

**Conclusion :** NCDT lowered the soil moisture content even in a shaded environment. This cost effective technology is expected to contribute to stable production of ginseng, which is vulnerable to moisture, in poorly drained paddy fields.

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## 현삼 육묘일수에 따른 생육 및 수량 특성

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## Growth and Yield Characteristics of *Scrophulariae buergeriana* by Seedling Periods

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### ABSTRACT

**Background :** *Scrophulariae buergeriana* is a medicinal crop that has been cultivated steadily without change in the number of cultivated farms and cultivated area with a nationwide cultivation area of 8ha and production of 20 tons. It is mainly cultivated in Gyeonggi-do and Gyeongsangbuk-do. Efficacy is effective against inflammation, hypertension, and pneumonia. The main ingredients are harpagide, phytosterol, and o-methoxycinnamic acid. Propagation is mainly by seedlings and seeds, but seed propagation is used for the first cultivation. This experiment was conducted to investigate the growth and yield characteristics according to the seedling periods to produce healthy seedlings to increase resistance to rapid environmental changes such as low and high temperatures during planting in late April to early May.

**Methods and Results :** From March 1 to March 31, seeds of landrace figwort were sown in 72 seedling trays at 10-day intervals, and seedling qualities were investigated on May 10. From 50 days after planting, 4 times at 30-day intervals, plant height, tuber height, leaf number, tuber length, tuber and dry weight of above-ground parts were investigated. As for seedling quality, plant length was 5.9 cm for 40-day seedlings, 11.7 cm for 70-day seedlings, root length was 11.2 cm for 40-day seedlings and 11.7 cm for 70-day seedlings and plant weights were 1.4 g for 40-day seedlings and 3.7 g for 70-day seedlings. The number of leaves was 6.1 in 40-day seedlings and 7.7 in 70-day seedlings. In the higher growth period, there was no difference according to the number of seedling days. The number of branches was 19.1 for 40-day seedlings and 28.3 for 70-day seedlings, and the tuber length was 26.2 cm for 40-day seedlings and 29.6 cm for 70-day seedlings. The T/R ratio, which is the ratio of dry weight between the above-ground and underground parts of the plant, was investigated five times from seedling survey to harvest. As a result, the 40-day seedling had the highest and the 70-day seedling the lowest, and it steadily decreased until harvest. At harvest, the dry weight of the above-ground part per plant was 395g, 402g, 407g, and 414g, respectively, 40-day, 50-day, 60-day, and 70-day seedling.

**Conclusion :** For seedling qualities such as plant height, live weight, leaf length, leaf length, and leaf area, 70-day seedlings showed the best growth. And plant height, light length, branching, and tuber dry weight showed the best growth during the growing season. For seed propagation, 60 - 70day seedlings was the seedling peorids with the highest yield.

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## 황기 후작 가능한 유망 약용작물 선발

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### Selection of Promising Medicinal Crops as Succeeding Crop of *Astragalus membranaceus* Bunge

Eun Song Lee<sup>1)\*</sup>, Yong Il Kim<sup>1)</sup>, Kyung Sook Han<sup>1)</sup>, Tae Jin An<sup>2)</sup>, Sang Ku Lee<sup>1)</sup> and Young Ho Yoon<sup>1)</sup>

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#### ABSTRACT

**Background :** *Astragalus membranaceus* Bunge should be cultivated annually in the first crop field because continuous cultivation in the same field causes crop failure due to a decrease in yield and an increase of diseases and pests. The injury by continuous cropping can lead to increased imports and weakened price competitiveness of domestic medicinal crops, so countermeasures are urgently needed. This experiment was to select promising medicinal crops as succeeding crop of *A. membranaceus*.

**Methods and Results :** The continuously cropped land was soil that was cultivated for two years in '17 - '18, and the first cropped land was a new field that did not grow crops. For medicinal crops with the highest cultivated area in Korea, 10 species of crops, which can be harvested in the same year, were sown by tray seedling transplantation or division of seminal root. Harvesting was carried out at the appropriate harvest time for each crop. As a result, the crops with superior yields in the continuous cropped field compared to that in the first cropped field were *Peucedanum japonicum* Thunberg and *Platycodon grandiflorum* A. De Candolle. Both yield of the above ground part (kg/10a) and underground part yield (kg/10a) of *P. japonicum*, which are indicators related to the yield and profitability of plants, were 327.1 kg and 349.1 kg in the continuously cropped land, compared with 231.4 kg and 245.7 kg in the first cropped field. The yield of underground part (kg/10a), an indicator related to the yield and profitability of *P. grandiflorum*, was 457.4 kg in continuous cropped field, which was significantly higher than that of 413.7 kg in first cropped field. Other than that, there was no significant difference in the yields of *Cassia tora* Linné, *Artemisia princeps* Pampanini, *Coix lacryma-jobi* var. *ma-yuen* (Rom.Caill.) Stapf, *Carthamus tinctorius* Linné, *Paeonia lactiflora* Pallas and *Cnidium officinale* Makino in the continuous cropped field and first cropped field. But, *Rehmannia glutinosa* Liboschitz ex Steudel and *Codonopsis lanceolata* (Siebold & Zucc.) Trautv. should be avoided as succeeding crop of *A. membranaceus* since their yields were poor in continuously cropped land.

**Conclusion :** After cultivation, it is hard to re-cultivate *A. membranaceus*, so vegetables are mainly grown in farmhouses. However, based on the results of this study, it is expected that the medicinal crops industry will be maintained if *P. japonicum* and *P. grandiflorum* are cultivated as following crop of *A. membranaceus*.

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맥문동 정식시 묘 절단방법에 따른 생육특성

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**Effects of Different Types of Cutting on the Growth  
for Planting in *Liriope Platyphylla***

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**ABSTRACT**

**Background** : Because half of the production of *Liriope Platyphylla* consists of labor costs, labor-saving technologies are required. It is the harvest and planting times overlap, and there are many farms that have delayed planting due to lack of labor. Therefore, there is a need for research that can be planted in a optimum period through labor-saving cultivation while maintaining in quantity and quality.

**Methods and Results** : This study was carried out to find a method of preparing seedling for labor saving in *Liriope Platyphylla*. Plant hight was short in the control group planted by cutting the leaves and roots and in the treatment with only the leaves cutting, and long in the treatment with only the roots cutting and in the untreatment. The number of leaves and tillers was high in the control group and in the treatment with only the leaves cutting. Flower stalks averaged 4 per plant and the control group had the lowest number of 2. The number of tubers was high in the treatment with only the roots cutting (135/plant) and in the untreatment (137/plant). The weight of 100 tuberos roots was high in the control group (131g) and in the treatment with only the roots cutting (137 g). Yields were high in the control group (364 kg/10a) and in the treatment with only the root cutting (387 kg/10a) having a relatively high dry matter rate. As a result of the investigation of the growth characteristics according to the seedling cutting method during planting, the yield was higher in the treatment with the root cutting than the treatment with the leaf cutting.

**Conclusion** : *Liriope Platyphylla* is generally planted by cutting leaves and roots to prevent water loss and encourage new root development. If only the roots are cut and planted, labor will be reduced by about 30% compared to conventional cultivation.

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## 참당귀의 생육특성과 유효성분 함량간의 상관관계 분석

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### Correlation Analysis between Growth Characteristics and Various Active Compound Contents of *Angelica gigas*

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#### ABSTRACT

**Background :** *Angelica gigas* is one of the most popular herbal medicines in Asian countries. *A. gigas* has been used as a functional food products for treatment anemia, women's health care, a sedative, an anodyne or a tonic agent. *A. gigas* has various active compounds, such as nodakenin, decursin, and decursinol angelate. Samples in different sites (Bonghwa, Chungju, Jeongseon) were collected and their growth characteristics and active compound contents were measured. The purpose of this study is to investigate the correlation between the growth characteristics and the contents of 3 active compounds.

**Methods and Results :** *Angelica gigas* planted in Jeongseon, Chungju, and Bonghwa test sites in 2019 were collected in July 2021, and after investigation of growth characteristics, the samples were pulverized and analyzed for three active compound (nodekenin, decursin, and decursinol angelate) contents by HPLC. A meteorological measurement device (HOBO U30, USA) was installed on the test site to measure atmospheric temperature, soil temperature, solar radiation, and relative humidity. All of the climate conditions in Jeongseon was the lowest among three sites except for solar radiation.

**Conclusion :** As a result of comparing the regional weather data, it was found that all weather conditions were lower in Jeongseon than in the other two region. The growth characteristics of *A. gigas* were significantly lower in Jeongseon, but the active compound contents were significantly high in Jeongseon. As a result of analyzing the correlation between regional growth characteristics and active compound content, decursin and decursinol angelate in Bonghwa have positive correlation with the growth characteristics without stem length. In Chungju, only decursin has positive correlation with leaf diameter. In Jeongseon, root diameter has positive correlation with all active compounds and decursin has positive correlation with leaf diameter, weight, and root dry weight. Since *A. gigas* grown in Jeongseon generates active compounds to survive on its own, it can be expected that the active compound contents is higher than that of the other two regions.

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[P01-009]

대마 삼목시 배지소독, 호르몬처리 여부 및 배지의 상토와 모래 혼합비율이  
발근특성에 미치는 영향

문윤호, 이윤정, 김장훈, 구성철, 허목, 허운찬, 박우태\*  
국립원예특작과학원 약용작물과

**Effects on Rooting Characteristics of Hemp (*Cannabis sativa* L.) Cutting by  
Sterilizing of Rooting Media, Rooting Hormone and Mixing Ratio of Growing Media  
and Sand of Rooting Media**

Youn Ho Moon, Yoon Jeong Lee, Jang Hoon Kim, Sung Cheol Koo, Mok Hur, Yun Chan Huh  
and Woo Tae Park\*

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**ABSTRACT**

**Background :** With medical use of hemp, many medicinal cultivar were bred in world wide. In spite of expensive propagating cost to seed propagating cultivar, vegetatively propagating cultivar has various merit including short breeding period and uniformity in cannabinoids profile and growth characteristics. Thus, development of cutting method of hemp will be essential technique for rapid distribution and cultivation of medicinal hemp. This experiment were conducted to develop a adequate cutting method of hemp including sterilizing of rooting media, rooting hormone and mixing ratio of growing media and sand of rooting media.

**Methods and Results :** The cutting slips were coated with rooting compound (1-Naphthylacetamide 0.4%) just before planting to planting. The rooting media, a horticultural nursery media, was autoclaved for 3 hours at 121 °C for sterilizing. The second experiment was conducted to evaluate mixing ratio of sand and horticultural nursery media for hemp cutting. The mixing ratio of sand and nursery media were 9:1, 7:3, 5:5 and 3:7 in weight. The cutting materials were planted in tray pot of 72 cells and grown in walk-in-chamber for 20 days which environmental condition were 20 °C and 500 µmol/m<sup>2</sup>/sec in temperature and intensity of radiation, respectively. Rooting rate were 81.1% and 91.2% in cutting tray pots of coating slips with rooting hormone and sterilizing rooting media whereas 40.0% and 18.3% in cutting tray pots of non-coating slips and non-sterilizing rooting media, respectively. In mixing ratio of sand and horticultural nursery media for hemp cutting, rooting rate were 98.1 - 100% which were not shown significant difference in all treatments. Seedling rate were 61.1%, 77.8% and 63.0% in mixing ratio 1:9, 3:7 and 5:5 of sand and horticultural nursery media, which were significantly higher than 31.5% of mixing ratio 7:3. Root length were 97 mm, 91mm and 81mm in mixing ratio 1:9, 3:7 and 5:5 of sand and horticultural nursery media, which were significantly longer than 37mm of mixing ratio 7:3.

**Conclusion :** In vegetative propagating (cutting) of medicinal hemp, sterilizing of rooting media and coating slips with rooting hormone will be essential to conduct efficient propagation process. In order to get health seedling, horticultural nursery media should be mixed with above 50% of sand in preparation of rooting media.

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## 참당귀의 생육시기별 건물생산성과 양분 축적

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경상북도농업기술원

### Dry Matter Productivity and Reserve Accumulation of *Angelica gigas* according to Growth Period

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#### ABSTRACT

**Background :** The cultivated area of *Angelica gigas* is 457 ha in 2019 and it is used as a major medicinal and active material, but production stability is weakening due to the recent environmental change in the main production area. This study was conducted to develop growth diagnostic indicators and establish a stable production base by examining the growth period and building productivity and nutrient accumulation patterns of each organ.

**Methods and Results :** On April 24, 2019, 8 weeks raised seedlings were planted at intervals of 50 cm  $\times$  25 cm in the plot divided into 2 m  $\times$  2 m. Fresh and dry weight were measured 14 times at intervals of about 10 days from May 13. Samples were pulverized and T-C and T-N were measured using an elemental analyzer according to the Dumas method, and the carbon and nitrogen distribution ratios in plants for each growth period were investigated. Dry weight increased linearly after 50 DAT, and after 111 DAT, the increase in the underground weight increased while the above-ground part decreased. The dry matter rate was high in the order of root > leaf > petiole, and ranged from 17.5% to 32.5%, 12.3% to 27.4%, and 9.9% to 16.8%, respectively. The total nitrogen content per unit dry matter tended to decrease toward the later stages of growth, and the average level for the underground was 2.0%. The total carbon content of leaves, petioles, and roots was 42.8%, 38.3%, and 40.8% on average, and there was no significant variation according to the growth period. The T-N and T-C of the plant unit were similar to the changes in the underground dry weight. Nitrogen was distributed to 50.7% of leaves, 33.6% of roots, and 15.7% of leaf stems, and the proportion of roots increased toward the later stages of growth. Carbon was distributed about 42.4% of the roots, 41.7% of the leaves, and 15.9% of the stems. In the underground dry weight, carbon and nitrogen contents showed a significant positive correlation with temperature ( $r = 0.69$ ) and soil temperature ( $r = 0.69$ ).

**Conclusion :** The increase in dry matter weight for each growth organ was expressed in the form of a quadratic function, and the accumulation and distribution of carbon and nitrogen could be investigated. It is judged that studies related to the evaluation of building productivity according to various growing environments and cultivation conditions and the generation of secondary metabolites should be continued.

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## 고온피해 천궁의 생산성 평가와 양분 축적 변화

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경상북도농업기술원

### Changes of Primary Productivity and Reserve Accumulation of High Temperature Damaged *Cnidium officinale*

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#### ABSTRACT

**Background :** *Cnidium officinale* is a medicinal crop with weak resistance to heat. The cultivation area is rapidly decreasing due to recent climate warming. In order to improve the competitiveness of the medicinal crop industry, stable supply of raw materials is essential, but studies on growth and abnormal weather damage diagnosis are insufficient. The productivity and reserve accumulation of high-temperature-damaged *Cnidium officinale* was evaluated.

**Methods and Results :** Seed rhizomes were planted on April 4th, 2019 with the planting distance of 30 cm × 25 cm. Experiment was conducted with 3 replication of completely randomized design. The investigation was conducted 17 times at intervals of about 10 days from April 19th to October 21st. The vegetation indices including NDVI (Normalized difference vegetation index) were calculated using a multi-spectral sensor. Fresh and dry weight were measured for each period and growth organ. T-C and T-N were measured, and their distribution in plants were investigated for each growth period. From mid-June to early September, the daily maximum temperature exceeded 30°C continuously. Fresh and dry weight decreased after increasing to 78 DAP (June 20) and 103 DAP (July 15) in the above-ground part. The changes in most of vegetation indices were similar to the changes in the dry weight. In particular, NDVI showed a significantly positive correlation with the dry weight ( $r = 0.67$ ) and SRI (Simple reflectance index) with the above-ground dry weight ( $r = 0.88$ ). Nitrogen content per unit dry weight was in the order of leaves (3.7%), leaf stems (2.9%), and rhizomes (2.3%), and the carbon content was leaves (41.8%), rhizomes (38.0%), and leaf stems (35.1%). The amount distributed nitrogen and carbon to the above-ground part increased in the early stage of growth, but then the distribution to the underground part increased rapidly after high temperature damage.

**Conclusion :** As for the high temperature damage of *Cnidium officinale*, the decrease in the dry weight in the above-ground part occurred first, and as the amount of assimilates accumulation decreased, the productivity of the underground part decreased. The decrease in productivity could be evaluated using the vegetation index. After the high temperature damage, the distribution of nutrients to the storage organs increased. Additional review is required on the growth response to sudden abnormal weather such as high temperature and drought.

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## 생육시기와 생육기관별 지황 생산성과 저장양분 변화

남효훈\*, 서영진, 김광섭

경상북도농업기술원

### Productivity and Reserve Accumulation of *Rhemannia glutinosa* according to Growth Period and Organ

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#### ABSTRACT

**Background** : *Rhemannia glutinosa* is thermophilic and vegetatively propagated plant, so it is evaluated as a crop with high cultivation stability. The rise in temperature in the cultivation area due to climate change is lowering the productivity of general medicinal crops. This study was conducted to provide basic data for productivity improvement by studying the growth period of *Rhemannia* and the distribution of nutrients in the body and the growth period of *Rhemannia* in the northern part of Gyeongsangbuk-do.

**Methods and Results** : Plant materials were planted with a density of 22,222 plants per 10 a on April 24, 2019. The test plots were 3 replicates of complete random plots. Fresh weight, dry weight, T-N, and T-C for each growing organ were investigated at intervals of about 10 days after 20 DAP (Days after planting, May 13). The fresh and dry weight of leaves and petioles increased after 140 DAP and then decreased. The dry weight of rhizomes increased significantly after 90 DAP and increased linearly until late in growth. The nitrogen content per unit dry matter per growing organ such as leaves, petioles, flowers, and rhizomes is 3.2% - 5.2% (average 3.9%), 1.9% - 3.7% (average 2.5%), 3.2% - 6.0% (average 3.7%), respectively. ), and 1.1% - 1.7% (average 1.3%), carbon content of 39.1% - 43.5% (average 41.5%), 34.5% - 42.9% (average 41.1%), 42.5% - 44.5% (average 43.6%), and 39.2% - 40.9% (average 40.0%), respectively. There was no significant difference in the content by growth period. The total amount of nitrogen and carbon per plant changed with the increase and decrease of the dry matter weight. Most part of assimilates distributed to the above-ground part in the early stage of growth and to the underground part after 90 DAP. The distribution of nitrogen and carbon to the underground part rapidly decreased due to the consumption of stored nutrients in the rhizomes. After that contents of nitrogen and carbon in rhizome continued to increase from June until the harvest. The time when the distribution ratio between the above-ground and the underground part was reversed was about 30 DAP for C and 90 DAP for N, which coincided with the completion of survival and regeneration of the above-ground part.

**Conclusion** : The enlargement of the *Rhemnammia glutinosa* rhizomes started around 90 DAP, when flowering and fruiting were finished, and increased until harvest time. The distribution of carbon and nitrogen in the plant was determined according to changes in dry weight.

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# 삼백초 논 재배시 혼합 유기질 비료 사용이 토양 화학성 및 수량에 미치는 영향

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## Effect of Mixed Organic Fertilizer on Soil Chemistry Properties and Yield of *Saururus chinensis* Baill in Paddy Field

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<sup>2)</sup>Department of Herbal Crop Research, NIHHS, RDA, Eumseong 27709, Korea.

### ABSTRACT

**Background :** Recently, as various viruses such as Corona 19, SARS, and MERS occur, interest in organic cultivation of medicinal crops derived from natural substances is increasing to enhance immunity. As the per capita rice consumption decreases, the cultivated area of rice decreases, but a rice shortage problem may arise depending on the abnormal climate, so a rice paddy management system that can be used flexibly as paddy fields and fields according to the food situation is needed. *Saururus chinensis* Baill commonly known as Asian lizard's tail, is an herb that grows in low, damp places. *Saururus chinensis* Baill is effective in lowering blood pressure and preventing diabetes, and is a medicinal crop suitable for cultivation in paddy fields in moist areas. It is particularly suitable for organic cultivation as it is resistant to pests and diseases during cultivation. This study were conducted to establish an appropriate Mixed Organic Fertilizer (MOF) application amount for organic cultivation in rice paddy cultivation of *Saururus chinensis* Baill.

**Methods and Results :** This study was conducted to examine the effect of Mixed Organic Fertilizer application on the growth, yield, and soil chemistry change of *Saururus chinensis* Baill in paddy cultivation for organic cultivation. *Saururus chinensis* Baill were cultivated with five levels of MOF application including 50% treatment based on the nitrogen content of the soil test fertilization amount. The plant length showed a tendency to increase as the amount of MOF increased, and the fresh weight of the above-ground part was the highest in the 100% MOF treatment and the underground rhizome was the highest in the 125% MOF treatment. Among soil chemistry, pH was lowered, and available phosphoric acid showed a tendency to increase as the amount of MOF increased. The P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O of content of inorganic components in the leaves showed a tendency to increase as the amount of MOF increased.

**Conclusion :** The MOF for obtaining the highest yield of *Saururus chinensis* Baill were 100% MOF for the above-ground part and 150% MOF for the rhizome.

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고온 지역에서 참당귀 재배 시 멀칭 비닐 종류의 효과

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**The Effect of Mulching Vinyl Type on Cultivating *Angelica gigas* Nakai in High-temperature Area**

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**ABSTRACT**

**Background** : *Angelica gigas* Nakai (AGN) is mainly grown in a cool climate with an average temperature of 20-22°C from July to August as a traditional medicine in Korea. Eumseong shows an average temperature of about 25°C from July to August, which is a high-temperature area for growing AGN. This study was carried out to evaluate the effect of mulching vinyl type on growing AGN in high-temperature area.

**Methods and Results** : After transplanting 8-week-old seedlings into field with different mulching type (No, black and white), the survival rate and soil temperature were investigated in early July. The survival rate of white-mulching was 97.5%, similar to that of no-mulching, and that of black-mulching was 53.3%, which was lower than that of no-mulching. The soil temperature at 5cm- and 10cm-depth was in the order of black-mulching > no-mulching = white-mulching. Black-mulching showed about 6°C and 8°C higher than no- and white-mulching at 5cm- and 10cm-depth, respectively. The soil temperature at 5 cm- and 10 cm-depth was in order of black-mulching > no-mulching = white-mulching. The root weight was in the order of white-mulching > no-mulching > black-mulching. The root weight was about 20% higher in white-mulching than in no-mulching, and about 33% less in black-mulching.

**Conclusion** : This study showed that mulching vinyl type influences soil temperature and root weight (yield) when cultivating AGN, suggesting that white-mulching type could be suitable to cultivate AGN plant in high temperature area.

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## 일천궁 기내발근에 미치는 옥신의 효과

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### Effects of Auxin on Root Induction of *Cnidium officinale* Makino

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#### ABSTRACT

**Background :** *Cnidium officinale* Makino is a traditional medicinal crops in Korea. It belonging to the family Umbelliferae. The dried rhizome of *C. officinale*, contains ligustilide and butylphthalide, have many effects including sedative, anti-fungal, anti-anaemia, smooth muscle relaxing, blood circulation and anti-complementary properties. Auxin is the hormone that induced rooting in tissue culture. Using different kinds of auxin, we optimized the tissue culture protocol for improved condition for root induction of *C.officinale*.

**Methods and Results :** In the test, explants were placed on the test tube including 1/2MS medium supplemented 2% sucrose and three kinds of auxin (IAA, IBA, NAA) and 1/2MS hormone free medium supplemented 2% sucrose was used to the control medium. Three kinds of auxin was tested at three concentrations that 0.1, 0.5, 1.0 mg/ℓ. Each treatment contained twenty explants and the test tubes were placed at  $25 \pm 2^{\circ}\text{C}$  under a 16 h photoperiod with  $70 \mu\text{mol m}^{-2} \cdot \text{s}^{-1}$  light intensity. The number of shoot and root, length of shoot and root and fresh weight were investigated after 4 weeks of culture. As a result of root induction according to the three kinds of auxin, IBA was found to be the most suitable for *C.officinale* root induction, and the root length was the longest in 0.1mg/ℓ IBA, and the number of roots and fresh weight were the highest in 1.0 mg/ℓ IBA among the ten treatments. The reason why IBA treatments had lower shoot length and number levels than other kinds of auxin treatments was thought to be due to the relatively decrease in shoot growth when the root developed. Therefore, 1.0mg/ℓ IBA was considered to be the most effective for the root development of *C.officinale*.

**Conclusion :** In this study, we found that 1.0mg/ℓ IBA was the most effective for rooting by significantly improved fresh weight and the number of roots. Based on this, we expect that this study will provide advantages to researchers who are developing production tissue culture system to optimal condition for rooting of *Cnidium officinale* Makino.

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울무의 국내수집지역에 따른 생육특성 및 Coixol 함량

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Growth Characteristics and Coixol Content according to Domestic Collection Area of

*Coix lacryma-jobi* var. *ma-yuen* (Rom.Caill.) Stapf (Poaveae)

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Byeoung Kwan An<sup>1)</sup>, Eun Aa Yoo<sup>2)</sup> and Jun Hwan Yeo<sup>1)\*</sup>

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ABSTRACT

**Background :** The purpose of this study is to use as basic data for nurturing new variety of *Coix lacryma-jobi* var. *ma-yuen* (Rom.Caill.) Stapf. 352 resources were distributed at the National Agrobiodiversity Center to investigate their growth characteristics and Coixol components.

**Methods and Results :** *Coix lacryma-jobi* var. *ma-yuen* (Rom.Caill.) Stapf 352 resources were distributed at the National Agrobiodiversity Center. HPLC was performed on a C18 Unison column (4.6 × 150 mm, 5 µm column) using a gradient elution of 0.1% (v/v) trifluoroacetic acid and acetonitrile at a flow rate of 1.5 ml/min at 40°C. the analyte was detected at 290nm. *Coix lacryma-jobi* var. *ma-yuen* in Gyeongnam region had the laegest plant length, and showed the smallest quantity characteristics with 98.22 ± 87.92 seeds per hill, the growth characteristics of *Coix lacryma-jobi* var. *ma-yuen* resources in Gyeongbuk region were the closest to the overall average value, but the region with the hight Coixol content. the number of resource with a Coixol content of 10 µg/g or less was 284 resource, the number of resource with content of 11 µg/g - 20 µg/g is 60 resource, the number of resource with content of 21 µg/g - 30 µg/g is 7 resource, the number of resource with content of 30 µg/g or more is 2 resource. Growth characteristics of *Coix lacryma-jobi* var. *ma-yuen* (Rom.Caill.) 9 resource with a content of 20 µg/g or more showed 3.93 - 29.61% more favorable results gor breeding than th growth characteristics of all resource such as germination rate, days to heading from emergence, height, and seed number per hill. despite the advantage of *Coix lacryma-jobi* var. *ma-yuen* (Rom.Caill.) Stapf as a herbal medicine, most of the research on the breeding of *Coix lacryma-jobi* var. *ma-yuen* (Rom.Caill.) Stapf is mainly used as a food trsource, and the research on the breeding of barley for use as a herbal medicine is insufficient.

**Conclusion :** This study reports the results obtained by analyzing the growth characteristics and Coixol content according to the collection area of the barley radish in order to use it as basic data for the selection of the breeding parent material for the cultivation of varieties with high Coixol content.

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## 피마자 유전자원의 엽색에 따른 생육특성

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### Growth Characteristics in Genetic Resources according to Leaf Color of *Ricinus communis* L.

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### ABSTRACT

**Background** : The purpose of this study is to use as basic data for nurturing new variety of *Ricinus Communis* L. 200 resources were distributed at the NIAS and 2 resources were distributed at the NIKOM to investigate their growth characteristics.

**Methods and Results** : Collection resources : *Ricinus Communis* L. 200 resources were distributed at the NIAS, 2 resources were distributed at the NIKOM. Sowing date : 28 april 2021, planting density : 60 × 60 cm, cover material : open field cultivation, black vinyl, black non-woven fabric, fertilization amount : N-P-K/compost = 4-3-3-1000 kg/10a, research item : Investigation of immature leaf (intensity of anthocyanin coloration), petiole (intensity of anthocyanin coloration), leaf blade (undulation, main color, main color of vein), leaf vein(main color), inflorescence (shape, color of stigma before pollination), capsule (main color) as morphological characteristics. agronomic characteristics of plant (height, width, number of internode, length of internode), leaf blade (length, width, depth of sinus), petiole (length, width), inflorescence (length of inflorescence), capsule (number of capsule, length of pedicel) were analyzed. This is the result obtained by conducting survey on the morphological and agronomic characteristics of 202 resources.

Leaf colors were divided into four groups : green, light green, light purple and purple. In the entire group, green was 108 resources, light green was 41 resources, light purple was 40 resources, purple was 3 resources and non-germination was 10 resources. The average value of the leaf colored group was 318.44 cm in plant height, 62.82 mm in length of internode and the number of internode was 19.44, similar to that of other groups and the width was the thinnest at 25.89 mm. The petiole height was 19.66 cm and 3.9 mm petiole width in purple group, showing the lowest figure in the group. The leaf blade height was the widest with a purple group of 28.87 cm and a width of 28.42 cm and the depth of lobed was the shortest whit 10.14 cm. The length of the inflorescence was the lowest at 9.82 cm for the purple group and 23.33 in the number of capsule and the length of pedicel was 42.28 mm the second longest.

**Conclusion** : The purpose of this study is to select superior resources through a growth characteristics survey of *Ricinus Communis* L. 202 resources.

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지황 논재배 시 뿌리썩음병 발생양상 및 생육특성

이은숙<sup>1)\*</sup>, 김효진<sup>1)</sup>, 서상영<sup>1)</sup>, 조종현<sup>1)</sup>, 김창수<sup>1)</sup>, 안민실<sup>1)</sup>, 이용문<sup>2)</sup>

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**Occurrence Pattern and Growth Characteristics of Root Rot Disease  
during Cultivated of *Rehmannia Glutinosa* in Paddy Field**

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**ABSTRACT**

**Background :** The *Rehmannia glutinosa*, a representative medicinal crop, may be cultivated once a year thus has excellent cash convertibility, however, it has a high risk of moisture damage due to thin root epidermis when the soil moisture level is excessive. And its harvest is likely to reduce by the successive damage from continuous cropping. The purpose of this study was to provide basic data for stable production in paddy *Rehmannia glutinosa* by investigating the occurrence pattern of root rot disease and the growth characteristics in first planted paddy and replanted paddy.

**Methods and Results :** This study was performed in first planted paddy and replanted paddy cultivation lands located in Jeong-eup. Approximately 1500 kinds of bacteria and 500 kinds of fungi were identified in the analysis of microorganism from soils collected in rhizosphere environment of *Rehmannia glutinosa* cultivation land before planting (March), early growth stage (May), and middle growth stage (September). While the proportion of *Fusarium* sp., *Fusarium solani*, *Thanatephorus cucumeris* (*Lysoctonia* sp.) that causes root rot disease in the soil was found to be low as less than 1% from before planting to early growth stage. After the mid-growing period (September), *Fusarium* sp. the distribution was more than 4 times higher replanted paddy compared to those from first planted paddy. The *Fusarium* sp. and *Rhizoctonia* sp. were isolated and identified from *Rehmannia glutinosa* individuals suffering from root rot disease, and *Phytophthora* sp. and *Pseudomonas cichorii* were additionally identified. For the growth and yield missing plant rate was higher by 13.3% and the yield was less by 29.0% in replanted paddy compared to first planted paddy. In addition, for the quality, the 'high grade' (root width > 0.8 cm) items occupied more than 50% in those from first planted paddy, while the proportion of 'low grade' or those suffering from root rot disease was 17% higher in replanted paddy.

**Conclusion :** The analysis of microorganism from soils collected in rhizosphere environment of *Rehmannia glutinosa* cultivation land showed that, in replanted paddy, the proportion of *Fusarium* sp. increased significantly after middle growth stage, suggesting that it is a causative pathogen of root rot disease. but though there is necessity of verification across years since microorganism is highly sensitive to environment. The comparison of growth between first planted paddy and replanted paddy showed lower yield for paddy and significantly higher missing plant rate and incidence of root rot disease in individuals from replanted paddy compared to those from first planted paddy.

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결명자 발아일수별 생육특성 및 항산화 성분 함량

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농촌진흥청 국립원예특작과학원 인삼특작부

**Growth Characteristic and Antioxidant Contents of Cassia Seed Sprout (*Senna tora*)  
according to Different Growth Stage**

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**ABSTRACT**

**Background :** Sprout is the stage from seed germination until the primary leaves emerges. Among the growth stages of crops, the sprouting state is the fastest and most convenient stage for nutrient intake. *Senna tora* is an annual crop of the Fabaceae family, mainly using seeds from ancient times to the present, and is popularly known to be good for the eyes. There are many studies on *senna tora*, especially about the use and effect of seeds. However, the studies on leaves and sprouts that can be used as food materials are scarce.

**Methods and Results :** To conduct this study, 45(W)\*45(D)\*30(L) cm box under LED light and automatic irrigation of 3 min/7 hour was prepared. Before germination, the seeds were immersed in an easy-draining plate for 24 hours. The seeds were measured from 3<sup>rd</sup> day to 9<sup>th</sup> day with an interval of 2 days. Length of hypocotyl showed a trend of elongation to 4.3 cm until the 7<sup>th</sup> day, but decreased to 3.83 cm on the 9<sup>th</sup> day when the primary leaf was developed. Thickness of hypocotyl was 1.09 mm, 0.76 mm, and 0.96 cm, respectively, on the 3<sup>rd</sup>, 5<sup>th</sup>, and 9<sup>th</sup> days, showing no positive correlation with the date. Length and Width of cotyledon increased significantly days increased, but there was no significant difference between the 5<sup>th</sup> and 7<sup>th</sup> days. When total polyphenols and total flavonoids contents were determined in *Senna tora* sprout, antioxidant content increased significantly by day compared to the seeds.

**Conclusion :** Growth and antioxidant phytochemicals contents of *Senna tora* sprouts were excellent at 9<sup>th</sup> day. This study suggests that sprouts of *Senna tora* has the potential to be used as a functional food materials. And it shows the potential for applications other than *Senna tora* seeds.

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**Proper EC Levels of Nutrient Solution for Plug-seedling in *Platycodon grandiflorum*.**

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**ABSTRACT**

**Background :** *Platycodon grandiflorum* is a principal medicinal crop and widely used as medicinal purpose or vegetable. Recently, the interest of growers in *Platycodon grandiflorum* is increasing, and From 3 or 4 years ago, research on growing *Platycodon grandiflorum* seedlings in large quantities in a greenhouse using a seedling tray has been started. The growing period for *Platycodon grandiflorum* is as long as 60 days, so this study was conducted to improve the productivity and quality of *Platycodon grandiflorum* by supplying an appropriate nutrient solution.

**Methods and Results :** *Platycodon grandiflorum* seeds were harvested at the Medicinal Resources Research Department of Gyeongsangnam-do Agricultural Research and Extension Services at the end of October 2019. The seeds were sown on 128 spherical seedling trays at the beginning of May 2020, and grown for 60 days in seedling greenhouse until the first part of July 2020. After sowing, *Platycodon grandiflorum* seedlings was treated at the EC levels of 0.5, 1.0, 1.5, 2.0, 2.5, and 3.0  $\text{dS}\cdot\text{m}^{-1}$ , from the first part of June to the middle part of June 2020. 60 days after seedling, seedling growth characteristics such as emergence rate, plant length, stem diameter and other factors were investigated the first part of July 2020. After transplanting into the field, growth characteristics such as percentage of establishment, root fresh weight, root dry weight and other factors were investigated the first part of October 2020. As a result, seedling growth characteristics such as root length (11.2 cm), root diameter (3.89 mm), root fresh weight per hill (0.35 g) were the highest at 1.0  $\text{dS}\cdot\text{m}^{-1}$ . Field growth characteristics such as root diameter (23.4 mm), root fresh weight per hill (54.5 g), root dry weight per hill (15.3 g) were the highest at 1.0  $\text{dS}\cdot\text{m}^{-1}$ .

**Conclusion :** In the seedling stage, considering root length, root diameter, and root fresh weight per hill, 1.0  $\text{dS}\cdot\text{m}^{-1}$  was excellent seedling growth characteristics. In the field stage, considering root diameter, root fresh weight per hill and root dry weight per hill, 1.0  $\text{dS}\cdot\text{m}^{-1}$  was excellent field growth characteristics.

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[P01-021]

## 이중직 길이조절 인삼해가림에서의 지상·지하부 생육 및 미기상 특성

홍영기, 성봉재, 김선익, 박용찬, 김현호, 지무근\*

충청남도 농업기술원 인삼약초연구소

### The Growth and Micrometeorology Traits of Korean Ginseng Shading Facilities to Control Length of Two-layerd Black Polyethylene Net

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#### ABSTRACT

**Background :** The growth of ginseng is a perennial semi-shaded plant that is greatly affected by the micrometeorology as temperature and light intensity. The optimal light condition for top part of ginseng growth was 8 to 19% of daylight. the minimum and maximum light intensity for the survival was 3% and 30% of daylight, It was shown that high yield of ginseng root is expected at 19% rather than 8% (Kim et al. 1964). Currently, various types of shading sheets was supplying to farms to prevent the inflow of rainwater and reduce the incidence disease on ginseng (Lee, 2007)

**Methods and Results :** This study was used for 2, 3 years old Korean ginseng at Ginseng & Medicinal Plant Research Institute, Chungnam Agricultural Research & Extension Service (CNARES). the treatment and control facility was covered with blue-colored shading sheet (BCSS). and then we control two-layerd black polyethylene net (TBPn) of four-length (90, 120, 150, 180 cm) to control light intensity and reduce high temperature damage from the shade facility. The results are as follows. The average light transmittance for four-days in the sun shade was 90 cm (21.0%) > 120 cm (16.9%) > 150 cm (11.2.%) > control (6.5%). In the case of 90 cm treatment, the it was 21.0%, but 23.8% of the rear line exceeded the growth optimum light transmittance. The photosynthesis rate was in order of 120 cm (2.58) > 90 cm (2.29) > 150 cm (1.63  $\mu\text{mol CO}_2 \text{ m}^{-2}\text{s}^{-1}$ ) > 180 cm treatment. There was no significant difference in the temperature and humidity measured on rear line and between treatments in the top part of ginseng growth. also, the SPAD value was in order of 180 cm (control) > 150 cm > 120 cm > 90 cm treatment. there are not to affect leaf burn incidence on 3-year-old ginseng, but 2 year olds showed 90 cm (33.1%) > 120cm (20.8%) > 150 cm (6.7%) > control (4.2%).

**conclusion :** 120 cm treatment of 2-year-old ginseng showed optimal light transmittance (average 16.9%) relatively high photosynthetic rate, but the survival ratio was lower than 180 cm treatment even leaf burn incidence of 20%. It was shown that young ginseng (1 - 2 years old) plants are unsuitable for the short additional cover with two-layerd black polyethylene net. while, short treatment TBPn of 3-year-old ginseng showed a little higher fresh root weight and there was no difference compared to control survival ratio. although it result not including climate change such as heat waves, It seems that the additional seasonal TBPn length adjustment in older rhizome, such as three-year ginseng, is related to the increase in quantity.

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## 감초 재배방식에 따른 토양 및 항산화 성분 함량 분석

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경상남도농업기술원

### Analysis of Soil and Antioxidant Component Content according to Licorice (*Glycyrrhiza* spp.) Cultivation Method

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#### ABSTRACT

**Background :** The most problematic in licorice culture are weed control, low seedling establishment and root rot. Licorice, which has been used as food and medicine for more than 4,000 years, is a perennial herb belonging to the legume family and is widely used in the tobacco, food, and pharmaceutical industries. Licorice is effective in rheumatism and gastric ulcer, and it has been reported to be effective in allergies, chronic hepatitis, and viral diseases. It is also known to inhibit the proliferation of prostate cancer cells and to exhibit asthmatic effects. In order to increase farm household income through stable, high-quality production of licorice effective for various diseases, it was intended to provide basic data for research such as standardized production and growth promotion through analysis of soil and licorice components in field and container cultivation.

**Methods and Results :** Soil and 2-year licorice were collected from Sancheong, Gyeongsangnam-do, Yeongwol, Gangwon-do, Iksan, Jeollabuk-do, and Gangjin, Jeollanam-do. Analysis of the physical and chemical components of the collected soil was carried out according to the Rural Development Administration analysis method, and the analysis of antioxidant and physiological activity of licorice root was extracted using 95% ethanol, filtered and concentrated. As a result of the analysis of 7 types of licorice cultivation soil (pH, organic matter, phosphoric acid, potassium, calcium, magnesium, EC), the pH of the field soil was 0.2 higher than the appropriate range, and the EC and potassium were good. Organic matter and magnesium were insufficient, and phosphoric acid and calcium were found to be excessive. The pH and EC of the soil in the container were good, organic matter was insufficient, and phosphoric acid, potassium, calcium, and magnesium were excessive. The pH and EC of the soil in the container were good, organic matter was insufficient, and phosphoric acid, potassium, calcium, and magnesium were excessive. The soil under the container had pH 0.1 lower than the appropriate range, and EC, potassium, and calcium were good. Organic matter was insufficient, and phosphoric acid and magnesium were excessive. DPPH radical scavenging activity was 1.5 times higher in container culture (7.40 mg/g) than in field culture (4.92 mg/g), and FRAP assay showed that container culture (46.57 mg/g) was 1.3 times higher than field culture (35.97 mg/g). Contents of total phenol, total flavonoids, total sugar, reducing sugar, and water-soluble protein were found to be 1.1 to 1.7 times higher in container cultivation than in field cultivation.

**Conclusion :** Therefore, it was thought that standardized production of high-quality licorice with high antioxidant content differentiated from field cultivation would be possible if soil selection suitable for container cultivation and a new fertilization method were developed and applied through the results of this study.

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**Survey on Cultural Practice and Soil Chemical Property of Organic *Platycodon grandiflorum***

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**ABSTRACT**

**Background :** *Platycodon grandiflorum* is perennial plant of the campanulaceae family. Platycodon root contains abundant pharmaceutical substances and is widely used as a food and a medicinal herb. Nowadays, safe food is one of the biggest concerns. In addition, as well-being becomes a daily routine, more and more people are looking for eco-friendly foods. Plants that use the roots of *Platycodon grandiflorum*, *Panax ginseng*, and *Codonopsis lanceolata* for medicinal or edible purposes grow in the soil for a long period of time. Accordingly, many consumers have paid attention to the safety of medicinal crops. Organic refers to agricultural products grown on land without the use of synthetic pesticides and chemical fertilizers, and is being applied to medicinal crops recently. This study was conducted to determine the cultural environment and soil chemical property of *Platycodon grandiflorum*.

**Methods and Results :** For the survey, I met famers in Gyeongbuk 2, Jeonnam 2, Jeonbuk 1, Chungbuk 1, and Jeju Island 1. Survey method was site visits and interviews, and soil was collected in the area. Average number of years of growing *Platycodon grandiflorum* in the surveyed area was 3 years, and the cultivated area ranged from 0.1ha to 1ha. Also, the soil chemistry did not fall within the appropriate range. For soil management, organic compost was used or cultivated naturally.

**Conclusion :** *Platycodon grandiflorum* grows well in well-drained and nutrient-rich soil. When planted for more than 3 years, *Platycodon grandiflorum* have problems with continuous cultivation, so soil management is very important. Most of the farms investigated were cultivated in a natural state, and weed control was important. It is expected that many organic *Platycodon grandiflorum* will be produced and established as a healthy and safe food.

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## 고려인삼의 비생물학적 스트레스 (습해)에 대한 생육반응

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충청남도농업기술원 인삼약초연구소

## The Response of Korean Ginseng (*Panax ginseng* C. A. Meyer) to Abiotic Stress (Wet Injury)

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### ABSTRACT

**Background :** This study was conducted to develop an SNP set that can be useful for marker-assisted breeding (MAB) in Korean ginseng (*Panax ginseng* C. A. Meyer). We have plan to carry out morphological, genetic characteristics and relationship for Geumsan native species, breeding lines. Furthermore, We could be used diverse genetic resources for Ginseng breeding.

**Methods and Results :** This experiment measured the chlorophyll fluorescence image that occurs during the wet injury treatment of Korean ginseng. through this, resistance and sensitivity individuals were selected to develop wet injury markers. Soil flooding treatment was performed after the stem became hard at 30 days of ginseng seedling planting. Growth characteristics surveys of the above and underground part were conducted every 5 days after treatment. As a result, 17.2% of the above ground part withering 20 days after treatment and 47.8% withering 30 days after treatment. The underground part spoiled 13.9% after 15 days of treatment, 42.5% after 20 days and 74.4% after 30 days of treatment. The survival rate of the above ground part was investigated by dividing the degree of resistance according to the wet injury treatment period by resistance line, moderate, susceptible line. As a result, it survived 100% on the 10th of treatment, but showed a survival rate of 82.7% from the 20th and 47.3% after 30 days of treatment. As a result of investigating chlorophyll fluorescence characteristics by degree of resistance,  $F_o$  (minimum fluorescence value) was 900.4 in the susceptible line and 400 or less in the resistance line.  $F_v/F_m$  (maximum quantum yield) was found to be 0.2 in the susceptible line, control and resistance line were 0.76 and 0.71. As a result of investigating chlorophyll fluorescence properties according to treatment days, control remained below 400 for 30 days, but the ginseng treated stress increased to 517 on 20 days and 610 on 30 days, and the  $F_v/F_m$  value decreased from 0.69 to 0.38 on 30 days, resulting in photosynthesis potential was decreased.

**Conclusion :** In order to select ginseng to get wet stress using chlorophyll fluorescence response analysis devices,  $F_o$  values (minimum fluorescence values) will be selected at 400 or less, sensitivity objects at 500 or more,  $F_v/F_m$  values (maximum quantum yield) at 0.7 or less, and sensitivity entities at 0.55 or less. The Wet injury on 2 years old ginseng was caused by Ginseng roots disease (flacherie) through root cementation and wound infection.

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## 지황의 조직배양묘와 종근묘의 생육 특성 비교

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### Comparison of the Growth Characteristics of *Rehmannia glutinosa* Tissue Culture Seedlings between Rootstock Seedlings

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#### ABSTRACT

**Background :** *Rehmannia glutinosa* is a perennial herb belonging to the Scrophulariaceae family. Rootstock cultivation of *R. glutinosa* gives rise to several problems including root rot, and results in a low productivity and poor quality. To solve these problems, we established optimal *in vitro* tissue culture conditions to produce sterile culture seedlings of *R. glutinosa*. The purpose of this study was to identify differences between tissue culture seedlings and rootstock seedlings in the field.

**Methods and Results :** The conditions of optimal micropropagation for tissue culture seedlings used in this experiment are LS medium containing 825mg/l  $\text{NH}_4\text{NO}_3$ . Two types of *R. glutinosa* seedlings were cultivated from May to October 2021. The aerial part growth of tissue culture seedlings was better than that of rootstock seedlings. The fresh weight of tissue culture seedlings was 524.7g/plant, which was 1.7 times higher than those of rootstock seedlings. In addition, the most characteristic of this experiment was that no flowering occurred in tissue culture seedlings.

**Conclusion :** From the above results, we may suggest suggested that tissue cultured seedlings of *R. glutinosa* are optimal seedlings that mass production in the field.

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감초 육성품종 ‘원감’의 연생에 따른 월별 생육 특성 비교 연구

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Comparative Study on Monthly Growth Characteristics of Licorice Breeding Variety  
‘Wongan’ by Year

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ABSTRACT

**Background** : Licorice is one of the major herbal medicine material and is the most commonly used as herbal medicine and industrial material. However, in Korea, it is largely dependent on imports. Although there were attempt to cultivate licorice in domestic environment, it is a difficulty due to physiological disorder. Recently, RDA researchers have developed the domestic-optimized licorice vareity with high yield and quality. Thus, in this study, we evaluated the growth and yield characteristics of licorice variety on every month for 2 years.

**Methods and Results** : The stolon of *Glycyrrhiza korshinskyi* (breeding variety ‘Wongam’) were transplanted in the experimental field of NIHHS (Eumseong). *G. uralensis* (Manju) was used for comparison. All experiment plots were designed by the randomized block method with 3 independent replicates. The initial growth of *G. korshinskyi* was later than that of *G. korshinskyi*, but the growth period of *G. korshinskyi* had lasted two months longer than that of *G. uralensis* until September. The weight of above-ground part had increased until the end of July, however, it was gradually decreased in *G. korshinskyi* compared to *G. uralensis*. The main feature of root growth is that licorice significantly showed the growth in length in 1 year and in 2 years it showed the growth in volume. The root length had gradually increased every month and it stopped on November both *G. uralensis* and *G. korshinskyi*. The root thickness stopped growing after increasing until September in the 1 year, but continually increased both *G. korshinskyi* and *G. uralensis* in 2 years. The root weight of *G. uralensis* was increased until October in first year. The root weight was gradually increased until November both resources, showing that it was twice as large as that of a first year. The stolon weight has increased year by year both resources. The ingredients of underground part had increased on monthly in 1 year, whereas, in 2 years, they decreased once and then gradually increased.

**Conclusion** : *G. korshinskyi* grew better in the middle and late growth stages than *G. uralensis*. Root only showed the growth in length in 1 year, while in 2 years, it showed the growth in volume along with growth in length. The root yield of *G. korshinskyi* has gradually increased and stolon has developed from 2-years old. Furthermore, the ingredients of underground part has increased with year, but in spring season, they accumulate more in the stolon than in the root.

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## 새싹율무 생산을 위한 적정 재배 조건 설정

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## Setting Proper Cultivation Conditions for the Production of Sprouted Adlay

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### ABSTRACT

**Background :** Adlay [*Coix lacryma-jobi* var. ma-yuen (Rom.Caill.) Stapf] is one of the medicinal crops with a wide cultivation area in Korea. Despite its economic importance, little is known about adlay sprouts because they are not yet a food ingredient. This study investigated the growth and cultivation characteristics of adlay sprouts to prepare for the future food industry.

**Methods and Results :** To find the optimal seeding density, the size and weight of the seeds were estimated. Coixol content and antioxidant activity were tested according to each method. After finding the optimal seeding density, a light quality test was conducted to find an appropriate light wavelength region to increase production. For the light quality, red, blue, and green light LEDs were irradiated with a luminous intensity of 50  $\mu\text{mol}/\text{m}^2/\text{s}$ . As a result, the length of each 1,000 seeds was  $5.93 \pm 0.31$  mm, the width was  $7.50 \pm 0.70$  mm, the occupied area was  $35.02$  mm<sup>2</sup>, and the weight of the kernel was  $125.73 \pm 0.15$  g. When the seeds were sown at 2.2, 2.8, 3.3, and 3.9 kg/m<sup>2</sup>, the overlapping multiples were 1.0, 1.2, 1.4, and 1.6. When the seeding density increases, the yield per unit area increases, but when the density is higher than a certain density, the yield per area decreases. When analyzing based on the dry weight of sprouts, the optimal seeding densities (overlapping multiples) are 2.8 kg/m<sup>2</sup> (1.2) and 3.3 kg/m<sup>2</sup> (1.4). The antioxidant activity (IC<sub>50</sub>; 728.13  $\mu\text{g}/\text{mL}$ ) was the highest at an overlap multiple of 1.4, but the coixol content of adlay sprouts

was not significantly different between the dental treatment groups. As for the optimal light quality, red light showed a high sprout productivity, and among monochromatic lights, red light was found to be the most useful.

**Conclusion :** Adlay sprouts are excellent in functionality, so continuous research is needed for industrialization by preparing a basis for safe ingestion as food through toxicity tests.

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## 도라지 종자의 발아에 필요한 적산온도 분석

허목, 구성철, 박우태, 김장훈, 이윤정, 문윤희, 허윤찬\*

농촌진흥청 국립원예특작과학원 약용작물과

### Analysis of Accumulated Temperature according to the Germination of *Platycodon grandiflorus* seeds

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Yun Chan Huh\*

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#### ABSTRACT

**Background :** This study was conducted to create a model that can predict the germination time of balloonflower seeds in the open field using the accumulated temperature. It is expected to be usefully used for moisture management by accumulating the daily average temperature of 5°C or higher until the germination period and predicting the germination period at a time different from the normal temperature.

**Methods and Results :** Seeds produced last year were used (Jang-baek, germination rate >80%).

In order to find out the accumulative temperature required for germination, multi-temperature seed germination table was used. referring to the average surface temperature (mid-April to May - 15 to 18°C) during the sowing period of bellflower (early April to May) as a reference, the germination rate was investigated at 14, 16, 18, 20, 22, 24°C and room temperature (21 - 25°C) for 20 days. Temperature variation within 1°C for each treatment temperature was observed and 100 grains for each temperature were repeated 5 times. The relationship between the sum of temperature and the germination rate was regression-analyzed to calculate the germination rate according to the sum of temperature for each temperature.

**Conclusion :** From the above results, we may conclude that relationship between the germination rate and the sum of temperature at fluctuating temperature, the fluctuating temperature shows a similar tendency to the sum of temperature required at 21 °C.

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## 큰꽃삼주의 시기별 생육 및 성분변화

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### Changes in Growth, Yield and Active Content of *Atractylodes macrocephala* Seedling in Different Growth Stage

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Jeong Yang Sun<sup>1)</sup>, Yi Lee<sup>2)</sup>, Myeong Won Oh<sup>1)</sup> and Kyung Ho Ma<sup>1)</sup>\*

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<sup>2)</sup>Department of Industrial Plant Science and Technology, Chungbuk National University, Cheongju 28644, Korea.

### ABSTRACT

**Background :** ‘Atractylodes rhizome white (白朮)’ is a dried rhizomes of *Atractylodes macrocephala* K. or *A. japonica* K. and has long been used for gastric treatment, so it is widely used in traditional medicines along with ginseng and licorice. As a representative import-dependent medicinal crop, about 1,462 tons (\$ 2.7 million), or 92% of the total distribution, are imported (’19). In addition, as the functional food market has grown recently, the scale of domestic cultivation production is expanding. Therefore, the growth characteristics and active content of *A. macrocephala*, a species that is mainly cultivated and easy to reproduce seeds, were investigated in this study.

**Methods and Results :** In mid-February, *A. macrocephala* seeds were planted in greenhouses, and in mid-April, seedlings were transplanted to investigate their growth characteristics and active contents every month. Between mid-June and mid-July, plant height, stem diameter and No. of leaves increased rapidly. The fresh and dry weight of aerial part steadily increased from mid-June to mid-October and then decreased. The length of rhizome increased until mid-October, and then growth stopped, but the rhizome diameter steadily increased until mid-November. The growth of underground part such as dry weight of rhizome increased rapidly from mid-June to mid-July, and then steadily increased until mid-November. Atractylenolide I and Atractylenolide III were the highest in mid-August and mid-November. Each of these periods is before the flower buds have grown extremely large or the aerial part of plants have completely dried out.

**Conclusion :** In summary, growth of aerial part peaked around mid-October, but growth of underground part growth steadily increased until mid-November. The active contents were highest in mid-August and mid-November. These results can help researchers and farmers by providing basic physiological information about *A. macrocephala*.

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터리풀 대량증식을 위한 차광재배 연구

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농촌진흥청 국립원예특작과학원 인삼특작부

**Study on Shading Cultivation for Mass Growth of *Filipendula glaberrima***

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**ABSTRACT**

**Background :** *Filipendula glaberrima* is a native plant of Korea. This plant has analgesic and antispasmodic effects in traditional knowledge, and effect on moisturizing, wrinkle improvement, anti-aging, and whitening in recent research. Even though the demand for *F.glaberrima* as cosmetic materials is increasing, there is rarely research on cultivation or utilization. *F.glaberrima* grows in a humid and shady environment, so it is necessary to install a light shield to block the light. Therefore cultivation studies especially about shading condition were conducted for mass production.

**Methods and Results :** In order to identify the proper cultivation method, *F.glaberrima* seeds were collected at Chungju, Korea and they were propagated in June, 2020. When planting, the intervals were 60 cm in width and 60 cm in length, and cover the ridge with black vinyl that can prevent weeds and moisture evaporation to prevent soil temperature rise. And shading treatments were 0, 30, 50, 70 and 90%. When 50% light was blocked, the yield per square meter of the upper part was 1.91 kg (based on dry), which was 4 times higher than when no light was blocked. After that, 30% were excellent with 1.24 kg. The quantity of no shading treatment was 0.38 kg, because the edges of the leaves to burn or turn yellow, and the plant can wither and die. Due to insufficient amount of light required for growth, the yield under 90% light blocking condition was the lowest.

**Conclusion :** To use *F.glaberrima* as a new income crop, the study on shading cultivation was conducted. As a result of the experiment, the best growth was achieved when 50% of the light was blocked. It was followed by 30%, 70%, 0%, and 90% in that order. This result is expected to be useful basic data for cultivation and to help increase the productivity and income of industry.

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조생종과 만생종 형개의 생육 및 수량 특성  
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경상남도 농업기술원

**Growth and Yield Characteristics of Early and Late Maturing *Schizonepeta Tenuifolia***

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and Young Ho Chang  
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**ABSTRACT**

**Background** : The *Schizonepeta Tenuifolia* is annual plant cultivated in Asia province of China, Japan and Korea. The raceme used as medicinal material were collected in fall and dry. It has distinctive scent derived from its essential oil consisted of monoterpenoid, and flavonoid etc. Major effects include alleviating fever, pain and anti-inflammation. There are no official varieties developed so far, and it is necessary to develop standard varieties to supply reliable material with consumers and markets. In this study, the growth and yield characteristics of the genetic resources collected for cultivating good-quality varieties were tested. two varieties were classified into early and late maturing.

**Methods and Results** : This study was conducted at the test field of the Gyeongsangnam-do Institute of Medicinal Resources Research Institute. Seedling of *Schizonepeta Tenuifolia* were planted in the first week of June, 2021. its seed had sowed and manged in the last week of April, 2021 in the greenhouse. Those were planted at intervals of 50 cm for 40 objects on each of the 14 banks. The early variety began to ripen in mid-September, fully ripening in early October, and The late variety started to ripe in early October, 4 weeks later it became into turn purple-brown color which means entirely ripen. it found that the early variety almost 1 month earlier ripen than the late variety. As a result of examining the growth characteristics and yield, the height of the late variety (136.5 cm) are 1.4 times higher and the number of raceme (299) is 1.5 times more.

**Conclusion** : According to the results of this study, it was found that early maturing *Schizonepeta Tenuifolia* can be harvested earlier due to early flowering and maturation compared to late maturing *Schizonepeta Tenuifolia*, but yields are lower than those of late maturing *Schizonepeta Tenuifolia*. Therefore, it was considered necessary to develop mid-maturing *Schizonepeta Tenuifolia* that could complement this and to develop techniques for increasing early harvest.

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[P02-001]

콜히친처리에 의한 4배체 (tetraploid) 유기된 식방풍 (*Peucedanum japonicum*)의  
생육특성

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충남농업기술원 인삼약초연구소

**Growth Characteristics of the Tetraploid *Peucedanum japonicum* Induced by  
Colchicine Treatment**

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and Hyun Ho Kim

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**ABSTRACT**

**Background :** *Peucedanum japonicum* grows in the seashore of Korea. It began to be cultivated recently. In 2019, it was cultivated in the area of 137 ha. The root of *Peucedanum japonicum* is used as a medicinal herb, and its young leaves are consumed as a wild vegetable. *Peucedanum japonicum* is perennial. From its second year, its flowers begin to blossom. After flowering, its underground part mostly withers to death. Even though *Peucedanum japonicum* is more demanded, its wild seeds are collected mostly and then are cultivated. It has no variety. Therefore, colchicine treatment was applied to foster tetraploid *Peucedanum japonicum* in order to develop a variety for wild vegetables. For tetraploid proliferation, root butting was conducted, and its growth and flowering characteristics were surveyed.

**Methods and Results :** *Peucedanum japonicum* was collected in 24 domestic regions. Its seeds were soaked in 0.05% colchicine for six hours. After sowing, young leaves were collected, and tetraploid *Peucedanum japonicum* was screened on the basis of the number of chloroplasts in stomatal guard cell and the DNA content. In addition, for the proliferation of tetraploid system, root cutting was performed. Pollens of diploid *Peucedanum japonicum* have a monad and prolate type. Its pollen has 25.4 $\mu$ m in length and 16.4 $\mu$ m in diameter. As for pollens of tetraploid *Peucedanum japonicum* have a tetrad and tetrahedral array, and its pollen had 30.3  $\mu$ m in length, and 27.2  $\mu$ m in diameter. Compared to diploid one, it had a different pollen type and its size is significantly large. The growth of the ground part of tetraploid *Peucedanum japonicum* was surveyed through root cutting. A leaf of tetraploid one had 82.4  $\mu$ m in thickness, and the number of branches per plant was 2.5, the largest.

**Conclusion :** Colchicine treatment was applied to the seeds of *Peucedanum japonicum*, and thereby to induce tetraploid one. According to the analysis on pollen comparison between tetraploid and diploid *Peucedanum japonicum*, tetraploid pollens oversized than diploid ones and had a different shape. In terms of the growth of the ground part, tetraploid one had a longer stem and petiolelength, a thicker leaf, and more stems.

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## Cannabidiol 생산성 분석에 의한 스마트팜에 적용 가능한 의료용 대마 F1 교배품종 선발

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생약자원개발학과, <sup>4)</sup>(재)춘천바이오산업진흥원

## Selection of Medical Cannabis F1 Hybrids Applicable to Smart Farms Platform by Cannabidiol Productivity Analysis

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### ABSTRACT

**Background :** Cannabinoid refers to the C21 terpenophenol compound uniquely found in hemp. In many countries, cultivation of hemp with high  $\Delta^9$ -THC content as well as hemp with high CBD content is legally restricted. Therefore, it is important to breed new varieties of hemp exclusively for nutrient solution cultivation for excellent CBD production that is more controllable, easier to maintain, and adaptable to a closed hydroponic cultivation system that can achieve consistent quality than open field cultivation.

**Methods and Results :** The mother seed used Cherry wine, and father plants used native varieties from Portugal, India, England, Lithuania, and Korea. All hemp seeds were germinated in soil. The germinated parents lines were grown vegetatively by light control of 16 hours/day for about 8 weeks. After that, change to light condition of 12 hours/day, and then crossing was induced naturally. The harvested F1 generation hemp seed was germinated for 17 days in running water after being transferred to a sponge for germination in nutrient solution culture. After germination, the young plants were planted in a grow block (Grodan Co., Reormond, Netherlands) and setted up to a hydroponic system. LED conditions are brightness, 40,076 Lux; PPFD, 692.4; PFD-R, 291.2; PFD-G, 254.8; PGF-B, 146.5. All temperature conditions were performed at  $27 \pm 2^\circ\text{C}$ . Freeze dried samples are extraction used MeOH in sonicator and analysis by HPLC.

**Conclusion :** The cannabinoid content of leaves and inflorescences was highest at 50 days after short daylight treatment. After dividing the harvested individual into inflorescence part and leaf part, drying and weighing, as a result of evaluation of CBD production per cubic meter, CW21-5 individual had the highest yield with a total of  $53.252 \text{ g/m}^3$ , and the second was CW21-1, and CW21-4 in the third order, with the highest CBD production based on cubic meter.

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## 수확시기에 따른 산수유의 품질특성과 기능성 변화

이은숙, 최수지, 이병주, 이승은, 김형돈, 강민혜, 지윤정, 김금숙, 장귀영\*  
농촌진흥청 국립원예특작과학원 인삼특작부

### Changes in Quality Characteristics and Functionalities according to Different Harvest Times in *Cornus officinalis*

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#### ABSTRACT

**Background :** *Cornus officinalis* (*C. officinalis*) is a medicinal herb that has been traditionally used in Korea. The quality characteristics and functionalities of medicinal crops change depending on the harvest time. Therefore, it is important to determine the appropriate harvest time.

**Methods and Results :** Sequentially harvested *C. officinalis* was freeze-dried and extracted with 70% alcohol to measure quality characteristics (color, sugar content and acidity) and functionalities (antioxidant activity and active ingredient content). The general quality characteristics of *C. officinalis* are excellent in the 2nd and 3rd, but in the functionalities the 1st is superior.

**Conclusion :** As a result of comparing the quality characteristics and functionality according to harvest time, the trends were not consistent. Although the quality characteristics of *C. officinalis* harvested in the 1st are lower than in the 2nd and 3rd, the functional analysis result is excellent, so it is considered to have great utility value as a functional material.

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오미자 품종판별 마커개발을 위한 실험 디자인

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**An Experimental Design, Developing Molecular Markers in the Varieties of  
*Schisandra chinensis* (Turcz.) Baillon**

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**ABSTRACT**

**Background :** *Schisandra chinensis* has been widely cultivated as a major medicinal crop in South Korea and the fruits (Omija) have been popular with peculiar properties of taste and tonic. Recently Bonghwa Herbal Crop Research Institute (BHCRI) has developed new varieties of *S. chinensis* that increased fruit size and precocious trait are materialized. In these circumstances, we now have a plan to develop molecular makers that distinguish these new varieties from present cultivars including related species, viz. *S. repanda* and *Kadsura japonica*.

**Methods and Results :** A suggestive strategy is the genotyping-by-sequencing (GBS) approach that either single-nucleotide-polymorphism (SNP) or simple-sequence-repeats (SSR) is considered. We first weigh on SSR of microsatellites because of high degrees of genetic heterogeneity found in *S. chinensis*. A core collection of Omija (20 accessions) will be used to find polymorphic SSR region(s) in the genome-wide scale and further analyzed.

**Conclusion :** We expect that targeted SSR genotyping will reveal suitable sets of DNA marker and genomic information in case of absence of reference genome sequences in Schisandraceae.

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수확기가 빠르고 다수성인 오미자 신품종 ‘썸레드’

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경상북도농업기술원<sup>1)</sup>, 문경시농업기술센터<sup>2)</sup>, 경북대학교<sup>3)</sup>

**A New *Schisandra chinensis* (Tucrz.) Baillon Cultivar ‘Ssumred’**

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**ABSTRACT**

**Background :** In recent years *Schisandra chinensis* (TUCRZ.) Baillon farms mainly use *Schisandra chinensis* by seedling so harvesting season is not constant and yield is variable. In order to solve this problem, a new variety is required.

**Methods and Results :** In 2014, 97 *Schisandra chinensis* germplasms were collected from Mungyeong, Jinan, Yeongwol, Bonghwa, Yeongyang, Taebaek, and Yeongwol. Three lines with early mature and excellent fruit color were selected and uniformity was tested by vegetative propagation. BH105, which can be harvested at the end of August was selected as an early species *Schisandra* and uniformity was verify those selected in 2019. After characteristics test, final selection was made. The main characteristic of ‘Ssumred’ is a variety that can be harvested in August due to the early harvest season. The flower color is red and fruit color is red. The cluster size is medium. The flowering period is May 3rd and the harvest period is August 27th, and the content of schizandrin and gomishin N is higher than that of the control variety. The biggest trait of Ssumred is that it can be harvest before Korean Thanksgiving Day, so it can get a good price.

**Conclusion :** A new variety of *Schisandra chinensis* ‘Ssumred’ has been selected through resource collection and real-life breeding since 2014. A new variety make a standard for medicinal using and famers can save the labor force and high quality fruit of *Schisandra chinensis*.

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# 엽록체 기반 분자마커를 이용한 한국 야생 더덕의 유전적 다양성 분석

조남수<sup>1)</sup>, 길진수<sup>1)</sup>, 구성철<sup>2)</sup>, 이이<sup>1)\*</sup>

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## Genetic Diversity Analysis of Korean Wild *Codonopsis lanceolata* using Chloroplast-based Molecular Markers

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### ABSTRACT

**Background :** *Codonopsis lanceolata* is a perennial herbaceous plant distributed mainly in East Asia. It is a plant of very high value not only for medicinal use but also for edible use. *C. lanceolata* is called ‘Deodeok’ in Korea, and the name of the herbal medicine is Yangyu (羊乳) or Yangyugeun (羊乳根). However, despite its excellent efficacy and high value as a cooking ingredient, research on it is insufficient. *C. lanceolata*, which has high value in the field of breeding, in particular, lacks research and development of molecular breeding materials for building and utilizing breeding systems. In addition, Sasam, the medicinal herb name of *Adenophora triphylla*, is misused for dried root of *C. lanceolata*.

**Methods and Results :** In this study, the genetic diversity and phylogenetic relationship of *C. lanceolata* collections were analyzed using molecular markers, and the misuse and misuse caused by incorrect product labeling was investigated. We performed a genetic diversity analysis by applying 10 chloroplast-based InDel markers to 93 *C. lanceolata* wild resources collected nationwide and 18 herbal medicinal resources collected from 4 herbal medicine markets (54 individual plants, including 2 *A. triphylla* (6 individual plants) as an outgroup). As a result of constructing the phylogenetic tree, the genetic diversity was very rich because the wild collections were not grouped by region and did not form a specific cluster. In addition, in the resources collected from the herbal medicine market, it was found that some *C. lanceolata* products were sold with incorrect label as Sasam.

**Conclusion :** In this study, using 10 chloroplast-based InDel markers, not only the genetic diversity of 93 *C. lanceolata* wild resources was analyzed, but also incorrect product labeling of 18 herbal medicine resources (54 individual plants) was confirmed.

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## 고본 선발계통의 생육 및 수량특성

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### Agronomic Characteristics of Selected *Angelica Tenuissima* N. Lines for the Identification of a Standard Variety

Eun Jeong Koh<sup>1)\*</sup>, Sang Seok Lee<sup>1)</sup>, Beong Sung Kim<sup>1)</sup>, Kwang Seop Kim<sup>1)</sup>, Dong Chun Kim<sup>1)</sup> and  
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#### ABSTRACT

**Background :** A fundamental challenge for breeding of medicinal crops is the limited ability to phenotype due to their heterogeneity. In addition, previous studies do not provide relevant selection criteria to determine desirable characteristics for medicinal crop breeding. *Angelica Tenuissima* N. is one of medicinal crops grown in small scale farms. Only a very limited number of studies have reported its agronomic characteristics associated with productivity and quality. Therefore, this study aimed to determine typical characteristics of *A. Tenuissima* that can be used by breeders for comparison of agronomic performance as standard check.

**Methods and Results :** The parents of *A. Tenuissima* selected lines for this study were collected from two different regions: Bongwha and Taebak. The lines were selected on the basis of phenotypic performance for agronomic traits including height, leaf length, root length and diameter, seed productivity, and so on. They were screened to ensure the representativeness and uniformity by eliminating the most and least desirable plants. All of the selected plants for this study were two year old. The plant height of the four lines averaged 60.5cm, ranging from 51.6cm to 72.4cm. The root fresh weight ranged from 131.3g to 164.4g, an average of 144.5g. The average dry weight of roots was 52.4g. Stem color was initially light green or purple, maturing to olive green, dark purple, or green-purple chimera, with the green section being approximately 137A to 137C in color. Peduncles are green, topped by a compound umbel of small white flowers (155A to 155C). The average numbers of peduncle and pedicel were 25 and 21, respectively.

**Conclusion :** The findings of this study will provide typical characteristics of *A. Tenuissima* that breeders can use to evaluate their breeding lines for comparison.

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## 매화나무와 살구나무의 구별을 위한 InDel 마커 개발

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충북대학교 특용식물학과

### Development of InDel Markers for Distinguishing *Prunus mume* and *Prunus armeniaca*

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#### ABSTRACT

**Background :** *Prunus mume* and *P. armeniaca*, belonging to Rosaceae *Prunus*, are important crops used as ingredients for medicinal and health functional foods in Korea. These two plants are difficult to distinguish because of frequent hybridization and are very similar in appearance. Accurate distinction is required because there is a clear difference in ingredients and uses. However, no research or effort has been made to distinguish them at the genetic level. In this study, we developed InDel markers to distinguish the two species.

**Methods and Results :** We collected young leaves from 28 *P. mume* and 8 *P. armeniaca* in 6 regions in Korea. Genomic DNA for NGS analysis and PCR was extracted using genomic DNA extraction kit. Thirty InDel loci were found through NGS analysis. After the pretest, chloroplast-based CP-InDel-8 and nuclear-based NC-InDel-19 were selected. As a result of genotyping using electrophoresis, the 36 resources could be clearly distinguished into 17 *P. mume* and 6 *P. armeniaca*, and 12 hybrids.

**Conclusion :** *P. mume*, *P. armeniaca*, and the hybrids of the two species were clearly distinguished by the 2 InDel markers developed in this study.

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더덕 배수체 형성에 오리자린 처리가 미치는 영향

이윤정, 허목, 구성철, 박우태, 김장훈, 문윤희, 허윤찬\*

국립원예특작과학원 약용작물과

**The Influence of Oryzalin Treatment on Polyploid Formation  
of *Codonopsis lanceolata***

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Jang Hoon Kim, Youn Ho Moon and Yun Chan Huh\*

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**ABSTRACT**

**Background :** *Codonopsis lanceolata* is dicotyledonous herbaceous perennial plant, predominantly found in Central, East, and South Asia. This plant has been widely used in traditional medicine and is considered to have medicinal properties to treat diseases and symptoms such as bronchitis, coughs, spasm, psychoneurosis, cancer, obesity, hyperlipidemia, edema, hepatitis, colitis, and lung injury. However, it is necessary to secure breeding techniques such as rapid system development (generation reduction) and breeding of excellent varieties because *C. lanceolata* has low growth rate due to the characteristics of medicinal crops focused on seed propagation. Therefore, in this study, the treatment of oryzalin was carried out to develop the varieties of polyploid formation in *C. lanceolata*, and the effect of the treatment concentration and period of oryzalin on polyploid formation in *C. lanceolata* was investigated.

**Methods and Results :** The *C. lanceolata* was confirmed that the cotyledon was formed after sowing (approximately three weeks after sowing) and treated with oryzalin in the shoot apical meristems. The treatment concentration of oryzalin was 50, 100, 500 and 1000 ppm, and the treatment period was 3, 5, 7 days (once a day). As a result of measuring the stoma size after oryzalin treatment, the control group was found to be  $17.4 \pm 1.64 \mu\text{m}$ , while the suspected tetraploid sample was measured in the size of  $28.2 \pm 2.20 \mu\text{m}$  to confirm that the size increases. As a result of measuring the polyploid formation ratio, it was found to be the highest at 14.58% when oryzalin was treated at 50 ppm concentration for 3 days. In addition, the highest concentration of 1000 ppm showed the lowest polyploid formation ratio.

**Conclusion :** Although there was no significant difference among the factors, the number of suspected tetraploid was the highest when treated with oryzalin at a concentration of 50 ppm for 3 days. In the future, we will make a polyploid determinations by chromosomal observations on selected individuals suspected of polyploid after seed harvesting. In addition, the optimum organic conditions for the formation of polyploid will be determined.

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## 큰다닥냉이 유전자원의 농업기본형질 특징 조사 및 분석

심지형<sup>1)</sup>, 유은애<sup>2)</sup>, 안광훈<sup>1)\*</sup>

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### Basic Agricultural Trait Analysis of the *Lepidium Sativum* Parts

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### ABSTRACT

**Background :** Agricultural biomaterials are increasingly being used as natural products and functional materials in the food, health functional food, and pharmaceutical industries. In order to meet these various industrial needs, secure and evaluation of the various plant genetic resources such as special plants and medicinal plants are the basic starting point. In particular, *Lepidium sativum*, which possesses various functional advantages such as antioxidant effect, whitening effect, and skin protection, has high industrial application potential.

**Methods and Results :** *Lepidium sativum*, the core material of this study, was cultivated in an open-air environment in Hwaseong, Gyeonggi-do after receiving 155 genetic resources owned by the Genetic Resource Center, National Institute of Agricultural Sciences, Rural Development Administration. Genetic resource proliferation and basic agricultural trait surveys were conducted from 2019 to 2020. A total of 155 resources, including isolated resources, were investigated, and 4 resources were found to be ungerminated and 1 resource needed to be re-identified. The basic agricultural trait survey items consisted of planting date, germination period, harvest period, flowering period, harvesting period, stem color, flower color, leaf type, leaf size according to incision, plant height, tillage, and live weight. The resources for the investigation were sown in the fall of 2019 (1 resource) and the spring of 2020 (154 resources), and germination was investigated with 67 resources within 7 days and 88 resources after 7 days. The flowering period was investigated as 44 resources before May, 100 resources in May, and 7 resources after June. Finally, the color of the flower was investigated with 138 white and 13 lavender white.

**Conclusion :** As a result of examining the basic agricultural traits of *Lepidium sativum*, differences were observed for each genetic resource such as germination, harvest, flowering, and seed harvesting, appearance, stem color, flower color, leaf shape, leaf size, plant height, cultivar, and live weight. This diversity of genetic resources is expected to be usable as basic data for the development of customized seeds for consumers, establishment of cultivation methods, and identification of genetic resources with high content of functional substances. If a comparative study of functional natural substances such as total polyphenol content is carried out in the future, it is expected that it will be used as basic data for industrialization and evaluation of the utility value as a functional material for food and pharmaceuticals.

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전북지역 지황 선발계통의 지역적응성 검토

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**Test of Regional Adaptation for High Quality Selection  
of *Rehmannia glutinosa* in Jeonbuk Area**

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**ABSTRACT**

**Background :** *Rehmannia glutinosa* is one of the top medical crops in those produced in Korea. With the increase in the cultivation area of *Rehmannia glutinosa*, there has been a large deviation in annual yield due to sensitivity to climate and moisture, even if it is followed standard cultivation guidelines in the farm. To solve these problems, we are developing new varieties every year by testing the regional adaptability of high quality system. The purpose of this study was to develop new variety that ensures stable cultivation by testing the regional adaptaion for high quality selection of *Rehmannia glutinosa*.

**Methods and Results :** The test material used a jihwang-1 as standard variety, the test system was planted in RGES 29 (2 years), RGES 30 (2 years) and RGES 31, 32 (1 year). The planting date was May 13th, and the planting interval was planted 30 cm × 15 cm. The sprouting days were June 2nd in RGES29 and June 1st in other test system and Jihwang-1. The result of growth survey, showed that the above-ground growth was superior in RGES31 and RGES32, though RGES32 has high blooming rate 51%, a problem to be solved. RGES29 a second year system, showed superior early growth and low blooming rate of 5%, however, a decreased growth was observed in a period after middle growth stage in certain test groups. It was harvested on October 14th and the underground growth was investigated. RGES32, which had superior above-ground growth, has high tolerance against disease resistance and a high yield, but the root length long and root width thin, which required a lot of labor for harvesting. Underground growth was increased by 79% in RGES 31 (1,310.7 kg/10a) compared to Jihwang-1 (734.2 kg/10a), and RGES 29 (867.9 kg/10a) had short root length and thick root width.

**Conclusion :** RGES31 (1 years) showed superior growth, suggesting the potential of promising cultivate through verification across years after improving the yield. RGES29 (2 years) is expected to be effective in saving labor as it can be harvested by mechanization due to its short root length and thick root width. but, it is decrease in growth occurs in certain test groups, so verification through the third year test is required.

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[P02-012]

## 고려인삼의 품종별 비생물학적 스트레스 (습해)에 대한 생육반응

지무근\*, 정봉재, 박용찬, 김선익, 장원석, 김현호

충청남도농업기술원 인삼약초연구소

### Growth Characteristics of Korean Ginseng (*Panax ginseng* C. A. Meyer) Cultivar to Abiotic Stress (wet injury)

Moo Geun Jee\*, Bong Jae Seong, Yong Chan Park, Sun Ick Kim, Won Suk Jang and Hyun Ho Kim

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#### ABSTRACT

**Background** : This study was conducted to investigate growth traits to develop the technique to select resistant cultivar by wet injury at an early stage in 2 years old ginseng through the irrigation maintaining until soil surface respectively using native variety, Geumsun, Geumjin, Yunpoong, Gumpoong and others.

**Methods and Results** : This study was used for 2 years old Korean ginseng at Ginseng & Medicinal Plant Research Institute, Chungnam Agricultural Research & Extension Service(CNARES). We set up 10 ginseng cultivars and 47 breeding lines for this study. To investigate the survival rate for ginseng, We treat to put the water until soil surface for 30 days. A study was conducted physiological disorder rate through VS (Visual assessment by observation of individual plants of parts of plants) to set up 0 - 5 scored. 0 - 1.0 was deep blue color meaning very good condition. 1.1 - 2.0 was green color meaning good condition. 2.1 - 3.0 was skyblue color meaning intermediate condition. 3.1 - 5.0 yellow color meaning not good condition. 5.0 higher was red color meaning very not good condition. The physiological disorder rate of Geumjin, Gopoong and Geumsun were higher than others. It seem to resistant line. Moderate resistant line was Sunun, Geumpung, Chunpung, Yunpoong and other breeding lines. Susceptible lines was American Ginseng, GS 98-1-5, GS 98-69 and others. We classified by resistance such as resistant, Moderate, Susceptible lines. and extracted RNA for representative cultivar. We will analysis RNA sequencing through NGS (Next-Generation Sequencing).

**Conclusion** : Currently, Genetic functional analysis such as salt damage in ginseng has been attempted, but accurate markers have not yet been created. We will make DNA marker base on SNP set to have the potential for application to abiotic stress test (wet injury) not only for 96 elite inbreds but also for diverse resources for Ginseng breeding.

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[P02-013]

## 인삼 아쿠아포린 유전자 특성 및 염류 처리에 따른 유전자 프로파일링

조익현\*, 홍지은, 장우중, 이정우, 김장욱, 방경환  
농촌진흥청 국립원예특작과학원 인삼특작부 인삼과

### Genome-Wide Identification, Characterization, and Expression Profiling of The Aquaporin Gene Family in *Panax ginseng*

Ick Hyun Jo\*, Chi Eun Hong, Woo Jong Jang, Jung Woo Lee, Jang Uk Kim and Kyong Hwan Bang

Department of Herbal Crop Research, NIHHS, RDA, Eumseong 27709, Korea.

#### ABSTRACT

**Background :** Water movement across cellular membranes is mostly regulated by aquaporins (AQPs). The AQPs have been found to play an important role in plant growth and development, and also in the response of plants to abiotic stress. Despite the vital role of AQPs, the regulation of its function and activity remains unknown in *Panax ginseng*.

**Methods and Results :** In this study, we identified 21 aquaporin unigenes from *P. ginseng* Iso-Seq data that were separated by phylogenetic analysis into three sub-families (PIP, TIP and SIP). Next we selected a total of 10 unigenes based on criteria including the elimination of overlapping TAIR ID, the longest ORF, and e-value. To identify relative expression patterns to salt stress, 150 mM NaCl was treated with 3-week-old ginseng adventitious roots and the treated tissues were collected at the indicated time point for RNA extraction. Expression patterns varied however transcript level of 5 genes (KG\_ISO002645, KG\_ISO\_037543, KG\_ISO\_040118, KG\_ISO\_12789, KG\_ISO\_132560) increased at early time points (6, 9, 12 h) compared to control after salt stress. To confirm the sub-cellular localization of PgAQPs predicted using the online tool WoLF PSORT tool, the AQP:GFP fusion constructs were constructed. Subcellular localization analysis in *Nicotiana benthamiana* epidermal cells revealed the diverse and broad array of sub-cellular localizations of *Panax ginseng* aquaporins (PgAQ4, SIP1; PgAQ6, TIP1; PgAQ14, PIP2).

**Conclusion :** A total of 10 AQP genes in three sub-families were identified and characterized based on their sequences, phylogenetic relationships, and expression profiles upon abiotic stress. qRT-PCR analysis showed that salinity stress could alter the expression levels of PgAQPs. Moreover, transient expression analysis indicated that AQPs play roles in the regulation of plant water status.

Under stress conditions, further molecular study of PgAQPs should reveal more functional mechanisms for these genes. These results can also further expand our understanding of the AQPs in *P. ginseng* and may contribute to genetic engineering for ginseng cultivar stress-resistance improvement.

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고려인삼 품종 ‘금진’을 구분할 수 있는 CAPS marker 개발

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충청남도농업기술원 인삼약초연구소

**Development of a CAPS Marker for the Identification of Korean Ginseng Cultivar (*Panax ginseng* C. A. Meyer), 'Geumjin'**

Moo Geun Jee\*, Bong Jae Seong, Yong Chan Park, Sun Ick Kim, Won Suk Jang and Hyun Ho Kim

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**ABSTRACT**

**Background :** This study was conducted to develop an SNP set that can be useful for marker-assisted breeding (MAB) in Korean ginseng (*Panax ginseng* C. A. Meyer) using Genotyping-by-sequencing (GBS) analysis of 96 Ginseng breeding lines. The several studies on the characteristics of Korean Ginseng cultivars and breeding lines have already been carried out the level of molecular Classification analysis in Korea. In spite of where Geumsan is a representative place of Korean Ginseng, Geumsan native species (breeding lines) have not yet been carry out analysis of morphological, genetic characteristics and relationship. We have plan to carry out morphological, genetic characteristics and relationship for Geumsan native species, breeding lines. Furthermore, We could be used diverse genetic resources for Ginseng breeding.

**Methods and Results :** We collected 96 Ginseng breeding lines from Korea, China and America. GBS analysis of the collection were conducted for extraction gDNA using sprout. Each DNA sample was quantified at the final DNA concentration of 5ng/ml using sterilized distilled water. We selected total 3,999 SNP through SNP filtering and clustered for the selection of Geumsan native ginseng in Korea using SNPs. The result of GBS showed that 88.8% of approximately 806,450,723 raw reads were mapped on the ginseng genome with an average mapping region of about 25,736,085bp, which indicated genome coverage of 0.86%. For the understanding genetic relationship of 96 elite breeding lines, Population genetic structure analysis was carried out with 3,999 SNPs, which resulted in the classification of inbreds into 5 groups, thus causing differentiation between the inbreds. A similar classification pattern for Population genetic structure analysis was observed from clustering analysis. We classified into five groups on 96 Ginseng breeding lines, included Group1 in Sunone, Sunpung, Chungsun, Chunpung, Group2 in Geumone, Group3 in Geumsun, Sunhyang, Chunryang, Geumpung, Sunun, Group4 in Geumjin, Group5 in Yunpoong, gopung k-1. We have created 39 markers that can Identify group 4. We selected 7 of 39 maker. At results, we used Geumjin 5 marker to specific digest only geumjin located 458bp.

**Conclusion :** The SNP set developed in this study has the potential for application to cultivar identification and purity test not only for 96 elite inbreds but also for diverse resources for Ginseng breeding.

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[P02-015]

## 주요 인삼속 식물 4 종의 미토콘드리아 유전체 완성 및 유연관계 분석

장우중, 이정우, 권나영, 김동휘, 방경환, 조익현\*

농촌진흥청 국립원예특작과학원

### The Complete Mitochondrial Genomes and Phylogenetic Analysis of Four Major *Panax* Species

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Department of Herbal Crop Research, NIHHS, RDA, Eumseong 27709, Korea.

#### ABSTRACT

**Background :** *Panax* species (ginsengs), which belong to the Araliaceae family, have been used as important medicinal plant worldwide for a long time. These plants have various pharmacological properties, and many studies have been performed on major metabolites. However, fundamental genetic studies for these valuable species are still limited and remained as a closed book.

**Methods and Results :** In this study, we completed mitochondrial genomes of four major *Panax* species including *P. ginseng* (Korean ginseng), *P. notoginseng* (Chinese ginseng), *P. quinquefolius* (American ginseng), and *P. vietnamensis* (Vietnamese ginseng) using hybrid assembly method. Korean ginseng showed a typical mitochondrial genome structure containing single circular form, but other three species had multipartite structure fragmented into 3-4 chromosomes. Mitochondrial genome of each species encoded 72 (45 protein-coding genes (PCGs), 24 tRNAs, and 3 rRNAs), 60 (38 PCGs, 19 tRNAs, and 3 rRNAs), 73 (44 PCGs, 26 tRNAs, and 3 rRNAs), and 94 (60 PCGs, 31 tRNAs, and 3 rRNAs) unique genes, respectively. Average GC contents were estimated as 45.1%, 45.19%, 44.32%, and 43.48%, respectively, which contained similar nucleotide compositions within *Panax* species. Phylogenetic analysis based on orthologous PCGs in mitochondrial genome with related species revealed that four *Panax* species clustered as a sister group and clearly distinguished from other families.

**Conclusion :** The first completed mitochondrial genomes of major *Panax* species will provide valuable information for further advanced studies involved with the important medicinal plants and the phylogenetic result will help to establish the obvious relationship among the related species.

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반하 (*Pinellia ternata*)의 수집계통들 중에서 우수계통의 생육특성

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**Growth Characteristics of Superior Lines in Collected Lines of *Pinellia ternata***

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**ABSTRACT**

**Background :** *Pinellia ternata* (Thunb.) Bretenb. is perennial herbaceous plant, pinellia tuber is used as herbal medicine according to The Korean Pharmacopoeia (KP). Most pinellia tuber imported more than 95% from China. Therefore, this study aimed to use basic research data to develop standard varieties using agronomic characteristics.

**Methods and Results :** A total of 43 *Pinellia ternata* (Thunb.) Bretenb. superior lines were selected from collected lines, it is sown and their growth characteristics were investigated. The growth characteristics were measured by plant height, terminal leaflet length, terminal leaflet width, lateral leaflet length, lateral leaflet width, peduncle height, peduncle diameter, spathe length of inflorescence, tube length of spathe, tube diameter of spathe and limb width of spathe. Observations were terminal leaflet shapes is elliptical (length/width < 2.0), oblong (length/width 2.0 - 6.0) and lanceolate (length/width > 6.0) at flowering day. Agronomic characteristics at flowering day were elliptical 20.1 ± 2.8 cm, oblong 24.5 ± 3.4 cm and lanceolate 29.1 ± 2.8 cm in plant height, Terminal leaflet length were elliptical 8.0 ± 1.8 cm, oblong 11.1 ± 1.9 cm and lanceolate 15.0 ± 1.7 cm. Terminal width were elliptical 4.4 ± 0.9 cm, oblong 3.0 ± 0.7 cm and lanceolate 2.1 ± 0.2 cm. Inflorescence characteristic were elliptical 17.2 ± 3.7 cm, oblong 18.3 ± 5.0 cm and lanceolate 18.2 ± 3.6 cm in peduncle length. Peduncle width were elliptical 2.7 ± 0.6 cm, oblong 3.0 ± 0.4 cm and lanceolate 2.9 ± 0.5 cm. Spathe length of inflorescence were elliptical 6.3 ± 1.1 cm, oblong 5.8 ± 0.4 cm and lanceolate 6.5 ± 0.5 cm. Tube length of spathe were elliptical 3.7 ± 0.7 cm, oblong 3.4 ± 0.4 cm and lanceolate 3.5 ± 0.8 cm. As a result of agronomic characteristics survey, by using the *Pinellia ternata* in which the median characteristic has, it tries to breed.

**Conclusion :** These results could be used as fundamental data to breeding of standard variety for *Pinellia ternata* (Thunb.) Bretenb.

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## 원지 유용 계통 선발을 위한 특성 평가

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### Evaluation of Characteristics for Selection of Useful Genotypes in *Polygala tenuifolia* Willd.

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Youn Ho Moon, Yoon Jeong Lee and Jang Hoon Kim

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#### ABSTRACT

**Background :** *Polygala tenuifolia* Willd. is a perennial plant that grows wild in central and northern Korea and China. It is known as a medicinal herb that helps to treat cognitive disorders and improve memory. Its consumption has recently increased as a herbal medicine, but it is entirely dependent on imports in Korea. Therefore, it is necessary to develop standard varieties by collecting genetic resources for import substitution and uniform quality. This study was conducted to evaluate for characteristics of the collected genetic resources and to select useful genotypes.

**Methods and Results :** The experiment was conducted at the National Institute of Horticultural & Herbal Science in Eumseong, Korea. A total of 26 germplasm were collected at domestic and abroad, and they were classified into 11 genotypes according to morphological characteristics, such as leaf morphology and stem branching type. In 2018, eleven genotypes were planted open field after growing the seedlings for about 2 months in the greenhouse. Plant height, branch number, root length, sub root number and dry weight were measured at growing periods and harvest time in 2018. To analyze the content of polygala saponin B contained in the polygala root, 20 mg of dried polygala root powder was added with 1 ml of 100% methanol and ultrasonically extracted for 30 minutes, the extract was centrifuged at 1,200 rpm for 10 minutes, and the supernatant was filtered with a syringe filter. Above ground part (Plant height, stem diameter, branch number, shoot dry weight) and under ground part (root length, root diameter, sub root number, root dry weight) of collected genotypes were characterized. Leaf morphology and stem branching type was divided into 4 group, thin leaf-unbranched type, thin leaf-few branched type, thin leaf-multi branched type, broad leaf-multi branched type. Plant height of examined genotypes range from 18.6 cm to 28.3 cm, root length vary from 15.3 cm to 25.6 cm, root dry weight range from 1.2g to w.2.7g per plant, and polygala saponin B contents of tested accessions range from 0.17% to 0.33%. Root dry weight of PT3, PT5 and PT8 genotypes were relatively heavier than that of others. The content of polygala saponin B of the PT4 genotype was the highest at 0.37%.

**Conclusion :** According to the above results, it was possible to select genotypes with a high yield of root and high content of polygala saponin B. Further breeding programs will address the development of standard cultivars utilizing the collected genotypes to combine desirable traits such as high yields and highly useful ingredients.

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## 홍화 내도복 계통 육성을 위한 유전자원 평가

허목, 구성철, 박우태, 김장훈, 이윤정, 문윤희, 허윤찬\*

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### Screening of Safflower Germplasm for Development of Lodging Tolerant Lines

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Yun Chan Huh\*

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#### ABSTRACT

**Background :** Safflower has been traditionally used for the treatment of blood stasis, and Radix has been used as a drug for fracture in Chinese medicine. In terms of cultivation, spines are known as difficulties during cultivation. Lodging is also a problem to be solved. In this study to develop lodging tolerant lines we investigated the variation in morphological characteristics and relationship between the morphological characteristics.

**Methods and Results :** Seeds of 100 accessions are obtained from gene bank of the National Agrobiodiversity Center of Korea. Each material had 15 seedlings in a plot in non-replicated. Plant spacing were 15 cm and 15 cm respectively (row and column). Morphological traits were plant length (PL), No. of main stem node (SN), No. of branch (NB), No. of flower (NF), stem diameter (SD), lodging degree (LD), spine score (ss). The spines were recorded in score of 0 to 2 score, spineless = 0, short spine = 1 (< 2 mm), long spine=2 (> 2 mm). Above aerial-part were investigated as four kinds of characters, 1)inverted triangle 2)diamond 3)rectangle 4)semicircle. Inverted triangle and diamond shapes were investigated as most shapes. This investigation performed Pearson correlation analysis. The lodging degree was correlated with PL, NB, SN, NF, SD.

**Conclusion :** From the above results, we may conclude that developing of lodging tolerant lines of safflower, plant length (PL), No. of main stem node (SN), No. of branch (NB), No. of flower (NF), stem diameter (SD), lodging degree (LD) are very important traits.

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구기자 4배체 품종 및 계통의 교잡친화성

이보희\*, 현혜경, 손승완, 최현구, 송전의  
충청남도농업기술원 구기자연구소

**Cross-compatibility of Tetradiploid Varieties and New Breeds of Goji Berry**  
**(*Lycium chinense* Miller)**

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**ABSTRACT**

**Background :** Goji berry is a food material that has been traditionally consumed in South Korea for medicinal and edible uses. Recently, several tetradiploid cultivars have been bred for more yielding and pests and diseases resistance. Tetradiploid varieties of Goji berry (*Lycium chinense*) have a tendency of self-compatibility in fruit bearing. Although tetradiploid varieties of Goji berry have self-compatibility we need to investigate cross-compatibility with newly developed tetradiploid varieties. Therefore, this experiment was carried out to select proper pollinizer through researching self-compatible and Cross-compatibility of tetradiploid varieties and new breeds of Goji berry.

**Methods and Results :** The cross-compatibility between tetradiploid varieties were investigated by evaluation of bearing rate and characteristics of fruits had harvested after artificial fertilization. Evaluations of pollination affinity of tetraploid varieties and new breeds were tested with two-ways by changing the maternal and pollen parent for each combination. According to the test results, ‘Hwaseon’ Goji berry had a high pollination affinity with ‘Hwagang’ Goji berry, and the fruit characteristics were also found to be larger and heavier than other combinations, so it was judged to be a good combination. ‘Hwasu’ Goji berry had the highest fertilization affinity with ‘Cheongyang No. 37’, and the fruit characteristics were also found to be larger and heavier than other combinations, indicating that it was the best combination. Inference from the test results of pollination affinity of self-compatible tetraploid Goji berry, it was possible to confirm the metaxenia phenomenon in which the paternal characteristics appear in the fruit, and it was considered to be useful for selection of pollination.

**Conclusion :** As a result of examining the pollination affinity of tetraploid Goji berry, the affinity between ‘Hwagang’ and ‘Hwaseon’ Goji berry was high, and ‘Hwasu’ and ‘Cheongyang No. 37’ had good hybridization affinity, so good combinations were selected for pollination.

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강원지역 황기 지역수집종의 자가불화합성 타파 처리 효과

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강원도농업기술원 인삼약초연구소

**Effect of Treatment for Breaking of Self-Incompatibility *Astragalus membranaceus* Bunge Local Collections in Gangwon Area**

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**ABSTRACT**

**Background :** *Astragalus membranaceus* bunge is a medicinal crop belonging to the Leguminosae family with self-incompatibility. Self-incompatibility characteristics can be maintained pure through the temporary break-down method of self-incompatibility, and chemical treatment, temperature treatment, and CO<sub>2</sub> treatment have been studied as methods to overcome. Therefore, in this study, NaCl treatment, CO<sub>2</sub> treatment, and artificial pollination treatment were used to compare the self-incompatibility effect of *Astragalus* collecting species in Gangwon.

**Methods and Results :** *Astragalus* collected from 4 regions of Gangwon was sown in a small plastic house in a test field at the Ginseng & Medicinal Plants Research Institute in Cheorwon-gun, Gangwon-do, around the beginning of April. For each treatment, artificial pollination was carried out with a cotton swab to artificially pollinate the pollen of different flowers blooming from the same plant after putting a bag on the pedicel with flower buds and then removing the bag on the day of flowering. It was carried out in early August to late September. For NaCl treatment, a cotton swab was moistened with 1, 3, or 7% NaCl for artificial pollination. In the CO<sub>2</sub> treatment, a small amount of 99.99% pure CO<sub>2</sub> gas was injected after artificial pollination before putting it in the bag to maintain the CO<sub>2</sub> density in the bag at 0.5% (5,000 ± 500 ppm), and completely sealed for 2 hours. As a result of examining the pod setting and seed set for each treatment, in early August, the pod setting and seed set of artificial pollination were 2.6% and 85.7%, respectively, and when NaCl was treated, the pod setting and seed set were 0.0 - 7.5% and 0.0 - 66.7% depending on the density. Also when CO<sub>2</sub> treatment was 2.6% and 66.7%. At the end of August, CO<sub>2</sub> treatment had the highest pod setting at 25.4%, artificial pollination showed a 3.4% pod setting, NaCl 1% treatment showed 12.9%, and NaCl 7% treatment had a pod setting of 9.6%. was relatively low. At the beginning of September, when CO<sub>2</sub> was treated, the pod setting was 42.3%, and when NaCl was treated with 1%, the pod setting was 66.5%. At the end of September, all the treatment groups showed a decrease in the pod setting and the seed set, and in the case of artificial pollination, the pod setting was lowered to 6.1%.

**Conclusion :** The treatment for self-incompatibility of *Astragalus membranaceus* bunge local collections in Gangwon area was most effective when treated with 1% NaCl in early September.

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약용식물 백수오, 이엽우피소, 박주가리의 게놈 초안

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**Draft genome of Medicinal Plant *Cynanchum wilfordii*, *C. auriculatum* and *Metaplexis japonica***

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**ABSTRACT**

**Background** : *Cynanchum wilfordii* (Cw) and *C. auriculatum* (Ca) have been used as traditional medicine in Korea and China, respectively. *Metaplexis japonica* (Mj) also has been regarded as a nutritious tonic. In particular, Cw has recently been widely used as a raw material for health functional foods to alleviate menopausal symptoms. Cw, Ca and Mj are nearly allied species and have very similar phenotypes, but they show remarkable differences on traits in inter-species level, such as storage root development, size of aerial parts, and disease resistance. Although many studies on the pharmacological efficacy and metabolites were published, genome researches were limited to species authentication. Therefore, in this study, we tried to reveal the genome sequences of the three important medicinal plants.

**Methods and Results** : The hybrid assembly was conducted with Oxford Nanopore Sequencing Technology (ONT) long-read sequence, Illumina paired-end (550 bp), and mate-pair sequencing (3 k, 5 k, 8 k). Genome scaffolding was performed using the DNase Hi-C method, and high-quality draft genome sequences of three species were obtained. The genome size estimated through the *k*-mer analysis was about 250 Mbp, and the assembled sequences were about 180 Mbp. The BUSCO value and mapping rate of transcriptome read were both 99%. The Cw, Ca, Mj genome sequences had a quite high similarity. As a result of synteny analysis with *Coffea canephora*, a vividly conserved chromosome structure was found even though they were estimated to have a divergence event about 100 million years ago. through the hidden paralogue sequence excavation with *Solanum lycopersicum* genome, these three Apocynaceae species were predicted not to experience genome duplication events after gamma paleohexaploidization.

**Conclusion** : From the result of this research, high-quality draft genome sequences of three Apocynaceae species were assembled, and they are expected to be useful for further genomic and metabolomic pathway study.

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## 경기지역의 인삼 신육성 계통 4, 5년생 생육특성

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<sup>1)</sup>경기도농업기술원, <sup>2)</sup>농촌진흥청 인삼특작부

### Growth Characteristics of Four and Five Years Old Ginseng (*Panax ginseng* C.A. Meyer) of New Lines in Gyeonggi Province

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#### ABSTRACT

**Background :** This study examines the main growth characteristics, physiological stress, or diseases damage for 4- and 5-years old ginseng in the new lines cultivated in Gyeonggi for development of new lines of Ginseng.

**Methods and Results :** In Yeoncheon county Gyeonggi province, Eumseong 24, 25 and 26, which are two-years old seedling in the new line ginseng were transplanted in 7 lines × 9 rows (70 plants)/1.62m<sup>2</sup> in 2017 along with Gumpoong and Yeonpoong as the control lines while Eumseong 9 and 12 as well as Chunpoong as the control line were transplanted in the same way in 2016. The ginseng shading was installed with the front post of 170 cm high and the rear post of 100 cm high using the rear line while as the sun blocking material, the aluminum shade plate was used. As for the new growth lines of 4- and 5-years ginseng in the new growth line, the aerial parts of the ginseng (such as plant height, stem height, stem diameter and leaf length, etc.) and underground part of ginseng (such as root length, root diameter and root weight, etc.) were examined. In addition, the physiological stress such as the leaf discoloration, rusty root and root rot as well as the resistance against the disease were examined. It was found out that as for the aerial parts of 4-years old ginseng in test line, Eumseong 24, 25 and 26 were better in the growth than the control lines were while in 4-years old ginseng, Eumseong 9 and 12 were better in the growth than Chunpoong as the control line was. As for the root weight of the 4-years old ginseng for the underground part, Eumseong 24 and 25 were heavier in the growth than the control lines were while in 4-years old ginseng, Eumseong 9 and 12 were heavier in the growth than the control lines were while in 5-years old ginseng. The leaf discoloration did not happen to both 4- and 5-years old ginseng. As for the root rot, 4-years old Eumseong 24, 25 and 26 suffered less root rot in the same way as for the control line. 5-years old Eumseong 9 and 12 had root rot as much as the control line. 4-years old Eumseong 24, 25 and 26 have rusty root as much as the control line while as for 4-years old ginseng, Eumseong 9 showed a lot of rusty roots in the same way as the control line.

**Conclusion :** Finally, considering the growth characteristics, physiological stress and root rusty of the aerial parts and underground parts of the ginseng, we selected Eumseong 24, 25 and 26 as the excellent lines for 4-years old ginseng, and Eumseong 12 as the excellent lines for 5-years old ginseng.

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## 남원 · 지리산권 허브 3 종의 피부 진정 효능에 관한 연구

한지원, 남보미, 김세울, 박유나, 이범석, 황지영\*

(재)남원시화장품산업지원센터

### Skin Soothing Effect of Three Herbs from the Namwon-Mt.Jiri Regions

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#### ABSTRACT

**Purpose :** This study was conducted to evaluate lavender, lemongrass, and peppermint grown in the Namwon-Mt.Jiri regions as functional soothing ingredients for cosmetics.

**Methods and Results :** The simultaneous analysis of 19 polyphenols in 50% ethanol-extracted samples of lavender, lemongrass, and peppermint cultivated in the Namwon-Mt.Jiri regions were analyzed by high-performance liquid chromatography (HPLC). Antioxidant activity was measured using 2,2-diphenyl-1-picrylhydrazyl (DPPH). Using real-time PCR, improvements in skin barrier function were confirmed by observing the mRNA expression levels of filaggrin and involucrin, and the moisturizing ability was confirmed through the mRNA expression of HAS-2 and HAS-3. The anti-inflammatory efficacy was verified by confirming the expression levels of the inflammatory cytokine IL-6 and the pro-inflammatory mediator nitric oxide (NO). In the simultaneous analysis of 19 phenolic compounds, rosmarinic acid from lavender; chlorogenic acid, syringic acid, *p*-coumaric acid, and ferulic acid from lemongrass; and caffeic acid, quercetin hydrate, rosmarinic acid, and hesperetin from peppermint were identified. Antioxidant efficacy was confirmed by DPPH radical scavenging, and excellent efficacy was shown in the order of lavender, peppermint, and lemongrass. Filaggrin and involucrin, skin barrier-related genes, were increased more in lavender, lemongrass, and peppermint than in the untreated group. HAS-2 and HAS-3 were also confirmed to be increased in lavender, lemongrass, and peppermint. Lavender, lemongrass, and peppermint all showed concentration-dependent inhibition of IL-6 and NO.

**Conclusion :** Extracts of lavender, lemongrass, and peppermint cultivated in the Namwon-Mt.Jiri regions had excellent antioxidant, skin barrier, moisturizing and anti-inflammatory effects, so may be considered for use as natural raw materials for soothing cosmetics.

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[P03-002]

## 에탄올 농도에 따른 별개미취 추출물의 페놀성분 및 항산화 특성

장귀영, 이은숙, 지윤정, 김형돈, 강민혜, 김금숙, 최수지, 이승은\*

농촌진흥청 국립원예특작과학원 인삼특작부

### Phenolics Composition and Antioxidant Properties of *Aster koraiensis* Extracts with Different Ethanol Concentrations

Gwi Yeong Jang, Eun Suk Lee, Yun Jeong Jee, Hyung Don Kim, Min Hye Kang,

Geum Soog Kim, Su Ji Choi and Seung Eun Lee\*

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#### ABSTRACT

**Background :** *Aster Koraiensis* Nakai (*A. koraiensis*) has been used as a food and as a medicinal plant, and is valuable as a functional food material. Therefore, this study was determined antioxidant properties and major phenolics of *A. koraiensis* extracts with different ethanol concentrations (0, 50, 70, and 100%).

**Methods and Results :** Aerial parts of *A. koraiensis* was extracted with different ethanol concentrations (0, 50, 70, 100% aqueous ethanol solutions) at room temperature, these extracts were used to analysis of antioxidant properties and phenolics composition. When increasing ethanol concentration of extraction solvent, extraction yield was decreased, and 34.2, 23.2, 21.0, and 5.5% in 0, 50, 70, and 100% ethanolic extracts, respectively. Total phenolics content and antioxidant activities of extracts were increased in a ethanol concentration-dependant manner. The major phenolics of extracts were chlorogenic acid (21.264-58.666 mg/g), isochlorogenic acid A (10.432-145.353 mg/g), and isochlorogenic acid C (0.239-13.148 mg/g), and these phenolic content was higher in 70 and 100% ethanolic extracts than other extracts. Significant correlations were observed between ethanol concentration of extraction solvent, antioxidant properties, and major phenolics.

**Conclusion :** These results indicated that the optimal ethanol concentration for extraction was 70% ethanol in terms of efficiency.

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의료용 대마 선발 우량 계통종 CW21-5의 생리활성 검정

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**Biological Activity of Selected Superior Line, CW21-5 for Medicinal Cannabis**

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**ABSTRACT**

**Background :** Hemp (*Cannabis sativa* L.; Sam) contains more than 525 compounds, and about 109 cannabinoids are known to exist. Hemp is a plant that has been used for centuries to relieve a variety of symptoms. Medical research on this plant began in earnest in the 1960s. The physiological activity of cannabis is known to be very excellent based on many studies. The purpose of this study was to compare the 'CW21-5' cultivar leaf and inflorescence selected through prior research by comparing physiological activities such as lung cancer apoptosis, antioxidant and antibacterial activity with a native Korean cultivar that 'Chungsam'.

**Methods and Results :** Leaf and inflorescence samples were freeze-dried with 'Cheongsam' and 'CW21-5' variety, precisely weighed 0.1g. Extraction was performed by sonication at room temperature for 40 minutes using 100 ml of 80% MeOH as a solvent. Thereafter, it was concentrated at 30 degrees using a rotary evaporator, and recovered to a concentration of 40,000 µg/ml and used for this experiment. As a result of the evaluation of apoptosis rate for A549, CW21-5 cultivar was superior to Chungsam in both leaf and inflorescence than cheongsam. As a result of evaluation by paper disc diffusion assay and MIC method, the antibacterial effect of CW21-5 cultivar was also superior to that of Chungsam. In the case of TPC, the content of cheongsam flowers was the highest, and in the evaluation of antioxidant capacity including TFC, the CW21-5 variety was excellent. In most of the physiological activities, the inflorescence extract showed higher activity than the leaf extract.

**Conclusion :** The 'CW21-5' variety is for CBD production, and the 'Chungsam' variety is for fiber production and seed production. Hemp is a plant that is used limitedly in Korea. If cultivated and used for its intended purpose, the Korean hemp industry will gradually develop.

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[P03-004]

## 들깨 용도별 주요 품종의 페놀성 화합물 함량 및 항산화 활성 비교

박재은, 김상우, 김민영, 김성업, 오은영, 이정은, 김정인, 이명희\*

농촌진흥청 국립식량과학원

### Comparison of Phenolic Compound Contents and Antioxidant Activity in Seed Perilla and Vegetable Perilla

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and Myoung Hee Lee\*

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#### ABSTRACT

**Background :** Reactive oxygen species have a protective effect on the human body during normal physiological action, but when excessively generated by factors such as radiation, pollutants, and stress, it causes chronic diseases such as cancer, cardiovascular disease, and degenerative diseases. In order to eliminate these free radicals, the antioxidant activity from various compounds is evaluated and research on the cytoprotective effect is being actively conducted. The purpose of this study is to compare the content of phenolic compounds by type of perilla seeds and leaves and evaluate the antioxidant activity to estimate the applicability of perilla seeds in breeding, pharmaceuticals, food, and cosmetics industries.

**Methods and Results :** The seeds of Dayu, Deulsaem, Deulchan, Deulhyang, and Sodam were used for the analysis, and the leaves of Dongle 1, Sangyeop, Soim, Namcheon, and Saebora were analyzed for vegetable perilla. The pulverized sample was extracted with 80% ethanol, and the total polyphenol content and total flavonoid content were quantified using the filtered supernatant, and the antioxidant activity was evaluated by measuring the DPPH radical scavenging activity and ABTS radical scavenging activity. As a result of the analysis of perilla cultivar for seed, the total polyphenol content was 295.67 - 351.63 mg CAE/100g, and the total flavonoid content was 324.83 - 394.25 mg CAE/100 g. The DPPH radical scavenging activity was 325.40-392 mg Te/100 g, ABTS radical scavenging activity was analyzed as 446.25 - 554.70 mg Te/100g. As a result of the analysis by vegetable perilla cultivar, the total polyphenol content was 1776.15-2955.85 mg CAE/100 g, and the total flavonoid content was 1486.33 - 3270.00 mg CAE/100g. The DPPH radical scavenging activity was 2022.80 - 3896.00 mg Te/100g, ABTS radical scavenging activity was found to be 2871.21 - 4754.83 mg Te/100g. There was a significant correlation with phenolic compounds and antioxidant activity in perilla. Sodam was the highest content of phenolic compounds, and Deulhyang was lowest content in perilla for seed. Dongle 1 was the highest content of phenolic compounds, and Namcheon was the lowest content in vegetable perilla.

**Conclusion :** The antioxidant activity of perilla can be compared only by comparing the content of phenolic compounds. These results can be used as useful information for material development using perilla.

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## 수확시기에 따른 산수유의 품질특성과 기능성 변화

이은숙, 최수지, 이병주, 이승은, 김형돈, 강민혜, 지윤정, 김금숙, 장귀영\*  
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### Changes in Quality Characteristics and Functionalities according to Different Harvest Times in *Cornus officinalis*

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#### ABSTRACT

**Background :** *Cornus officinalis* (*C. officinalis*) is a medicinal herb that has been traditionally used in Korea. The quality characteristics and functionalities of medicinal crops change depending on the harvest time. Therefore, it is important to determine the appropriate harvest time.

**Methods and Results :** Sequentially harvested *C. officinalis* was freeze-dried and extracted with 70% alcohol to measure quality characteristics (color, sugar content and acidity) and functionalities (antioxidant activity and active ingredient content). The general quality characteristics of *C. officinalis* are excellent in the 2nd and 3rd, but in the functionalities the 1st is superior.

**Conclusion :** As a result of comparing the quality characteristics and functionality according to harvest time, the trends were not consistent. Although the quality characteristics of *C. officinalis* harvested in the 1st are lower than in the 2nd and 3rd, the functional analysis result is excellent, so it is considered to have great utility value as a functional material.

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영정귀와 황해쑥의 포제 전(前) 후(後) 주요성분 변화

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농촌진흥청 인삼특작부

**Components Variation on Processing of *Cirsium Japonicum* var. *maackii* and *Artemisia argyi* H.Lev.**

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**ABSTRACT**

**Background :** The processing of medicinal plants is very important on oriental medicine. We investigated that the chemical constituents of *C. japonicum* and *A. argyi* are changed by the processing conditions, which are a heating temperature and time.

**Methods and Results :** The *C. japonicum* and *A. argyi* were processed by a heating temperature and time. The conditions of processing are distinguished by a heating temperature, 120~240°C, and time 10~20min. The prepared samples were extracted by a reflux extraction method, 70% EtOH, boiling temperature 85°C, 2h, 3 times, respectively. The extracts were concentrated and lyophilized. The chemical constituents were analyzed by a HPLC/UV, Agilent 1260 Infinity II, reverse-phase column with gradient elution program (water in 0.5% formic acid : acetonitrile = 100:0 to 0:100 for 45 min, 0.8 ml/min). UV detection was conducted at 340 nm in *C. japonicum*. And the chemical constituents were analyzed by a HPLC/UV, Agilent 1260 Infinity II, reverse-phase column with gradient elution program (water in 0.5% formic acid : acetonitrile = 100:0 to 0:100 for 70 min, 0.8 ml/min). UV detection was conducted at 210 nm in *A. argyi*. The 2 components of *C. japonicum*, which are cirsimaritin, cirsimaritin, and 3 components of *A. argyi*, which are jaceosidin, eupatilin, artemisinin, were analyzed. As a results, contents of cirsimaritin and cirsimaritin were increased at roasting conditions in *C. japonicum*. And also, jaceosidin, eupatilin, artemisinin were increased by a heating temperature and time. Above the results, Chemical components can vary with heating temperature and time, respectively. Therefore, a processing of *C. japonicum* and *A. argyi* might have useful as a utilization of the various functional materials.

**Conclusion :** From the above results, we may suggest that processing of *C. japonicum* and *A. argyi* might have useful as a utilization of the various functional materials.

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## 제주조릿대 추출물의 항산화 및 신경세포 보호 활성

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### Antioxidant and Neuroprotective Activities of *Sasa quelpaertensis* Nakai Extracts

Min Hye Kang<sup>1)</sup>, Yun Jeong Ji<sup>1)</sup>, Su Ji Choi<sup>1)</sup>, Seung Eun Lee<sup>1)</sup>, Gwi Yeong Jang<sup>1)</sup>, Kyung Hye Seo<sup>2)</sup> and Hyung Don Kim<sup>1)\*</sup>

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### ABSTRACT

**Background :** The *Sasa quelpaertensis* Nakai (SQ), a dwarf bamboo, is a medicinal plant. It is well known that SQ has diverse biological activities antioxidant, anti-inflammatory, anti-cancer effects. This study was performed to investigate the antioxidant and neuroprotective activities of SQ.

**Methods and Results :** *Sasa quelpaertensis* (SQ) aerial parts were extracted using distilled water and 70% ethanol respectively, producing SQ water extract (SQW) and SQ 70% ethanol extract (SQE). Antioxidant components, such as total phenolic content (TPC) and total flavonoid content (TFC), of the extracts were determined and antioxidant activities of the extracts were measured by *in vitro* assays including 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) and 2,2'-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity. The intracellular reactive oxygen species (ROS) levels in neuronal cells were detected by 2',7'-dichlorofluorescein diacetate (DCF-DA) assay. We found a difference in TPC and TFC between SQW and SQE. SQE had higher TPC and TFC than SQW. However, in ABTS and DPPH assay, SQW showed higher radical scavenging activity than SQE. And all SQ extracts (SQW, SQE) significantly reduced the H<sub>2</sub>O<sub>2</sub>-induced ROS production in neuronal cells.

**Conclusion :** Our results show that *Sasa quelpaertensis* (SQ) water and ethanol extracts have good antioxidant activities and ameliorated the H<sub>2</sub>O<sub>2</sub>-induced ROS production in neuronal cells. Therefore, this results indicate that SQ extracts are expected to be used for preventing oxidation and treating neurological disorders.

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## 열처리 감초 추출물의 미백 활성

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### Anti-Melanogenic Activity of Heat-Treated Licorice Extracts

Min Hye Kang<sup>1)</sup>, Gwi Yeong Jang<sup>1)</sup>, Yun Jeong Ji<sup>1)</sup>, Jeong Hoon Lee<sup>1)</sup>, Su Ji Choi<sup>1)</sup>, Tae Kyung Hyun<sup>2)\*</sup> and Hyung Don Kim<sup>1)\*\*</sup>

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### ABSTRACT

**Background :** The dried root and stolon of licorice have been used for treatment of cold, cough, asthma, fatigue and respiratory tract infections due to the biological activities of licorice including antioxidant, anti-microbial, anti-tumor, anti-platelet, anti-inflammatory and immunomodulatory activities. We aimed to confirm the potential of heat-treated Wongam (*Glycyrrhiza glabra* × *G. uralensis*), a new cultivar of licorice developed by the Rural Development Administration (RDA), as a whitening agent in cosmetics.

**Methods and Results :** Licorice was treated in an autoclave for 1 h at 130°C (WH-130). Untreated control licorice (WC) and WH-130 were separately extracted using 70% ethanol for 24 h at room temperature (RT). Isoliquiritigenin, an anti-melanogenic compound of licorice, was analyzed by HPLC. The isoliquiritigenin content was increased by heat treatment. In addition, WH-130 suppressed melanogenesis more effectively due to inhibition of tyrosinase activity in B16F10 melanoma cells than non-heated licorice extract.

**Conclusion :** Wongam extracts (WC and WH-130) inhibited melanin synthesis in IBMX-induced melanocytes by suppressing the activity of TYR. Heat treatment increased the anti-melanogenic activities of Wongam. As a result, WH-130 showed superior anti-melanogenic activities than WC. Our results suggest that heat-treated Wongam extract (WH-130) is a potent pigment-reducing agent with possible applications in various dermatologic hyperpigmentation disorders, including brown spots, freckles and melasma, and show that thermal processing can be used to improve the anti-melanogenic activity of licorice.

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백삼 및 약초류 추출물의 DPPH radical 소거능 및 혼합젖산균에 대한  
발효특성 비교

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<sup>1)</sup>충청남도농업기술원, <sup>2)</sup>중부대학교

**DPPH Radical Scavenging Activities and Fermentative Properties on Water and 70%  
Ethanol Extracts of White Ginseng and Medicinal Herbs.**

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**ABSTRACT**

**Background :** In order to develop a new lactic acid fermented product by mixing white ginseng with highly functional medicinal herbs, the DPPH radical scavenging activities was compared with respect to hot-water and 70% methanol extracts of white ginseng and 5 kinds of medicinal herbs ; *Adenophora Triphylla* var. *japonica* Hara leaves (ATHL), *Curcuma longa* Linne (CL), *Peucedanum japonicum* Thunberg (PT), *Schisandra chinensis* Baillon (SB), *Lycii fructus* z (LF). After fermented by mixture of 8 types of lactic acid bacteria, the fermentative properties were compared.

**Methods and Results :** White ginseng and 5 kinds of medicinal herbs were extracted with 20-fold water and 70% ethanol at 80℃ for 6 hours. In order to compare antioxidant activity, the amount of IC<sub>50</sub> was calculated by looking at the DPPH radical scavenging activities on each extracts. To see the fermentation characteristics on mixture of 8 types of lactic acid bacteria, each extract was fermented and the total amount of colonies of lactic acid bacteria was measured to compare the fermentation power. As a result of the antioxidant activity of extracts for each extraction solvent of white ginseng and medicinal herbs, 70% MeOH extract (IC<sub>50</sub>, 0.0069 ml) of ATHL had the highest antioxidant activity, followed by 70% MeOH extract of CL (IC<sub>50</sub>, 0.0182 ml). Next, it was followed by water extract of ATHL (IC<sub>50</sub>, 0.00250 ml), 70% MeOH extract of SB (IC<sub>50</sub>, 0.0544 ml), water extract of PT (IC<sub>50</sub>, 0.0640 ml), and 70% MeOH extract of PT (IC<sub>50</sub>, 0.0656 ml). It showed better antioxidant activity than red ginseng extract, and much superior antioxidant activity than white ginseng. As for the lactic acid fermentation of the extracts of 5 kinds of medicinal herbs including white ginseng, the lactic acid fermentation was performed best with ATHL regardless of the concentration of the extract. In the 20-fold extract, SB was not well fermented with lactic acid in the 20-fold extract due to the low acidity of the extract.

**Conclusion :** From the above results, Herbs with high antioxidant activity and good lactic acid fermentation are mixed with white ginseng and red ginseng extracts, which will serve as basic data for developing new probiotic products.

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[P03-010]

네트워크 약리학을 활용한 비만 완화를 위한 호랑가시나무 (*Ilex cornuta*) 잎의  
신호 전달 기전 규명

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**Uncovering Signaling Pathways of *Ilex cornuta* Leaves for Relieving of Obesity via  
Network Pharmacology**

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**ABSTRACT**

**Background** : *Ilex cornuta* Leaves (ICLs) are a representative and traditional prescription for controlling obesity. Nevertheless, the corresponding therapeutic compounds and related pharmacological mechanisms of such medication remain undocumented.

**Methods and Results** : The compounds from ICLs were identified by gas chromatography-mass spectrum (GC-MS), and SwissADME confirmed their physicochemical properties. Next, the target proteins related to compounds or obesity-associated proteins were retrieved from public databases. RPackage constructed the protein - protein interaction (PPI) network, a bubble chart, and signaling pathways - target proteins - compounds (STC) network. Lastly, a molecular docking test (MDT) was performed to evaluate the affinity between target proteins and ligands from ICLs. GC-MS detected a total of 51 compounds from ICLs. The public databases identified 219 target proteins associated with selective compounds, 3028 obesity-related target proteins, and 118 overlapping target proteins. Moreover, the STC network revealed 42 target proteins, 22 signaling pathways, and 39 compounds, which were viewed to be remedially significant. The NOD-like receptor (NLR) signaling pathway was considered a key signaling pathway from the bubble chart. In parallel, the MDT identified three target proteins (IL6, MAPK1, and CASP1) on the NLR signaling pathway and four compounds against obesity.

**Conclusion** : Overall, four compounds from ICLs might show anti-obesity synergistic efficacy by inactivating the NLR signaling pathway.

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[P03-011]

류마티스 관절염 완화를 위한 초피나무 (*Zanthoxylum piperitum*) 열매의 신호 전달 기전에 대한 네트워크 약리학 연구

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**A Network Pharmacology Research on Signaling Pathways of *Zanthoxylum piperitum* Fruits for the Amelioration of Rheumatoid Arthritis**

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**ABSTRACT**

**Background** : *Zanthoxylum piperitum* fruits (ZPFs) have been demonstrated favorable clinical efficacy on rheumatoid arthritis (RA), but its compounds and mechanisms against RA have not been elucidated. This study was to investigate the compounds and mechanisms of ZPFs to alleviate RA via network pharmacology.

**Methods and Results** : The compounds from ZPFs were detected by gas chromatography - mass spectrometry (GC-MS) and screened to select drug-likeness compounds through SwissADME. Targets associated with bioactive compounds or RA were identified utilizing bioinformatics databases. The signaling pathways related to RA were constructed; interactions among targets; and signaling pathways- targets-compounds (STC) were analyzed by RPackage. Finally, a molecular docking test (MDT) was performed to validate affinity between targets and compounds on key signaling pathway(s). GC-MS detected a total of 85 compounds from ZPFs, and drug-likeness properties accepted all compounds. A total of 216 targets associated with compounds 3377 RA targets and 101 targets between them were finally identified. Then, a bubble chart exhibited that inactivation of MAPK (mitogen-activated protein kinase) and activation of PPAR (peroxisome proliferator-activated receptor) signaling pathway might be key pathways against RA.

**Conclusion** : Overall, this work suggests that seven compounds from ZPFs and eight targets might be multiple targets on RA and provide integrated pharmacological evidence to support the clinical efficacy of ZPFs on RA.

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죽상 동맥 경화증 완화를 위한 영지버섯 (*Ganoderma lucidum*)의 약물 유사  
화합물에 대한 네트워크 약리학 분석

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**Network Pharmacology-based Study of Drug-like Compounds from *Ganoderma lucidum* against Atherosclerosis**

Ki Kwang Oh, Md. Adnan and Dong Ha Cho\*

<sup>1)</sup>Department of Bio-Health Convergence, Kangwon National University, Chuncheon 24341, Korea.

**ABSTRACT**

**Background :** *Ganoderma lucidum* (GL) is known as a potent alleviator against chronic inflammatory disease like atherosclerosis (AS), but its mechanisms against AS have not been unveiled. This research aimed to identify the key compound(s) and mechanism(s) of GL against AS through network pharmacology.

**Methods and Results :** The compounds from GL were identified by gas chromatography-mass spectrum (GC-MS), and SwissADME screened their physicochemical properties. Then, the target(s) associated with the screened compound(s) or AS related targets were identified by public databases, and we selected the overlapping targets using a Venn diagram. The networks between overlapping targets and compounds were visualised, constructed, and analysed by RStudio. Finally, we performed a molecular docking test (MDT) to explore key target(s), compound(s), on AutoDockVina. A total of 35 compounds in GL was detected via GC-MS, and 34 compounds (accepted by Lipinski's rule) were selected as drug-like compounds (DLCs). A total of 34 compounds were connected to the number of 785 targets, and DisGeNET and Online Mendelian Inheritance in Man (OMIM) identified 2,606 AS-related targets. The final 98 overlapping targets were extracted between the compounds-targets and AS-related targets. On Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway enrichment, the number of 27 signaling pathways were sorted out, and a hub signaling pathway (MAPK signaling pathway), a core gene (PRKCA), and a key compound (Benzamide, 4-acetyl-N-(2,6-dimethylphenyl)) were selected among the 27 signaling pathways via MDT.

**Conclusion :** Overall, we found that the identified 3 DLCs from GL have potent anti-inflammatory efficacy, improving AS by inactivating the MAPK signaling pathway.

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[P03-013]

네트워크 약리학 분석을 활용한 뽕나무 (*Morus alba* L.) 잎의 통풍 완화 신호  
전달 기전 규명

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**Network Pharmacology Analysis to Reveal Signaling Pathways of *Morus alba* L.  
Leaves Against Gout**

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**ABSTRACT**

**Background** : *M. alba* L. is a valuable nutraceutical plant rich in potential bioactive compounds with promising anti-gouty arthritis. Here, we have explored bioactives, signaling pathways, and key proteins underlying the anti-gout activity of *M. alba* L. leaves for the first-time utilizing network pharmacology.

**Methods and Results** : Bioactives in *M. alba* L. leaves were detected through GC-MS (Gas Chromatography- Mass Spectrum) analysis and filtered by Lipinski's rule. Target proteins connected to the filtered compounds and gout were selected from public databases. The overlapping target proteins between bioactives-interacted target proteins and gout-targeted proteins were identified using a Venn diagram. Bioactives-Proteins interactive networking for gout was analyzed to identify potential ligand-target and visualized the rich factor on the R package via the Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway on STRING. Finally, a molecular docking test (MDT) between bioactives and target proteins was analyzed via AutoDock Vina. Gene Set Enrichment Analysis (GSEA) demonstrated that mechanisms of *M. alba* L. leaves against gout were connected to 17 signaling pathways on 26 compounds. AKT1 (AKT Serine/Threonine Kinase 1),  $\gamma$ -Tocopherol, and RAS signaling pathway were selected as a hub target, a key bioactive, and a hub signaling pathway, respectively. Furthermore, three main compounds ( $\gamma$ -Tocopherol, 4-Dehydroxy-N-(4,5-methylenedioxy-2-nitrobenzylidene) tyramine, and Lanosterol acetate) and three key target proteins—AKT1, PRKCA, and PLA2G2A associated with the RAS signaling pathway were noted for their highest affinity on MDT.

**Conclusion** : The identified three key bioactives in *M. alba* L. leaves might contribute to recovering gouty condition by inactivating the RAS signaling pathway.

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[P03-014]

비만 완화를 위한 옥수수 수염 (*Stigma Maydis*)의 네트워크 약리학을 활용한  
약리학적 메카니즘 규명

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**Revealing Promising Pharmacological Mechanisms of Corn Silk (*Stigma Maydis*) to  
Alleviate Obesity on Network Pharmacology**

Ki Kwang Oh, Md. Adnan and Dong Ha Cho\*

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**ABSTRACT**

**Background** : Corn silk (*Stigma Maydis*) has been utilized as an important herb on obesity by Chinese, Korean, and Native Americans, but its phytochemicals and mechanisms(s) against obesity have not been deciphering completely. This study is to identify promising bioactive constituents and mechanism of action(s) of corn silk (CS) against obesity via network pharmacology.

**Methods and Results** : The compounds were identified from CS by Gas Chromatography Mass Spectrometry (GC-MS) and were confirmed ultimately by Lipinski's rule via SwissADME. The association of the compounds-targets or obesity-related targets were confirmed by public bioinformatics. The signaling pathways related to obesity, protein-protein interaction (PPI), and signaling pathways-targets-bioactives (STB) constructed, visualized, and analyzed by RPackage. Lastly, molecular docking test (MDT) performed to validate affinity between ligand(s)-protein(s) on key signaling pathway(s). We identified a total of 36 compounds from CS via GC-MS, all accepted by Lipinski's rule. The number of 36 compounds linked to 154 targets, 85 among 154 targets related directly to obesity-targets (3,028 targets). On the final 85 targets, we showed that PPI networks (79 edges, 357 edges), 12 signaling pathways on a bubble chart, STB networks (67 edges, 239 edges) are considered as therapeutic components. The MDT confirmed that two key activators ( $\beta$ -Amyrone,  $\beta$ -Stigmasterol) bound most stably to PPARA, PPARD, PPARG, FABP3, FABP4, and NR1H3 on PPAR signaling pathway, also, three key inhibitors (Neotocopherol, Xanthosine, and  $\beta$ -Amyrone) bound most tightly to AKT1, IL6, FGF2, and PHLPP1 on PI3K-Akt signaling pathway.

**Conclusion** : Overall, we provided promising key signaling pathways, targets, and bioactives of CS against obesity, suggesting that crucial pharmacological evidence for further clinical test.

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## 국내 생산·유통 황기의 형태적 특성 및 항산화 활성 평가

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### Evaluation of External Characteristics and Antioxidant Activity of *Astragalus membranaceus* Bunge Produced and Distributed in Korea.

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#### ABSTRACT

**Background :** *Astragalus membranaceus* Bunge (AMB) is a perennial plant belonging to the family Legume and its dried roots are used for edible and medicinal purposes. This study was carried out to evaluate the quality of dried AMB root produced and distributed in Korea.

**Methods and Results :** Eleven dried AMB root products produced from 11 farms in 6 area of Korea were collected and external characteristics were investigated. Root products showed differences of 14.2 - 32.1 g in weight, 10.2 - 13.0 mm in diameter, 34.6 - 50.0cm in length, and 7.1 - 10.6% in water content. P1 and P2 had relatively excellent root characteristic, and P11 had not. Antioxidant activity was evaluated through total polyphenol content measurement and DPPH radical scavenging assay. The total polyphenol content was 0.218 - 0.292%, and P2, P7 and P10 had relatively high content. In addition, The IC<sub>50</sub> value of DPPH assay was 64.8 - 43.5 mg/ml, and P7 and P10 showed relatively high antioxidant activity. the results were similar to the previous total polyphenol content results.

**Conclusion :** This study showed that the quality of AMB root products distributed in Korea varies depending on the cultivation area and farm, suggesting that it is necessary to set quality standards for distribution of high-quality AMB root products.

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## 누리대 잎 추출물 및 분획물의 생리활성

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### Study of Biological Activities of Extract and Fractions from Leaves of *Pleurospermum camtschaticum* Hoffm.

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Chang Yeon Yu<sup>2)</sup>, Yong Soo Kwon<sup>3)</sup> and Myong Jo Kim<sup>2)\*</sup>

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### ABSTRACT

**Background :** *Pleurospermum camtschaticum* Hoffm. has been widely used as herbal plants in South Korea, especially in Gangwon-do province. But recently, *Pleurospermum camtschaticum* Hoffm. was being forgotten without being consumed by people and therefore, according to the Ministry of Food and Drug safety, *Pleurospermum camtschaticum* Hoffm. was not used as a major ingredient related with food for health. Therefore, this study aimed at investigating the various biological activities of extract and fractions of leaves from *Pleurospermum camtschaticum* Hoffm. and confirming the possibilities to be used as an useful ingredient related with industry of food for health.

**Methods and Results :** Leaves of *Pleurospermum camtschaticum* Hoffm. were extracted with MeOH in room temperature for three times. The various solvent fractions including hexane, EtOAc, n-butanol and water were obtained from MeOH extract of *Pleurospermum camtschaticum* Hoffm. The antioxidant capacities from extract and fractions of *Pleurospermum camtschaticum* Hoffm. were measured by using 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity, reducing power, total phenol contents (TPC) and total flavonoid contents (TFC). The inhibition capacities of enzymes causing obesity, production of melanin and wrinkle were also conducted. The cell viability of Raw 264.7 cells was conducted by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay and the concentration of nitric oxide (NO) in cell culture supernatant was conducted by using nitric oxide assay. EtOAc fraction had the best antioxidant capacities among all fractions, showing  $392.78 \pm 3.87$  mg · GAE/g of phenol and  $300.90 \pm 1.46$  mg · QE/g of flavonoid. Also, EtOAc fraction showed the best enzyme inhibition activities among all fractions. In cell viability, Raw 264.7 cells survived at least 85% at all concentrations except for n-BuOH fractions, especially in concentration of 200  $\mu$ g/ml. In NO generation, as the concentration increased, the generation of NO decreased except for water fraction.

**Conclusion :** The results of this study suggest that *Pleurospermum camtschaticum* Hoffm. had various biological capacities and gave the necessity of further studies concerning the food for health.

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[P03-017]

## 콜레스테롤 생합성과 Notch 신호전달 억제를 통한 무궁화 켈러스의 대장암 사멸 효과

Rongbo Wang<sup>#</sup>, Xing Yue Xu<sup>#</sup>, 최지인, 인예진, 정유나, 김연주<sup>\*</sup>

경희대학교 생명과학대학 한방생명공학과

### **Hibiscus syriacus L. Cultivated in Callus Culture Exerts Cytotoxicity in Colorectal Cancer via Suppressing Notch Signaling Pathways and Cholesterol Synthesis**

Rongbo Wang<sup>#</sup>, Xing Yue Xu<sup>#</sup>, Ji In Choi, Ye Jin In, Yu Na Jung and Yeon Ju Kim<sup>\*</sup>

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#### **ABSTRACT**

**Background :** Ecosystem destruction due to environmental pollution and global warming is regarded as a major risk factor for the depletion of natural resources, including plants. To overcome this, plant based *in vitro* cultures have received considerable attention as a viable technology to grow plants.

**Methods and Results :** In the present study, *Hibiscus syriacus* leaf tissue was successfully cultivated in an optimized callus culture system, and subsequently extracted with 70% EtOH to prepare *H. syriacus* callus extract (HCE). We aimed to investigate the effect of HCE on the colorectal cancer (CRC) and its underlying mechanism of action using HT-29 CRC cells and thymus-deficient mice bearing HT-29 xenografts. Results of cell viability and colony formation assays revealed a significant cytotoxic effect of HCE against HT-29 cells. through differential protein expression analysis, signaling pathways underlying anti-CRC activity were predicted in HCE-treated HT-29 cells: Notch signaling, cholesterol biosynthesis. These putative pathways were validated using qRT-PCR and immunoblotting analyses.

**Conclusion :** HCE may prove useful as a novel anti-CRC agent via regulation of Notch signaling and cholesterol synthesis. In addition, our results can provide as a good starting point for developing a novel anti-CRC agent using HCE, as a targeted medicine via the regulation of Notch Signaling and cholesterol synthesis.

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<sup>#</sup>Rongbo Wang and Xing Yue Xu were contributed equally to this research.

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## 알코올 섭취 마우스에서 알로에 전잎의 숙취 해소 효과

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### *Aloe arborescens* Leaves Ameliorates Acute Alcohol-Induced Hangover Mouse Model

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#### ABSTRACT

**Background :** Abuse of alcohol is known to cause various diseases such as neurological disorder, alcoholic fatty liver, liver injury, and cancer. In particular, headache, dizziness, and nausea are acute hangover symptoms caused by alcohol consumption. Aloe has been reported to be effective in alcohol-induced liver injury. In addition, it is known that the fermentation of aloe is further enhanced bioactive effects by the increase of active biocomponents. Therefore, we evaluated the protective effect of non-fermented *Aloe arborescens* leaves (AAL) and fermented *Aloe arborescens* leaves (FAAL) on acute alcohol-induced liver injury in mice.

**Methods and Results :** *Aloe arborescens* leaves was fermented by *Lactobacillus plantarum*. As a results, FAAL increased the total polyphenol and total flavonoid compared to AAL. Based on these results we investigated the effect of AAL and FAAL on acute alcohol-induced liver injury in mice. AAL and FAAL were orally administered once a day for 5 consecutive days. At 30min following each treatment, ethanol (3 g/kg) was orally administered. For this study, we not only tested hangover marker but also checked inflammatory factor and indicators of liver function with serum and liver. Alcohol administration significantly increased the liver index and spleen index. Pre-treatment of AAL and FAAL for 5 days reduced the hangover marker such as alcohol dehydrogenase (ADH), aldehyde dehydrogenase (ALDH), and cytochrome P4502E1 (CYP2E1). Especially, FAAL was shown to significantly. Also, it was confirmed that interleukin (IL)-6, a representative inflammatory factor, was decreased. SOD showed a tendency to increase and GOT was significantly decreased by AAL and FAAL.

**Conclusion :** AAL and FAAL showed a tendency to decrease hangover markers and inflammatory factors, and to restore liver function indicator. These results suggest that *Aloe arborescens* leaves can be a natural substance for alleviating acute alcohol-induced liver injury and can be used as a hangover relieving agent.

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[P03-019]

Piper sylvaticum 잎과 줄기 추출물의 항불안, 항산화 약리학적 효능에 대한  
*in vivo*, *in vitro*, 그리고 *in silico*를 통한 비교 연구

Md. Adnan, 오기광, 조동하\*  
강원대학교 의생명과학대학 생명건강공학과

Deciphering Molecular Mechanism insight of Phyllanthus emblica L. Fruit in the  
Treatment of Type 2 Diabetes Mellitus by Network Pharmacology

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ABSTRACT

**Background** : *Phyllanthus emblica* L. fruits (PEf) are thought to be a good source of natural anti-diabetic compounds. Nevertheless, the bioactive ingredients and molecular mechanisms of its type 2 diabetes mellitus (T2DM) properties have yet to be established. Here, we implemented a network pharmacology protocol to ascertain its essential compound and mechanisms of action over T2DM.

**Methods and Results** : PEf's bioactive ingredients were mined through a literature study and filtered by employing Lipinski's rule of five. Besides, genes associated with the screened compounds and T2DM were extracted from public databases. A Venn diagram was utilized for retrieving common genes. Cytoscape was used to plot and portray the interconnected network between compounds and intersecting genes. Finally, molecular docking simulations were performed between key compounds and targets. The literature review yielded a total of 57 compounds in PEf, and 38 compounds were filtered based on Lipinski's rule for further investigations. A total of 244 compound-related and 4979 T2DM-targeted genes were extracted, and Venn pinpointed 183 commons among them. Gene set enrichment analysis manifested 15 signaling pathways which were strongly correlated with the mechanism of PEf against T2DM, with the pivotal mechanism being the diminution of oxidative stress, vascular calcification, and the augmentation of superoxide dismutase 1 expression via the inactivation of a number of co-regulated genes in the AGE-RAGE signaling pathway. In addition, the study of molecular docking affirms that Quercetin is the essential compound in T2DM therapy owing to its greater binding affinity among ten proteins connected with the AGE-RAGE signaling cascade.

**Conclusion** : Our study illustrates the pharmacological proof that substantiates the PEf therapeutic effectiveness over T2DM and discovers largely potent PEf chemicals and mechanisms of action against T2DM. Overall, Quercetin might alleviate T2DM by inactivating the AGE-RAGE signaling pathway.

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노랑꽃창포 꽃 에탄올추출물의 항산화 활성 및 성분 함량 분석

김태원\*, 조용남, 송재기, 김영빈, 이상은, 최재혁, 장영호  
경상남도농업기술원

**Analysis of Antioxidant Activity and Component Content of Yellow Iris (*Iris pseudacorus* L.) Flower Ethanol Extract**

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Jae Hyoek Choi and Young Ho Chang  
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**ABSTRACT**

**Background :** Since very old times, herbal medications have been used for relief of symptoms of disease. Despite the great advances observed in modern medicine in recent decades, plants still make an important contribution to health care. Large number of medicinal plants has been investigated for their antioxidant properties. Natural antioxidants either in the form of raw extracts or their chemical constituents are very effective to prevent the destructive processes caused by oxidative stress. Although the toxicity profile of most medicinal plants have not been thoroughly evaluated, it is generally accepted that medicines derived from plant products are safer than their synthetic counterparts. Yellow iris is a perennial plant of the Iris family and is a naturalized plant native to Europe. It inhabits ponds and wetlands nationwide and blooms in May. The roots and stems are effective against abdominal distension and abdominal pain, have a diuretic effect, and eliminate the symptoms of systemic swelling. It was also found that the seed extract has an inhibitory effect on the growth of cancer cells. In this study, we investigated the antioxidant activity and the content of bioactive substances in order to investigate the possibility of utilizing natural materials of yellow iris flowers.

**Methods and Results :** Yellow iris flowers that grow naturally in the Iksan area of Jeollabuk-do were collected at the time of flowering, extracted with 95% ethanol as a solvent for 72 hours, filtered, concentrated and analyzed. The levels of DPPH radical scavenging activity of yellow iris flower were 15.0 mg/g, ABTS radical scavenging activity was 205.5 mg/g, and FRAP assay antioxidant power was 31.2 mg/g. In addition, the total phenol content was 3,397.2 mg/g and the total flavonoid content was 224.9 mg/g, and the party content was analyzed. As a result, the total was 1,384.9 mg/g and reducing sugar was 2,373.9 mg/g. The water-soluble protein was analyzed to contain 3,397.2 mg/g. Among the four polyphenols that exhibit antioxidant effects, as a result of analyzing phenolic acid, it was analyzed that it contained 0.36 mg/g of gentistic acid, 0.11 mg/g of sinapic acid, and 2.96 mg/g of caffeic acid.

**Conclusion :** Therefore, from the results of this study, it was considered that the Yellow Iris extract could be used as a naturally derived material for research and development of various foods, cosmetics, pharmaceutical raw materials, and other functional products.

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[P03-021]

케나프 종자 분말의 생체 접근을 및 항산화 효능을 증대하는 열수 추출물을  
활용한 나노복합재 바이오폴리머 개발

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강원대학교 의생명과학대학 생명건강공학과

**Exploring Key Signaling Pathway and Bioactive of *Wolfiporia extensa* for  
Suppressing Inflammation based on Network Pharmacology**

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**ABSTRACT**

**Background :** *Wolfiporia extensa* (WE) is an edible mushroom regarded as essential food and medicine industry resource. Mainly, WE is popular for its anti-inflammatory potential, previously proved by several scientific instances on mice and cell lines studies. However, the key therapeutic molecular mechanisms of anti-inflammation have remained unexplored. Here, we interpreted key bioactives and mechanistic processes of WE to alleviate inflammation.

**Methods and Results :** Methanol (ME) extract of WE (MEWE) was used for GC-MS analysis to identify the bioactives presence in MEWE and screened by following Lipinski's rules. Filtered bioactives and inflammation-related targets were culled from public databases, and the Venn diagram retrieved the common targets within them. Afterwards, protein-protein (PPI) network and mushroom-bioactives-target (M-C-T) network were constructed utilizing STRING and Cytoscape tools. Gene Ontology and KEGG pathway analysis were performed by accessing DAVID database led by conducting a docking assay to validate the findings. GC-MS revealed 27 bioactives, and all obeyed Lipinski's rules. The public databases exposed 284 compound-related targets and 7283 inflammation targets, where Venn pointed 42 common targets between them were resulted in PPI and M-C-T network. KEGG analysis manifested that the majority of potential targets were connected to the HIF-1 signaling pathway. The inhibition of downstream NF $\kappa$ B, MAPK, mTOR, and PI3K-Akt signaling cascades was the most important strategy for preventing the onset inflammatory response. A key constituent, "N-(3-chlorophenyl)naphthyl carboxamide", affirmed such postulation comparing to core pathway enriched targets co-crystallized ligand and standard medicine evaluated through docking.

**Conclusion :** This research identified the key bioactives and potential targets for possible anti-inflammatory therapy of MEWE.

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## 쓴메밀 시기별 플라보노이드 함량 변화 분석

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### Analysis of Changes in Flavonoid Content for Each Part of Tartary Buckwheat

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### ABSTRACT

**Background :** The study was conducted to observe changes in flavonoids according to the growing season of tartary buckwheat and to use them as basic data for the development of food and pharmaceutical materials.

**Methods and Results :** Tartary buckwheat seeds were harvested from the Department of Central Area of the National Institute of Crop Sciences in 2019. Seeds were sown on March 14, 2020 and after flowering from May 22, samples were collected seven times from May 29, Jun 1, June 8, June 15, June 22 and June 29. Flowers and seeds were separated by collecting samples over the course of a period. The separated sample was freeze-dried at -70°C for 96 hours and then pulverized. The pulverized sample was passed through a 20 mesh sieve and used as an analysis sample for this study, and the contents of useful components such as chlorogenic acid, rutin, isoquercitrin and quercetin were analyzed. As a result of the analysis of flavonoid components for each part of tartary buckwheat, chlorogenic acid, isoquercitrin and quercetin of flowers increased from May 22 to June 1, while rutin decreased.

In the case of seeds, chlorogenic acid, rutin, and isoquercitrin were the most contained on June 1, the time at which the seeds were formed, and showed a tendency to decrease thereafter. On the other hand quercetin tended to increased until June 8 and then decrease.

**Conclusion :** Overall, flavonoid content was higher in flowers than in seeds, especially rutin. Next, there was a tendency to appear in the order of chlorogenic acid, quercetin, and isoquercitrin.

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## 수수 종자의 항산화 활성에 따른 항염 활성 검정

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### Anti-inflammatory Activity of *Sorghum bicolor* (L.) Seeds Depending on Antioxidant Activity

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#### ABSTRACT

**Background :** Sorghum (*Sorghum bicolor*) is one of the most important crops in the world. It has been considered an excellent source of nutrition, containing minerals, starch, proteins, in addition to having a high fiber content. Sorghum is ranked fifth in terms of crops being produced and consumed globally. Additionally, Sorghum has a high tolerance to drought stress, which makes it more important crop. It contains various levels of phenolic compounds such as phenolic acids, flavonoids and tannins. Also, there is a research that it has anti-inflammatory activity.

In this study, we investigated antioxidant activity from high to low and anti-inflammatory activity depending on antioxidant activity.

**Methods and Results :** The 8 seeds for this study were supplied from the Center for Agricultural Genetic Resources of National Institute of Agricultural Sciences. The seeds were extracted with 100% methanol at room temperature for 72h and the extracts were concentrated at 45°C. To determine antioxidant activity, we measured the DPPH radical scavenging ability. K167116 (RC<sub>50</sub> : 1662.54 ± 59.43 µg/ml) showed the lowest DPPH radical scavenging activity. On the other hand K261774 (RC<sub>50</sub> : 13.10 ± 2.37 µg/ml) indicated the highest DPPH radical scavenging activity. We used Raw 264.7 cell with LPS for anti-inflammatory experiment. We found that seeds with high antioxidant activity had higher anti-inflammatory activity. As a result, K227720 showed the highest inhibition rate (144.24%), and K159072 indicated the lowest inhibition rate at 100 ppm (41.50%).

**Conclusion :** 4 accessions with high antioxidant activity (K208142, K227720, K249590, K261774) had higher anti-inflammatory activity than the lower ones (K167116, K269323, K167034, K167197).

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**Wilma 뿌리 메탄올 추출물 및 분획물의 생리활성 비교**

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**Comparison of Biological Activity of Methanol Extract and Fractions from Root of  
*Cupressus macrocarpa* 'Wilma'**

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**ABSTRACT**

**Background :** *Cupressus macrocarpa* 'Wilma' is an evergreen tree belonging to the cypress family. It has been known to be used to treat various diseases such as pertussis, hemostasis disorder and rheumatism for decades. We confirmed the remarkable bioactivity of Wilma roots through previous studies and the aim of this studies was to investigate additional biological activity through fractionate.

**Methods and Results :** The dried *Cupressus macrocarpa* 'Wilma' roots were extracted by reflux extraction at 80°C and fractionated for each solvents (hexane, ethyl acetate, n-butanol and water). 1,1-Diphenyl-2-picrylhydrazyl (DPPH) and reducing power assay were performed using L-ascorbic acid as positive control. Total phenolic contents (TPC) and total flavonoid contents (TFC) were used colorimetric method and measured at 725nm and 415nm. α-glucosidase inhibition activity was measured at 405nm and quercetin was used as a positive control. Cytotoxicity of Wilma to HEK 293 (human embryonic kidney), AGS (human gastric carcinoma cell) was determined according to the MTT method. In anti-oxidant activity, ethyl acetate and n-butanol fraction were found higher than other fractions. n-butanol fraction showed the best α-glucosidase inhibition activity. As a result of MTT assay using AGS cells, all fractions were effective in cytotoxicity except for water fraction. However, in experiments using HEK 293 cell, cytotoxicity to normal cells was confirmed in all fractions except ethyl acetate and water fraction.

**Conclusion :** Among all fraction, the highest bioactivity was measured in ethyl acetate fraction and it could be considered a source of natural biological substance in pharmaceutical.

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품종별 콩 추출물의 이소플라본 함량 분석

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Quantification of Isoflavone Content of Seed Extracts among Soybean Cultivars

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ABSTRACT

**Background :** Among the physiologically active substances of soybeans, various derivatives such as daidzein, genistein, and glycitein, which are isoflavones, are phytoestrogens that have a function similar to estrogen, a female hormone, and are effective for breast cancer and prostate cancer induced in menopause. Therefore, in this study, the isoflavone content was compared between varieties to select superior varieties.

**Methods and Results :** This study was conducted to compare the isoflavone content of seeds according to major domestic cultivars sown on June 17, 2020 by the Miryang Southern Crop Department. A total of 18 varieties, including those for soy sauce and tofu, were used in the test field, and seeds harvested at maturity were used. The sample was pulverized and passed through a 20 mesh sieve to be used as an analysis sample for this study. The standards used for the analysis of isoflavones were daidzin, genistin and glycitin. The target analytes were confirmed and quantified in BEH C18 column (2.1 mm × 100 mm, 100 Å, 1.7 μm) using ultra performance liquid chromatography (UPLC) as with 0.1% formic acid in water (A) and 0.1% formic acid in acetonitrile (B) as the mobile phase. As a result of analysis, the total isoflavone content was the highest at 556 μg/g for soy-paste and tofu in Daepung 2, 310 μg/g in Soyeon for soybean-sprout, and 656 μg/g in color-soybean for Cheongja 5, and 294 μg/g in early-maturing for Miso was found.

**Conclusion :** As a result of analyzing a total of 18 kinds of soybeans, the highest total isoflavone content was Cheongja 5 of color-soybean with a content of 656 μg/g, and the lowest content was Danmi 2 of early-maturing with a content of 78 μg/g.

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메꽃 에탄올 추출물의 항산화물질 함량 분석

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경상남도 농업기술원

**Analysis of Antioxidant Content of Ethanol Extract from *Calystegia sepium* var. *japonica***

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and Young Ho Chang  
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**ABSTRACT**

**Background :** *Calystegia sepium* var. *japonica* is vine-like perennial plant of the convolvulaceae family. It is collected in spring and used as wild vegetables and have diuretic, tonic, fatigue recovery, blood sugar lowering effects. In folklore, it is known as a medicinal plant used to treat diseases. In previous studies, *Calystegia sepium* var. *japonica* was reported as an important source of phenolic compounds with high antioxidant activity. The objective of this study was to investigate antioxidant properties of *Calystegia sepium* var. *japonica* extracts such as antioxidant, total phenolic content, total flavonoid content, phenolic acid were analyzed.

**Methods and Results :** *Calystegia sepium* var. *japonica* flower heads was obtained from wild field, located in Hamyang, Gyeongsangnam-do. Sample was chopped into small pieces and they were placed into the beaker with 400 ml of ethanol (99.5%). Extraction was conducted under same condition, stirring speed (250 rpm), and extraction time (72 h). It was then filtered using quantitative syringe filter and then stored at 4 °C for later analysis. In this study, antioxidant activities such as DPPH, ABTS, FRAP showed the high activity in extract. also, total phenolic, flavonoid and phenolic acid showed rich contents in same extract.

**Conclusion :** The extract showed excellent antioxidant properties (DPPH 56.33 mg/g, ABTS 297.88 mg/g, total phenolic content 465.40 mg/g). The chlorogenic acid content (38.56 mg/g) was the highest among 10 phenolic acid. The result showed This information will be useful in medicinal herbs processing industries for producing high quality products.

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별노랑이 (*Lotus corniculatus* var. *Japonicus*) 꽃의 항산화 활성 분석

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경상남도 농업기술원

**Analysis of Antioxidant Activity of Asian bird's-foot trefoil (*Lotus corniculatus* var. *Japonicus*) Flower**

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and Young Ho Chang

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**ABSTRACT**

**Background :** Asian bird's-foot trefoil (*Lotus corniculatus* var. *Japonicus*) is a perennial plant in the Fabaceae family, which blooms yellow flowers from June to August and is distributed in Korea, Japan, China, Taiwan, and the Himalayas. Its height is 30 cm and can be easily seen in Korea on sandy land or grass near mountain streams. It is a hardy plant that adapts well to sunny or semi-shade conditions, and Asian bird's-foot trefoil (*Lotus corniculatus* var. *Japonicus*) has been reported as the dominant species from spring to autumn in the greening conditions of slopes. In oriental medicine, baekmaekgeun (白脈根) was used as a medicine for fatigue recovery, lowering blood pressure, cooling fever, and hemostasis. Recently, antitumor activity of Asian bird's-foot trefoil(*Lotus corniculatus* var. *Japonicus*) extract and the whitening functional active ingredient of the whole extract have been confirmed, revealing the potential for functional substances. Therefore, in this study, we investigated the antioxidant activity and physiologically active substances to examine the possibility of utilizing natural materials using Asian bird's-foot trefoil (*Lotus corniculatus* var. *Japonicus*)

**Methods and Results :** Asian bird's-foot trefoil (*Lotus corniculatus* var. *Japonicus*) were collected from Sancheong, Gyeongnam, dried in 40°C, pulverized, and extracted for 72 hours using 95% ethanol. Extracts were analyzed eight types : DPPH assay, ABTS assay, FRAP assay, total phenol and flavonoid content, total sugar and reducing sugar content and water-soluble protein. As a result of analysis, flowers showed high activity DPPH 84.29 mg/g, ABTS 300.00 mg/g, FRAP 500.73 mg/g. The total phenol and total flavonoid contents were analyzed as 2136.65 mg/g and 233.25 mg/g, respectively. The total sugar content was 1350.10 mg/g and reducing sugar content was 980.10 mg/g. The water-soluble protein was analyzed to contain 2136.65 mg/g. Phenolic acid by HPLC showed the highest content in the order of rutin (8.07 mg/g), gentistic acid (1.18 mg/g) and vanillic acid (0.99 mg/g)

**Conclusion :** Collectively, it is expected that Asian bird's-foot trefoil (*Lotus corniculatus* var. *Japonicus*) flower extract has potential as a natural antioxidant and can be used as a material in the health functional food and cosmetic industries.

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## 울초 지상부 (잎, 줄기)의 생리활성 성분 연구

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(재)전주농생명소재연구원

### Study of Phytochemicals from Aboveground Parts (Stems and Leaves) of *Humulus japonicus*

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#### ABSTRACT

**Background** : Phytochemicals were prepared by chromatographic procedure from the methanol extracts of the aboveground parts of *Humulus japonicus*. *Humulus japonicus* known as Japanese hops, is an ornamental plant in the family Cannabaceae. Because *H. japonicus* extract exhibited antimycobacterial activity in human macrophages, results of this chromatographic study would be a good limits for the quality control, and this plant might be a good candidate for developing a new high-valued food materials.

**Methods and Results** : *Humulus japonicus* aboveground parts were collected from Jeolabukdo and lyophilized and homogenized. These powder were extracted with hot water (60 - 70°C), indicated aqueous methanol and centrifuged at 12,000 - 15,000 rpm. The chromatographic conditions were optimized to the analytical HPLC method of Agilent-DAD (diode array detector). Column for the elution of the candidated phytochemicals were used as Gemini NX C18 analytical column (4.6 × 150 mm, 3μm particle size) at 30 - 40dg. Luteolin 7-O-glucoside as the marker, was separated and confirmed using 0.1% aqueous formic acid concluded 0.5% acetonitrile (A) and acetonitrile (B) as the mobile phase. Also, total polyphenols and flavonoids were evaluated according to previous reported methods. As a results, total polyphenols and flavonoids were  $1.16 \pm 0.11$ mg/kg (RSD, 9.44%) and  $0.64 \pm 0.03$  mg/kg (RSD, 4.81%) in hot-water extracts,  $1.86 \pm 0.39$  mg/kg and (RSD, 20.78%) and  $1.05 \pm 0.18$  mg/kg (RSD, 17.07%) in 70% methanol extracts, respectively. The precision and accuracy (%) of luteolin 7-O-glucoside using developed HPLC methods, were 0.3 - 11.5% and - 2.3 - 3.6% (limits of 15% or less). The linearity of luteolin 7-O-glucoside was evaluated the precision of 0.1 - 2.2%, the accuracy of -6.5% - 1.0%. Then, we profiled *H. japonicus* using LC tandem mass spectrometry and identified each phytochemicals.

**Conclusion** : From the above results, we may suggest that *Humulus japonicus* aboveground parts might have useful as a safe material for high-valued food and pharmaceutics.

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수용성 프로폴리스가 *tert*-butyl hydroperoxide로 유도된  
급성 산화 스트레스에 미치는 효과

김하림<sup>1)</sup>, 김민주<sup>1)</sup>, 노은미<sup>1)</sup>, 허용갑<sup>2)</sup>, 김선영<sup>1)\*</sup>

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**Effects of Water-Soluble Propolis on Tert-Butyl Hydro Peroxide Induced  
Acute Oxidative Stress in Mice**

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**ABSTRACT**

**Background :** Propolis is a resinous substance collected by honey bees from various plant sources, that is reported as a natural material with various physiological activities such as antioxidant, anti-bacterial, anti-inflammatory, immune-enhancing activities. Tert-butyl hydroperoxide (t-BHP), one of the pro-oxidant compounds, can acute and chronic toxicities in hepatocytes by deteriorating cell viability and proliferation, inducing oxidative stress. The present study investigates the antioxidant effects of Unibee water-soluble powder propolis (PP) and Unibee water-soluble liquid propolis (LP) in t-BHP induced acute oxidative stress.

**Methods and Results :** We developed an acute oxidative stress model in ICR mice via intraperitoneal injections using t-BHP (1.5 mmol/kg). Mice were orally administrated of PP (6 mg/kg) and LP (30 mg/kg) that provided from Uniquebiotech for 5 consecutive days, which flavonoid contents between 16 - 17 mg/day. On the 5th day, mice were intraperitoneal injections to t-BHP, 1 h after the administration. The results showed that PP and LP treatment alleviated liver and spleen index increased by t-BHP. We assess the improvement effect in t-BHP induced oxidative stress model by determining serum biochemical markers. PP and LP treatment protected the reduction of superoxide dismutase (SOD) activities and glutathione (GSH) content. Also, obviously improved the interleukin (IL)-6 and IL-1 $\beta$  level but the insignificant level of tumor necrosis factor (TNF)- $\alpha$ .

**Conclusion :** In conclusion, these results suggest that Unibee water-soluble powder propolis and Unibee water-soluble liquid propolis had anti-oxidant effects on tert-butyl hydroperoxide (t-BHP) induced acute oxidative stress and have useful as an applicability material for health functional foods.

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## 흑삼 주정 추출물과 발효물의 항염증 효과 비교

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농촌진흥청 국립원예특작과학원 인삼특작부

### The Comparison of Anti-inflammatory Effects of the Fermented Ethanol Extract of Black Ginseng Before and After Fermentation

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#### ABSTRACT

**Background :** Black ginseng (BG) is manufactured by steaming and drying Korean white ginseng (*Panax ginseng*) for several times. It is reported that BG has various physiological activities including anti-bacterial, anti-carcinogenic, immunomodulatory, anti-inflammatory, hepatoprotective, anti-diabetic, and anti-oxidant effects. In this investigation, we sought to find the optimal conditions for the growth of probiotic strains fermentation with the 30% fermented ethanol extract of black ginseng (BGE) with different amount and fermentation time, and evaluated the changes in anti-inflammatory activity of BGE and its fermented products.

**Methods and Results :** The fermented ethanol extract of BG (5 mg, 50 mg, 100 mg, and 1 g) were dissolved in 0.1% peptone water, and inoculated with three probiotic strains including *Lactobacillus plantarum*, *Streptococcus thermophilus*, and *Lactobacillus helveticus*. RAW264.7 and BV2 cells were pre-treated with BGE and its fermented products for 3 h, and stimulated with lipopolysaccharide (LPS) for 24 h. For evaluating the anti-inflammatory effects of BGE and its fermented products, the production levels of nitric oxide (NO), and pro-inflammatory cytokines, and the expression levels of inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2) were determined. The growth of three probiotic strains increased markedly under high concentration conditions compared to low dose conditions with fermentation time. In addition, the pre-treatment with BGE significantly inhibited the LPS-induced NO production in both RAW264.7 and BV2 cells compared to the pre-treatment with fermented products. Furthermore, BGE reduced the LPS-induced production of pro-inflammatory cytokines, and expression of iNOS and COX-2 proteins in both cells.

**Conclusion :** The fermented ethanolic extract of black ginseng promoted the growth of probiotic beneficial bacteria including *L. plantarum*, *S. thermophilus*, and *L. hevelticus*, showing the potential availability as prebiotics. In addition, BGE showed its potential as an anti-inflammatory agent by inhibiting the production of NO and inflammatory cytokines and the expression of iNOS and COX-2 proteins. Further investigation of molecular mechanism of BGE as anti-inflammatory agent for medicinal purposes, and it will increase the potential availability of BGE for treatment various inflammatory diseases.

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블루베리 및 아로니아 첨가 청국장 환의  
Dextran Sulfate Sodium 유발 급성 대장염 예방 효과

김하림<sup>1)</sup>, 김민주<sup>1)</sup>, 노은미<sup>1)</sup>, 조종현<sup>2)</sup>, 김선영<sup>1)\*</sup>

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Preventive Effects of Cheonggukjang Pellet Containing Blueberry and Aronia  
on Dextran Sulfate Sodium Induced Acute Colitis in Mice

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ABSTRACT

**Background :** Inflammatory bowel disease (IBD) is a complex multifactorial disease comprising two major disorders, Crohn's disease (CD) and ulcerative colitis (UC) that seriously affect the gastrointestinal tract. Although the pathogenesis remains unclear, IBDs are usually considered to be induced by impairment to inflammatory in the intestines. Soybeans contain functional components such as isoflavones and blueberries and Aronia berries are rich in a variety of dietary phenolics. Various phenolic compounds may modulate the composition of the intestinal microflora. The purpose of this study was to investigate the anti-inflammatory effect of cheonggukjang pellet containing blueberry and aronia (CPBA) on dextran sulfate sodium (DSS)-induced colitis in mice.

**Methods and Results :** CPBA (500 mg/kg) provided from Soonchang Moonokrae Foods was orally administered once a day for 2 weeks before DSS treatment. Colitis was induced in mice through consumption of 5% (w/v) DSS drinking water for 8 days. The results showed that CPBA treatment significantly alleviated DSS-induced body weight loss and disease activity index (DAI) associated with decreased colon length. In addition, CPBA markedly reduced the content of tumor necrosis factor (TNF)- $\alpha$ , interferon (IFN)- $\gamma$ , and interleukin (IL)-6 production in the serum. CPBA also protected intestinal inflammation by increasing the mRNA levels of cyclooxygenase (COX)-2, TNF- $\alpha$  and IL-6.

**Conclusion :** In conclusion, these results suggest that cheonggukjang containing blueberry and aronia had protective effects on DSS-induced colitis and may be a candidate material for the improvement of colitis treatment.

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## 천마 재배방식과 재배기간에 따른 기능성 성분 함량 특성

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### Characteristics of Funtional Constituents from *Gastrodia elata* Blume with Different Cultivation Methods and Cultivation Periods

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#### ABSTRACT

**Background :** *Gastrodia elata* (GE) has been mainly cultivated in the open field. GE is a crop with a very large variation in yield with a yield of 673-1,175 kg per 10a due to abnormal weather such as cold in winter and heavy rain in summer. In addition, the cultivation period is 18 months, which requires a long period. Jeonbuk Agricultural Research and Extension Services (JARES) is developing a new technology for cultivating GE. It is a technology that shortens the cultivation period to 12 months by using a rainshield facility and artificial soil. As such, this test was conducted to analyze and compare the content of funtional constituents in GE grown with different cultivation methods, cultivation periods, and soils.

**Methods and Results :** The results of analysis of the general components of GE with different cultivation methods and cultivation periods are as follows. The moisture content of GE grown for 18 months using soil in the plastic house was as low as 5.6%, and that of GE grown for 18 months using soil in the open field was high at 7.2%. The crude fat content was similar to the water content. However, the crude protein content was the lowest in GE grown for 18 months using soil in the open field at 5.48%, and GE in other treatments was high at 5.70-7.96% level. There was no significant difference in the chromaticity value of GE using a colorimeter by cultivation method or cultivation period. However, the lightness value (L\*) of GE cultivated for 18 months using artificial soil in the rainshield house was 76.1 higher than GE grown for 12 months, the redness (a\*) was lower at 3.5, and the yellowness (b\*) did not differ significantly. When the Gastrodin content of GE was 100% in the case of troditional cultivation (open field, soil, 18 months cultivation), the Gastrodin content of GE produced by other plastic methods was rather low at 75-99% level. The p-HBA content was increased by 5-6% in the plastic house soil cultivation and in the open field cultivation using soil and rainshield house cultivation using artificial soil were 75-90% of the open soil cultivation (18 months) GE. The p-HBAH content also showed similar results.

**Conclusion :** The moisture and crude fat content of GE produced through troditional cultivation (cultivated for 18 months using soil in the open field) was higher than that of GE produced in other test groups, and the crude protein content was lower. Functional component Gastrodin content was 22-25% higher in troditional culture than in rainshield house cultured artificial soil, but p-HBA and p-HBAH content were 5-6% and 15-46% higher in rainshield house-cultivated GE, respectively.

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전호 추출물의 항당뇨 효과

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(재)전주농생명소재연구원

**Anti-Diabetic Effects of *Antheriscus sylvestris* (L.) Hoffm. Extract**

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**ABSTRACT**

**Background :** The number of people with diabetes is rapidly increasing around the world, and therapeutic agents have been developed accordingly. Recently, research on therapeutic agents using natural extracts with few side effects have been actively pursued. The dried root of *Antheriscus sylvestris* (L.) Hoffm. has been used in Korean traditional drugs for the treatment of various diseases. Therefore, this study was to evaluate the antioxidant and antidiabetic effects of *Antheriscus sylvestris* (L.) Hoffm. and antidiabetic effects of *Peucedanum praeruptorum* Dunn and *Angelica decursiva* (Miq.) Franch. & Sav..

**Methods and Results :** The extracts of the root and aerial part of *Antheriscus sylvestris* (L.) Hoffm. were measured that HPLC quantitative evaluation, total polyphenol, total flavonoid content, antioxidant activity (DPPH, ABTS assay) and antidiabetic activity analysis. the content of nodakenin, a component that inhibits alpha-glucosidase and PTP1B (protein tyrosine phosphatase 1B), was found to be  $1169.13 \pm 6.00$  mg/g in the roots. Total polyphenols, total flavonoids, and antioxidant activity were higher in the aerial part than in the root. Both the root and the aerial part showed that the inhibitory activity of alpha-glucosidase, DPP4 and PTP1B. Next, as a result of the evaluation of glucose uptake ability using 3T3-L1 cells of extract from the root and aerial parts of *Antheriscus sylvestris* (L.) Hoffm., it was  $139.51 \pm 3.19\%$  in the aerial part, which was higher than the positive control, rosiglitazone. In order to confirm the pancreatic beta cell protective effect on high-glucose toxicity, we measured LDH level. As a result, the extract from the root and aerial parts inhibited cell damage. Additionally, the antidiabetic effect of chinese *Peucedanum praeruptorum* Dunn and domestic *Angelica decursiva* (Miq.) Franch. & Sav. was confirmed. Both the water and the ethanol extracts showed that the inhibitory activity of alpha-glucosidase and DPP4, and the ethanol extract has higher effect than the water extracts.

**Conclusion :** These results suggest that the roots and aerial parts of the *Antheriscus sylvestris* (L.) Hoffm. can be used as materials that can prevent and treat diabetes as well as prevent and treat diabetes.

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**MPP+ 처리한 SH-SY5Y 세포에서 황기 새싹의 신경세포 보호 효과**

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**Neuronal Protection Effect of Hwanggi (*Astragalus membranaceus*) Sprouts  
in MPP+ Treated SH-SY5Y Cells**

Chang Yeol Yang, Gwi Yeong Jang and Je Hun Choi\*

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**ABSTRACT**

**Background :** The study began with the aim of developing food materials using Hwanggi (*Astragalus membranaceus*) sprouts to find new ways to use Hwanggi, mostly using roots. It was confirmed that the shoots of medicinal crops had the functionality suitable for processed foods.

**Methods and Results :** Huanggi Extracts were manufactured using Huanggi seeds and Huanggi sprouts grown for 1, 5, 10 and 15 days. Extracts were frozen and dried with Huanggi seeds and shoots, then crushed, and reflux extracted at 70 percent ethanol for 2 hours, and 3 times at 85 degrees Celsius. The extracted solution was decompressurized and freeze dried. HPLC analyzes the content of tryptophan in Huanggi seeds and Huanggi sprout extracts. During seed cultivation up to 15 days, tryptophan content increased significantly and dramatically. Hwanggi sprouts grown on the 15th contained 4.57 times more tryptophan than Huanggi seeds. Neurotoxic inhibitory effect of Huanggi sprout extract was confirmed in Parkinson's disease nerve cell model induced by MPP+ (1-methyl-4-phenylpyridinium) treatment in neuronal cell SH-SY5Y. Neuronal cell SH-SY5Y was treated with 10  $\mu\text{g}/\text{mL}$  of Huanggi sprout extract (1, 5, 10, 15 days) and treated with MPP+ 1 mM, incubated for 24 hours, and the cell survival rate was measured. The neuronal protection effect of Huanggi sprout extract was confirmed in the Parkinson's disease nerve cell model. MPP+ is a neurotoxic metabolite of primates that accumulates in nigrostriac neurons through dopamine transporters and is transported to mitochondria by membrane potential. MPP+ shows very similar symptoms to Parkinson's disease and is widely used in cell and animal models.

**Conclusion :** Hwanggi sprouts grown on the 15th contained 4.57 times more tryptophan than Huanggi seeds. Furthermore, we confirmed that the Hwanggi sprout extract treatment group cultivated on the 10th and 15th showed a significant neuronal protection effect. This was the same as the tryptophan content change pattern. These results suggest that Hwanggi sprouts are likely to grow neurons and protect neurons. Moreover, the results will be provided as basic data for the development of materials for processed foods using medicinal crops such as residues. In addition, it could be helpful to the industry involved in the processing of medicinal crops.

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[P03-035]

## Cyclophosphamide로 유도된 면역 저하 마우스에서 삼채의 면역 조절 활성

이은별, 최지혜, 김시현, 김지수, 정운율, 김주희, 이성현\*

국립농업과학원 농촌진흥청

### Immunomodulating Activity of *Allium hookeri* Extract on Cyclophosphamide-induced Immunocompromised Mice

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Hyen Lee\*

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#### ABSTRACT

**Background :** *Allium hookeri* (Liliaceae, AH) consumed in Korea, Southeast asia regions, etc as a medicinal plant has anti-diabetic, anti-oxidant, anti-inflammatory and various diseases treating effects. This study evaluated *in vivo* immunological activities of AH in immunosuppressed mice by cyclophosphamide (CPA).

**Methods and Results :** Immune-stimulating effects of AH extract in immunocompromised mice model for AHL (*Allium hookeri* leaf) and AHR (*Allium hookeri* root) groups at 150 and 300 mg/kg were confirmed by measuring the immunoglobulin (Ig) and cytokine levels, the splenocytes proliferation, and natural killer (NK) cell activity. The CPA-induced decrease of Ig A and G was improved in the AHL and AHR groups, and AHL and AHR administration effecting regulated serum cytokine levels (TNF- $\alpha$ , IL-6, IL-1 $\beta$ , IFN- $\gamma$ ) than those of the PC group in concentration dependent manner. Proliferation of splenic T lymphocytes increased in the AH groups, but B lymphocytes didn't show significant difference as compared to the NC group. Also, enhanced NK activity in the AHL and AHR groups.

**Conclusion :** The results suggest that *Allium hookeri* extracts may be used as a functional supplement to improve immunomodulatory activity.

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## 사철쭉 및 더위지기의 주요 생리활성 물질 비교분석

정상미\*, 권민희, 라문진, 이용준

(재)홍천메디칼허브연구소

### Comparative analysis of Bioactive Compounds between *Artemisia capillaris* Thunb and *Artemisia iwayomogi* Kitamura

Sang Mi Jung\*, Min Hee Kwon, Moon Jin Ra and Yong Jun Lee

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#### ABSTRACT

**Background :** *Artemisia*, belonging to the daisy family *Asteraceae*, include the various species like mugwort, wormwood and sagebrush. After COVID-19 pandemic, some pharmaceutical botanists suggests any bioactive compound present in *Artemisia* genus might play a role part in the significant activity against SARS coronavirus and could be popularized as a therapeutic agent for the reason of cheap and easily available. Among the most used *Artemisia* genera in Korea, we noted that two *Artemisia* genera, *Artemisia capillaris* Thunb (ACT) and *Artemisia iwayomogi* Kitamura (AIK), were being used interchangeably. In this study, we revealed the different ingredients between ACT and AIK.

**Methods and Results :** Using the Simultaneously Analysis Method (SAM) developed by our research team, total 10 candidate bioactive compounds-scopoletin, scopolin, scoparone, caffeic acid, chlorogenic acid, hyperoside, isoquercitrin, isochlorogenic acid B, isochlorogenic acid A, isochlorogenic acid c-have been analyzed from ACT and AIK under 100% ethanol and distilled water extractions. The amounts of both, chlorogenic acid and scoparone, are the highest amounts of them in ACT, but not detected in AIK. The highest amounts of two bioactive compounds, scopolin and scopoletin, among them were detected in AIK, and specifically the higher levels of scopolin were found in AIK compared to ACT.

**Conclusion :** These results suggests that the comparative analysis of compositional components between ACT and AIK have to be useful as basic data for the purpose of the development of therapeutic agents or the commercialization of health functional foods.

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[P03-037]

## 다양한 추출 조건에 따른 강황 (*Curcuma longa* L.) 추출물의 항산화 활성

김시현, 이은별, 최지혜, 김지수, 정운율, 김주희, 이성현\*

국립농업과학원 농촌진흥청

### Antioxidant Activity of curcuma (*Curcuma longa* L.) Extracts with Various Extraction Conditions

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National Institute of Agricultural Sciences, RDA, Wanju 55365, Korea.

#### ABSTRACT

**Background** : This study investigated the antioxidant activity and cytotoxicity of curcuma (*Curcuma longa* L.) by condition (color, temperature, soil, solvent multiple and ethanol).

**Methods and Results** : Antioxidant activity of the curcuma extract was measured by 2,2'-diphenyl-1-picrylhydrazyl (DPPH), 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) and polyphenol content. MTS and LPS-triggered nitric oxide (NO) release were measured in Raw 264.7 cells. Superoxide dismutase activity in the cell's supernatant was measured according to the method of Colorimetric Activity Kit. Catalase-like activity was measured according to the method of Catalase Colorimetric Activity Kit. In DPPH and ABTS, dark color of curcuma showed the highest antioxidant activity. In DPPH, ABTS and total polyphenol assay, ethanol extracts had a higher antioxidant effect than hot water extracts. Cytotoxicity was evaluated by MTS. Then, SOD (superoxide dismutase) and CAT (catalase) of the ethanol extracts were evaluated at a concentration without cytotoxicity. As a result of evaluating the cell viability of the ethanol extract in RAW 264.7 cells, curcuma did not exhibit cytotoxicity. After evaluating cytotoxicity, SOD assay and CAT effects were evaluated with the ethanol extract. Ethanol extract significantly increased SOD and CAT antioxidant activity according to curcuma dose.

**Conclusion** : Overall, cytotoxicity and antioxidant activity effects according to the various of curcuma suggested that it may be of great help in future research on curcuma as functional materials.

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**GINOS의 항티로시나아제 및 항산화 활성 : 신규 인삼 혼합물**

Zelika Mega Ramadhania<sup>1)</sup>, Huo Yue<sup>1)</sup>, Ramya Mathiyalagan<sup>1)</sup>, 안종찬<sup>1)</sup>, 박진규<sup>2)</sup>, Feng Jiao Xu<sup>1)</sup>,  
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**Anti-tyrosinase and Antioxidant Activities of GINOS : A Novel Ginseng Mixture**

Zelika Mega Ramadhania<sup>1)</sup>, Huo Yue<sup>1)</sup>, Ramya Mathiyalagan<sup>1)</sup>, Jong Chan Ahn<sup>1)</sup>, Jin Kyu Park<sup>1)</sup>,  
Feng Jiao Xu<sup>1)</sup>, Dong Uk Yang<sup>2)</sup>, Dong Wook Lee<sup>2)</sup> and Deok Chun Yang<sup>1,2)\*</sup>

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**ABSTRACT**

**Background :** Ginseng possess many therapeutic and cosmeceutical properties because of their abundant bioactive compounds, especially their saponin compounds, ginsenosides. In the present study, the various ginsengs (white ginseng, red ginseng, black ginseng, fermented red ginseng, Taegeuk ginseng, and cultured root mountain ginseng (CRMG)) were mixed with an equivalent ratio, namely GINOS, to improve its benefit as human health and beauty products ingredient. Hence, we determined the anti-tyrosinase and antioxidant activities of GINOS to check its potential as a skin-whitening agent.

**Methods and Results :** The results showed dose-dependent inhibitory activity of GINOS towards mushroom tyrosinase and intracellular tyrosinase on B16F10 cells. Tyrosinase activity of GINOS-treated cells at 125, 250, and 500 µg/ml concentration was reduced by 23.6%, 39.6%, and 49.5% compared with IBMX-stimulated cells, respectively. GINOS reduced 35% free radical scavenging and increased the reducing power activity at 10 mg/ml concentration. We also evaluated intracellular Reactive Oxygen Species (ROS) production in H<sub>2</sub>O<sub>2</sub>-induced oxidative stress-treated on HaCaT cells, it showed GINOS at 1000 µg/ml reduced 35% of ROS level. Furthermore, GINOS did not show toxicity effect at the concentration tested in B16F10, HaCat and Human Dermal Fibroblast (HDF).

**Conclusion :** These results suggest that GINOS might be a good potential source of anti-tyrosinase and antioxidants for application in cosmeceutical products.

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비만 치료 및 알코올 해독을 위한 진오스 추출물

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**GINOS Extract for the Treatment of Obesity and Aid Alcohol Detoxification**

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**ABSTRACT**

**Background :** Ginseng is most frequently used herbal and traditional oriental medicines having wide range of therapeutic and pharmacological demand. The major active components of ginseng are the saponins, which are also called ginsenosides appear to be responsible for most of the activities of ginseng including antioxidation, anti-inflammation, anti-diabetes and anti-cancer. Though various kinds of ginseng were reported for different efficacies, here we report GINOS which is an representative ginseng namely white ginseng, red ginseng, Taegeuk ginseng, black ginseng, fermented red ginseng and culture roots of mountain ginseng (CRMG) and mixed them equally in the mixture.

**Methods and Results :** We investigate the effects of GINOS on lipid accumulation in 3T3-L1 adipocytes and Alcohol dehydrogenase enzyme (ADH) in HepG2 cells. ADH is the primary enzyme which breaks down alcohol in the liver. The changes in the content of ginsenosides in GINOS mixture were analyzed by HPLC, after which the effects of the GINOS on 3T3-L1 adipocytes and HepG2 cells were observed. When the 3T3-L1 adipocytes were treated with GINOS that effectively reduced lipid accumulation. Furthermore, the GINOS extract increased the ADH activity in HepG2 cells. These results suggest that the GINOS can be effectively used for the obesity treatment and to improve alcohol detoxication in liver.

**Conclusion :** In a nut shell, our results suggest that GINOS should be developed as an antiobesity functional food and have the potential for the protection of liver from harmful actions of alcohol.

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흑삼, 인삼열매, 발효녹차 추출물 및 복합물의 구강건강 개선효과 연구

김세정<sup>1)</sup>, 조윤호<sup>1)</sup>, 박비오<sup>1)</sup>, 정광희<sup>2)</sup>, 손용휘<sup>2)</sup>, 조경환<sup>2)</sup>, 김진성<sup>1)\*</sup>

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**Effects of Black Ginseng, Ginseng Berry, Fermented Green Tea Extracts, and the Mixture on Oral health**

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**ABSTRACT**

**Background :** This study aimed at investigating the effects of Black ginseng (BG), Ginseng Berry (GB), Fermented Green Tea (FG) Extracts, and their mixtures on oral health *in vitro*.

**Methods and Results :** Antimicrobial activity of GB and FG against oral pathogens (*Streptococcus mutans* and *Porphyromonas gingivalis* causing dental caries and periodontitis, respectively) was measured by disc diffusion assay. Antimicrobial activity of the purified ginsenoside, known as an index component of ginseng, was also examined. As the results, the antimicrobial activity was rarely observed in GB and FB extracts, but the clearzone was observed in the ginsenosides especially in Rg5 (22 mm) and Rk1 (20 mm). To induce inflammation in Raw264.7 cells (murine macrophage cell line) and YD-38 cells (oral mucosal cell line), LPS (100 ng/ml) and H<sub>2</sub>O<sub>2</sub> (300 μM) were treated to those cell line, respectively. The BG, GB, FG extracts (50 - 500 μg/ml), and their mixtures were additionally treated to the inflammation-induced cell lines to examine the anti-inflammatory and anti-oxidative effects of those natural extracts. As the results, BG (500 μg/ml) and FG (100 - 200 μg/ml) extracts had anti-oxidative effects with no cytotoxicity. Furthermore the mixtures (BG : FG = 1.0 : 2.5) were synergistic for anti-oxidation than the sole treatment of BG and FG extracts.

**Conclusion :** In conclusion, BG and FG extracts, especially their mixtures can be used for protecting oral health.

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## GINOS 및 발효된 GINOS 추출물을 이용한 항암 및 항염증 활성 평가

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### *In Vitro* Evaluation of Anti-cancer and Anti-inflammatory Activities using GINOS and Fermented GINOS Extract

Jinnatun Nahar<sup>1)</sup>, Dong Wook Lee<sup>2)</sup>, Yue Huo<sup>1)</sup>, Ramya Mathiyalagana<sup>1)</sup>, Jong Chan Ahn<sup>1)</sup>, Yaxi Han<sup>2)</sup>, Mohanapriya Murugesan<sup>1)</sup> and Deok Chun Yang<sup>1,2)\*</sup>

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### ABSTRACT

**Background :** Cancer and inflammation incidence rate has been increasing drastically. Ginseng has been used a traditional herb for anti-inflammation effect. Yet the research gap targeting the beneficial activities of GINOS has not reported elsewhere.

**Methods and Results :** We report the fermentation of GINOS which was the complex mixture of white ginseng, red ginseng, black ginseng, taeguk ginseng, fermented Red ginseng and CRmg extract using commercial hydrolytic enzymes and lactic acid bacteria. Ginsenosides content was confirmed by HPLC and its antioxidant inhibition activities were analyzed by DPPH and reducing power activity. we observed cytotoxicity and NO inhibition activity of FGINOS in Raw 264.7 Macrophage cells. Moreover, we were also analyzed cytotoxicity on A549 human lung cancer cells and HepG2 liver cancer cells by MTT reagent. Ginsenoside Rh1, Rh2, F2 and Compound K was increased significantly by fermentation of GINOS. FGINOS even at high concentrations such as 400 and 800 µg/ml not showed any cytotoxicity in the Raw 264.7 cells than GINOS which decreased approximately 20% and 60% of cell viability at above concentration. FGINOS inhibited NO production at 200 µg/ml than GINOS. Also, it was not much toxic to lung and liver cancer cells at 24h treatment.

**Conclusion :** These results suggest that FGINOS has less toxicity effects on RAW 264.7 cells and more inflammation reduction effect through inhibition of LPS induced NO production than GINOS which increase minor ginsenoside contents through fermentation. FGINOS could be a potential drug for anti-inflammation.

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[P03-042]

## 글리콜 키토산이 코팅된 셀레늄 나노파티클을 통한 진세노사이드 함량 강화 및 산화 스트레스 완화

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### Enhancement of Ginsenoside Content and Alleviation of Oxidative Stress via Glycol Chitosan Coated Selenium Nanoparticles (GC-Se NPs)

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### ABSTRACT

**Background :** Chitosan nanoparticles which are considered one of the potential candidate for inducing plant growth, and considering its less toxicity are conjugated with glycol and selenium to make (GC-Se-NPs) to enhance the ginsenosides content and alleviate the oxidative stress.

**Methods and Results :** In the current study, glucol Chitosan coated nanoparticles (GC-Se-NPs) are synthesized and characterized by different techniques. Furthermore, application of (GC-Se-NPs) on *P.ginseng* Meyer to alleviate the oxidative stress and enhancement of ginsenosides. After the application of 20 mg/L Se NPs and GC-Se NPs, the moderate accumulation of ROS ( $O_2 \bullet^-$  and  $H_2O_2$ ) and upregulation of *PgSOD* and *PgCAT* showed good biocompatibility and less toxicity even at the highest concentration. Furthermore, ginsenoside biosynthetic pathway genes (*PgHmgR*, *PgSS*, *PgSE*, *PgDDS*) also showed significant upregulation upon 20 mg/L GC-Se NPs treatment along with ginsenosides.

**Conclusion :** The results suggested that ecofriendly conjugation of GC with Se NPs could be used as a bio fortifier to enhance the ginsenoside profile and to increase the quality of ginseng roots.

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하수오 2배체와 4배체의 항산화 활성 및 주요 생리활성 물질의 비교 분석

김기현<sup>1)\*</sup>, 김영상<sup>1)</sup>, 박재호<sup>1)</sup>, 김익제<sup>1)</sup>, 김영호<sup>1)</sup>, 이정훈<sup>2)</sup>, 우선희<sup>3)</sup>

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**Comparative Analysis of Antioxidant Activity and Major Physiologically Active Substances of Diploid and Tetraploid *Fallopia multiflorum* Thunb.**

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**ABSTRACT**

**Background :** The aim of this study was to comparison the total phenol and total flavonoid contents and antioxidant activity of diploid and tetraploid *Fallopia multiflorum* Thunb (FMT).

**Methods and Results :** The DPPH radical scavenging ability of tetraploid and diploid showed excellent activity at a concentration of 100µg/ml of sample extract with 90% and 89%, respectively, with no significant difference in activity. In that case of ABTS, both tetraploid and diploid were also high at 95%, and there was no significance between polyploid. The analysis of superoxide anion radiological activity of *F. multiflora* found that the tetraploid at 85.3% was slightly higher than the 81.5% of diploid. The total polyphenol content was 133.9 mg/g in the tetraploid of *F. multiflora*, which was slightly higher than that of diploid at 121.7 mg/g. The flavonoid contents were also slightly higher at 114 mg/g in tetraploid than that of diploid at 107.8 mg/g. As a result of measuring DPPH radical scavenging ability, ABTS radical scavenging ability, and SOD antioxidant ability, the antioxidant and physiologically active substances of tetraploid and diploid showed excellent activity, and the PPH radical scavenging ability and ABTS radical scavenging ability did not show a significant difference. The content of SOD antioxidant capacity, total polyphenols and total flavonoids in the tetraploid showed a slightly higher tendency than the diploid, which is similar to the result of the metabolite component content analysis showing a slightly higher content than the diploid in the tetraploid.

**Conclusion :** In conclusion, As above, the content of antioxidants and physiologically active substances did not have a significant effect on the increase in the component content due to ploid, but it was analyzed that the tetraploid was somewhat higher than the diploid with a certain trend, and the target index component and physiologically active substance component It is judged that tetraploids will be useful as breeding resources when cultivating high-functional varieties.

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당고특대황의 형태특징과 유전적 동정

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**Morphological Characteristics and Genetic Identification of *Rheum tanguticum***

**Maximowicz ex Balf**

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**ABSTRACT**

**Background :** *Rheum tanguticum* Maximowicz ex Balf is a perennial herbaceous plant belonging to the Polygonaceae family. It is listed as one of the origin plants of Rhubarb along with *Rheum palmatum* Linne and *Rheum officinale* Baillon in the Korean Pharmacopoeia. As a plant that does not grow naturally in Korea, it is classified as *Rheum palmatum* var. *tanguticum* Maxim(Chinese rhubarb) in the National Standard Plant List of the Korea National Arboretum. Therefore, in this study, morphological characteristics and genetic analysis were performed to identify the species of Chinese rhubarb collected in Gansu Province, China.

**Methods and Results :** In 2018, In 2018, we collected *Rheum tanguticum* seeds from Gansu Province, China, and planted them after sowing. After developing the seedlings in the field, we observed the morphological characteristics of 18 surviving individuals at the 3rd year. All individuals appeared in early April, and only one individual had flower buds formed in early May. Flowers bloom from May to June. The compound raceme forms panicles at the ends of branches and main stems, and white flowers with peduncles are whorl in the inflorescence. There are 5 lobes of perianth and they are arranged in one row, there are no petals, 6 stamens, and 3 styles. The leaf shape is palmate heart-shaped, the veins are palmately lobate, and the leaf blades are severely engraved. The front side of the leaf is dark green and the back side is light green. The petiole color is green or green-purple, and it changes to dark purple in autumn. In the case of the root, the slow root develops in the main root and is enlarged and multiple. The root color is dark golden. Genetic identification showed 98% homology with *Rheum tanguticum* as a result of ITS analysis.

**Conclusion :** In the future, when *Rheum tanguticum* is introduced, it is intended to be used as basic data for species classification based on morphological characteristics.

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## 228개 엽록체 유전체에 기반한 협죽도과 진화 분석

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### Evolutionary Analysis of Apocynaceae Family based on 228 Plastomes

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#### ABSTRACT

**Background** : Apocynaceae family consists of about 400 genera and about 5,100 species. Apocynaceae is considered as a family which speciated diversely and successfully adapted to various environment, since it is widely distributed in the five continents except for polar zones and has various morphological traits including herb, shrub, tree and vine. Apocynaceae also has high values in several industrial aspects. Apocynaceae species including *Catharanthus roseus*, *Rhazya stricta*, *Asclepias syriaca* and *Calotropis gigantea* were proved to have medicinal effects and *Asclepias* genus occupies large proportion in horticultural market of North America. On previous studies, many plastomes and phylogenetic analyses of Apocynaceae plants were reported, but evolutionary analysis based on every plastome sequence is not conducted yet. In this study, we estimated divergence time of entire Apocynaceae family, predicted geological events highly related to subfamily divergence and suggested structural changes of plastomes and chloroplast genes which are likely to induce speciation.

**Methods and Results** : 219 Apocynaceae plastome sequences were collected from NCBI database. Nine Apocynaceae plants were collected and sequenced on Illumina HiSeq platform, and their plastomes were assembled using dnaLCW method. 79 CDS were extracted from each plastome and a phylogenetic tree based on the CDS was constructed using BEAST. Divergence time estimation was conducted using *Coffea* fossil evidence as reference. Divergence time between Rauvolfioideae and Apocynoideae is estimated to be about 60 million years ago (MYA), which corresponds to K-Pg extinction. Divergence time between Apocynoideae and Asclepiadoideae is estimated to be about 30 MYA, which corresponds to drastic temperature drop across the Eocene-Oligocene transition. Ka/Ks values between CDS were calculated through every possible one-to-one inter-subfamilies comparison. Calculated Ka/Ks values were visualized using density plot and ten genes which have high Ka/Ks mean values or extraordinary Ka/Ks tendencies were selected. Amino acid sequences of the ten genes were classified into several types using neighbor-joining methods. The classification is well-matched with a phylogenetic tree and divergence of subfamilies. Among the ten genes, *psaI* gene experienced truncation when Asclepiadoideae diverged, and PsaI subunit is reported to stabilize photosystem I during leaf senescence and chilling stress.

**Conclusion** : Apocynaceae family is estimated to speciate on large extent when substantial geological events occurred. Phenotypical changes between subfamilies well corresponds to the geological events. Also, it is probable that structural change of *psaI* gene has been selective pressure of Apocynaceae.

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## 인삼 고랑 비닐 피복에 의한 탄저병 방제효과

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## The Effect of Controlling Anthrax by Vinyl Mulching on Furrow in Ginseng Field

Sun Ick Kim<sup>1)\*</sup>, Won Suk Jang<sup>1)</sup>, Bong Jae Seong<sup>1)</sup>, Moo Geun Jee<sup>1)</sup>, Yong Chan Park<sup>1)</sup>, Hyun Ho Kim<sup>1)</sup> and In Bae Jang<sup>1)</sup>

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### ABSTRACT

**Background :** Ginseng is a semi-shade plant, requiring a sun-shading structure during its growth period. That is because it is necessary to control an amount of light and prevent diseases in order for appropriate growth of ginseng. Particularly, in the rainy season, anthracnose gives the largest damage to ginseng, and causes a quantity reduction. Ginseng anthracnose occurs more when rainwater falls in furrows, splashes together with soil, and gets attached to ginseng leaves. By mulching a furrow with vinyl, this researcher looked into its anthracnose suppression effect.

**Methods and Results :** After a furrow was covered with vinyl, the anthracnose suppression effect of vinyl was analyzed. In this study, there are three types of furrows: a type of furrow that was covered fully with black vinyl (mulching the entire furrow); a type of furrow whose both sides were covered with vinyl (mulching the sides of a ridge); and a type of furrow not covered with vinyl (no mulching). With these three types of furrows, anthracnose occurrence was surveyed. Sun-shading materials were 4-layer polyethylene net+2-layer polyethylene net, and 4-year old ginseng was used.

Regarding the rate of anthracnose occurrence, Covering the entire furrow was 1.2%, Covering the sides of a ridge was 2.7%, and Not covered was 20.5%. As a result, covering the entire furrow was excellent at suppressing anthracnose. Even though rainwater touches leaves and induces anthracnose, it was found that rainwater falling from a sun-shading structure splashes together with soil, gets attached to leaves again, and thereby increases anthracnose occurrence.

**Conclusion :** To prevent ginseng anthracnose, a furrow was covered with vinyl. In terms of vinyl mulching treatment, the analysis result was mulching the entire furrow 1.2% < mulching the sides of a ridge 2.5% < no mulching 20.5%. Therefore, it was found that mulching a furrow with vinyl was effective at the prevention of ginseng anthracnose.

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인삼 해가림자재별 두둑 폭의 위치 및 높이별 투광량 특성

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**Comparison of Light Transmittance by Type of Shading Material Type in the Ginseng Field**

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**ABSTRACT**

**Background** : Ginseng is a semi-shade plant, requiring a sun-shading structure during its growth period. For appropriate growth of ginseng, it is required to adjust an amount of light by using a sun-shading structure. Since an amount of light is different in each season, it is difficult to cultivate ginseng for a long time. This study looked into the positions in ridges according to sun-shading materials and structures, and a different amount of light depending on height.

**Methods and Results** : Sun-shading materials have five types: Type A (Polyethylene net 4 layers+Polyethylene net 2 layers), Type B-1 (aluminum foil vinyls+2 layers), Type B-2 (aluminum foil vinyl+2 layers), and Type C (polyethylene vinyl+2 layers). The width of ridges and of furrows was 90 cm, each. As for the heights of wood pillars, top pillars with 180 cm in height, and bottom pillars with 100 cm in height were installed. The azimuth angles of ridges were 120° and 300°. An amount of light was surveyed according to the width, length, and height of ridges. In other words, an amount of light was analyzed at the points of 0, 30, 60, and 90 cm from the front row of a ridge, and at the point of 30 cm of a furrow in terms of length; at the points of 20, 40, and 60 cm from a ridge in terms of height. A daily change in an amount of light in each time slot was measured with the use of Data logger (Watch dog, USA). A light transmission rate for external light was surveyed.

With regard to average light transmission rate, type A had 6.4%, Type B 8.5%, and Type C 4.6%. In terms of the distribution of light in a ridge, both sides of the ridge tended to have a high light transmission rate. The points of 30 and 60 cm in the ridge had a low light transmission rate. The higher the surveyed position was, the more the light transmission rate tended to decrease.

**Conclusion** : The light transmission rates of three types of sun-shading materials were analyzed. As a result, the average light transmission rate was B type 8.5% > A type 6.4% > C type 4.6%. The average light transmission rate for each surveyed position was 90 cm 11.9% > furrow 9.1% > 0 cm 7.0% > 60 cm 7.4% > 30 cm 5.9%. At the points of 30 and 60 cm in a ridge, the higher their position was, the more the light transmission rate was reduced.

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약용작물 일당귀, 홍화, 고본의 생육시기별 해충 발생 생태 조사

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**Investigation of Pest Occurrence Ecology by Growth Period of Medicinal Crops  
*Carthamus tinctorius* Linne, *Ligusticum tenuissimum* Kitagawa and *Angelica acutiloba*  
Kitagawa**

Eun Song Lee<sup>1)\*</sup>, Yong Il Kim<sup>1)</sup>, Kyung Sook Han<sup>1)</sup>, Tae Jin An<sup>2)</sup>, Young Guk Kim<sup>1)</sup>, Sang Ku  
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**ABSTRACT**

**Background :** Due to the recent increase in the cultivated area of medicinal crops, the number of pests is increasing and the management cost is also increasing. Although the occurrence of pests can have a detrimental effect on the production of high-quality seeds by directly or indirectly affecting crop yields, research on proper pest management is insufficient. Therefore, this study investigated the ecology of occurrence of three major insect pests: aphids, thrips, and whiteflies, which are the major medicinal crops *Angelica acutiloba* Kitagawa, *Carthamus tinctorius* Linné and *Ligusticum tenuissimum* Kitagawa.

**Methods and Results :** The occurrence patterns of aphids, thrips, and whiteflies, which are major pests of *A. acutiloba*, *C. tinctorius*, and *L. tenuissimum* in the Herbal Crop Research Division test fields in Eumseong, Chungcheongbuk-do in 2021, were investigated using sticky traps. For sticky traps, 150 × 250 mm yellow sticky traps were used in 3 repetitions, and the traps were replaced at 10-day intervals from the end of May to the harvesting season for each crop. The density of pests attached was investigated indoors. Aphids started to occur in the 3 crops from the end of May, and in mid-June, the highest occurrence density was shown at 49.7 in *A. acutiloba*, 420 in *C. tinctorius*, and 632 in *L. tenuissimum*, and decreased from the end of June. Thrips started to occur in the 3 crops from the end of May and showed the highest occurrence density at the end of June with 392 and 2,073.3, respectively, in *A. acutiloba* and *C. tinctorius*. In *L. tenuissimum*, the highest incidence density was 2,840 in early July, and it decreased sharply to 359.7 in mid-July, followed by a slight increase or decrease. In *A. acutiloba*, it gradually decreased after the beginning of June, and then showed a slight increase to 321.7 in mid-August again. White powdery appeared from the end of May in the three crops, and showed the highest density in late June with 25.3 and 56.7 in *C. tinctorius* and *L. tenuissimum*, respectively. In *A. acutiloba*, the density was 19.7 in late June, and the highest density was 38.3 in late July.

**Conclusion :** When cultivating medicinal crops, it is important to not miss the control time based on the occurrence density of each pest when cultivating medicinal crops, and it is important to use registered pesticides in appropriate concentrations in response to positive list system (PLS).

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## 고온조건에서 천궁 재배지 토양 수분이동 특성

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### Characteristics of Soil Water Movement in *Cnidium officinale* Makino Cultivation Area with Hot Temperature Condition

Kwang Seop Kim<sup>1)\*</sup>, Sang Seok Lee<sup>1)</sup>, Beung Sung Kim<sup>1)</sup>, Eun Jung Go<sup>1)</sup>, Dong Chun Kim<sup>1)</sup> and Bu Young Lee<sup>2)</sup>

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#### ABSTRACT

**Background :** Soil water content plays a major role in photosynthesis and leaf temperature as well as yields and growth in plants. *Cnidium officinale* Makino are highly sensitive to environmental stimuli especially water stress. However there is little study on transport water movement in *C. officinale* Makino cultivation area. This study focused on investigate the movement of water from water container to the pot in *C. officinale* Makino cultivation under hot temperature conditions.

**Methods and Results :** The movement of water from water container to bottom watering pot was evaluated using self-made weighing lysimeter. The solar radiation, air temperature, and leaf area was assessed with several instruments such as CMP6 pyranometer and HMP 155 sensor etc. The long-wave radiation in the greenhouse condition was 21.1% higher than that of the open field, which was an unfavorable condition for *C. officinale* Makino. The leaf area reached a maximum about 70 days after emergence, then leaf area index (LAI) was about 0.7 in this study. The range of transport water quantity was between  $345.7 \text{ g m}^{-2} \cdot \text{day}^{-1}$  to  $1712.4 \text{ g m}^{-2} \cdot \text{day}^{-1}$ , which was mainly occurred at night around midnight.

**Conclusion :** From the above results, one of the main factors of water movement in soil would be thought to the soil temperature gradient with hot temperature condition. Therefore, further researches are needed to fully explained the water movement in soil in respond to rising of global average surface temperature.

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구기자에 피해를 주는 노린재 조사 및 방제에 효과적인 유기농업자재 선발  
손승완\*, 최현구, 이보희, 현혜경, 송전의  
충청남도농업기술원 구기자연구소

**Investigation of Stink bugs (Hemiptera) that Damage Goji berry and  
Screening for Effective Organic Farming Materials (OFM) for the Control**

Seung Wan Son\*, Hyun Gu Choi, Bo Hee Lee, Hye Gyeong Hyeon and Jeon Eui Song  
Goji Berry Research Institute, Chungnam-Do ARES, Cheongyang 33319, Korea.

**ABSTRACT**

**Background** : Insect pests damages are increasing on the field of goji berry (*Lycium chinense*) under organic farming management and especially, pest damage of stink bug are serious. Currently, various organic farming materials are registered, but insecticidal activity against stink bugs were not verified. Therefore, this experiment was carried out to screening for effective organic farming materials showing insecticidal activity in stink bugs.

**Methods and Results** : The stink bugs that occur in goji berry were collected by species, and the damage to Goji berry was investigated in the laboratory. As a result, it was confirmed that *Riptortus clavatus*, *Halyomorpha halys*, and *Plautia stali* sucked the juice, and the goji berry was injured, and mold was generated as a secondary damage. Therefore, we tested the insecticidal activity in the laboratory to select organic farming materials (OFM) that can effectively control stink bugs. In the experimental method, the stink bug *Riptortus clavatus* was collected and placed in a container, and 14 kinds of OFMs (known to have an insecticidal effect on stink bugs) were diluted 1,000fold and sprayed, then the insecticidal effect was investigated. OFMs effective against *Riptortus clavatus* were first selected, and the selected OFMs were tested for their insecticidal effect against stink bug *Halyomorpha halys*. As a result, 7 kinds of OFMs showing an effective insecticidal effect on *Riptortus clavatus* were selected, and 4 of them were also effective against *Halyomorpha halys*.

**Conclusion** : It was confirmed in an *in vitro* experiment that various stink bugs damage goji berry, and further investigation should be carried out on the stink bugs which occur less frequently. In an *in vitro* experiment for controlling stink bugs using OFMs, the last four materials showed insecticidal effects against two species of stink bugs, but additional studies such as field tests are needed.

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## 2021 구기자 진균에 의한 병해 발생 조사

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충청남도농업기술원 구기자연구소

## 2021 Research on the Occurrence of Goji berry Fungal Disease

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### ABSTRACT

**Background** : Goji berries are crops in the solanaceae family such as pepper and tomato, and damage is caused by diseases similar to these. In particular, in open field cultivation, anthracnose causes the most damage and in rain house cultivation TSWV, Powdery mildew, and Hypophyllous mold become a problem. Recently, new diseases have occurred due to various factors, which may cause problems in growth or damage to crop yields. Therefore, this study investigated the occurrence of diseases caused by fungi in goji berry in 2021.

**Methods and Results** : In order to carry out the study, the regions where goji berry are grown were investigated in Cheongyang, Yesan, and Buyeo. The investigation was carried out from April to October, and the method was investigated through visual diagnosis of symptoms suspected to have been caused by fungal diseases in Goji berry. Among them, pathogens that were difficult to identify in the field or that require isolation and identification were separately collected and isolated, and stored for a long time for future research. As a result of the investigation, various diseases occurred in Goji berry, and in particular, new diseases such as enlarged leaves or spots and fallen leaves occurred between May and June. In some houses, the symptoms of rotting disease were suspected, so it was diagnosed and confirmed using a kit. In addition, diseases caused by unidentified fungus occurred in the rain house, which caused great damage leading to a decrease in yield, and damage caused by secondary diseases after damage caused by stink bugs was also investigated. Lastly, anthrax and powdery mildew, which are diseases that occur continuously every year, also occurred more frequently than usual.

**Conclusion** : As a result of the investigation, the occurrence of diseases caused by fungi this year was diverse and numerous. Among them, in the case of unidentified diseases, it is judged that studies such as isolation and identification, and analysis of causes of occurrence are necessary, and selection of fungicides that can control these new diseases is essential.

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인삼 뿌리썩음병원균 억제 길항균 탐색

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**Screening for Root Rot Antagonistic Bacteria against Fungal Pathogens, *Ilyonectria mors-panacis* and *Fusarium solani***

Chi Eun Hong\*, Seung Ho Lee, Mun Won Seo and Sang Kuk Kim

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**ABSTRACT**

**Background :** Ginseng root rot is a major causative agent of continuous cropping injury, which is difficult to control with chemical pesticide. In addition, since consumers prefer safe product, it is inevitable to strive for eco-friendly production. Thus, we isolated antagonistic strains which might be raw materials of biocontrol agents from root rot suppressive soil and verified selective strains inhibiting effect the growth of pathogens through dual culture assay in this study.

**Methods and Results :** We predicted that the root rot suppressive soil would contain antagonistic bacteria, we isolated bacteria strains from previously selected suppressive soil by serial dilution method. For *in vitro* antifungal activity assay, *Ilyonectria mors-panacis* and *Fusarium solani* were cultured on a potato dextrose agar (PDA) plates at 22°C in the dark for 20 days, and an agar plug of each culture was pre-incubated on and LB agar plate at 25°C for 7 days and 2 days, respectively. Then 20  $\mu$ l of bacterial cell suspensions at OD600 = 1.0 and 0.1 was dropped on LB agar plates. Seven days (*I. mors-panacis*) and 2 days (*F.solani*) after the co-inoculation of the pathogen and isolates, the antifungal activity of the strains was observed compared to a sterilized distilled water control. Of the total 77, 15 isolates inhibited the growth of root pathogens. Based on 16S rRNA sequence analysis, the fifteen strains were identified as being closely related to genus of *Bacillus*, *Paenarthrobacter*, *Serratia*, *Chryseobacterium* and *Pseudomonas*. Additionally, antifungal activity of the strain was concentration dependent.

**Conclusion :** From the above results, we suggest that the selected strains have a sufficient potential to become raw materials for a biocontrol agent that inhibits ginseng root rot.

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[P05-008]

함안 성산산성에서 출토된 고대 복숭아 종자의 형태학적 및 분자유전학적  
동정 연구

강정아\*, 조은민, 김수연, 김윤지, 김소진  
국립문화재연구소 보존과학연구실

**Morphological and Molecular Identification Study of Ancient *Prunus persica* (peach)  
Seeds from Haman Sungsan Fortress**

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**ABSTRACT**

**Background :** In Korea, peach trees (*Prunus persica*) have been cultivated for medicinal purposes as well as for enjoyment of flowers for a long time. Traditional medical books such as 'Hyangyakjipseongbang' and 'Donguibogam' describe in detail the medicinal effects of peach petals, leaves, fruits, seeds, and tree resins from trees. In the 14th excavation survey of Haman Seongsan Fortress (Historic Site No. 67) conducted in 2009, the research institute of Gaya cultural heritage excavated plant remain seeds that were presumed to have been cultivated 1500 years ago, and it was assumed to be peaches. In this study, morphological and molecular genetic experiments were performed to scientifically prove the contents recorded in ancient literature.

**Methods and Results :** The materials were provided from the storage of the National Gaya Cultural Heritage Research Institute. Morphological identification of the seeds was performed using the computing radiography system, and images were obtained by irradiating the seeds with radiation for 30 seconds under the conditions of 20-30 kV and 3 mA. The light-harvesting chlorophyll a/b binding (Lhcb-2) gene, which is an endogenous reference gene useful for peach detection by molecular biological method, was analyzed after DNA extraction using CTAB.

**Conclusion :** through this study, the ancient seeds were identified as peaches. The results are expected to be used as archaeological data on the planting period and evolution of plants in the Gaya period.

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## 건조 방법과 감마선 조사에 따른 감초의 미생물 저감화 효과

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### Effect of Reducing Microorganisms in Glycyrrhizae Radix by Drying Method and Gamma Irradiation

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#### ABSTRACT

**Background** : Glycyrrhizae Radix has been effective in detoxification of fever and detoxification, nourishes the lungs and relieves cough, replenish the spleen and qi, and Reconcile all medicines, A typical prescription are Galgeun-tang, Socheongryong-tang, Jakyakgamcho-tang, Soshiho-tang, and Jagamcho-tang. Glycyrrhizae Radix is one of 19 items with mycotoxin standards for herbal medicines, The potential for microbial contamination during processing and storage is very high. So far, there has been no study on the reduction of microorganisms according to the drying method. In addition, gamma irradiation is an alternative method to the prohibition of the use of chemical fumigants that have been used for food storage and distribution, and the application of irradiation technology is expanding. Although Glycyrrhizae Radix is not an item that can be gamma-irradiated officially, It is expected that the items will gradually expand in Korea. Therefore, in this study, the effect of drying method and gamma irradiation to reduce microorganisms such as Glycyrrhizae Radix vulnerable mold was tested, It was performed for the sterilization technology of processing, storage and distribution.

**Methods and Results** : Glycyrrhizae Radix, the official material, was grown by the National Development Institute of Korean Medicine. After washing, 300g of Glycyrrhizae Radix was divided and dried by hot air drying, microwave drying, freeze drying, and natural drying, respectively, After gamma irradiation of some dry samples, a microorganism detection experiment was performed. Detection was performed using the dry film method, 3M's AC (Aerobic Count) and YM (Yeast and Mold) Petrifilm were used. Dilute the dried, gamma-irradiated sample in sterile distilled water to  $10^{-1}$  -  $10^{-4}$  and apply it to a dry film medium. AC Petrifilm are incubated at 35°C for 48h, and YM Petrifilm are incubated at 25°C for 120h. Gamma irradiation was commissioned by Soya Greentech and the radiation dose was 10 kgy. As a result, general bacteria and fungus were not detected in microwave drying depending on the drying method. It was confirmed that the proliferation of general bacteria and fungus occurred the most in natural drying. However, in the case of gamma-irradiated samples, it was confirmed that AC and YM were not detected in all drying methods.

**Conclusion** : From the above results, the effect of drying method and gamma irradiation to kill general bacteria and fungus of Glycyrrhizae Radix was confirmed. In the future, we plan to analyze the components of licorice samples before and after gamma irradiation to confirm changes. If gamma irradiation is officially approved in the future, it is judged that this study will be helpful in sterilization technology for processing, storage and distribution of Glycyrrhizae Radix.

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[P05-010]

## 인삼 예정지의 토양훈증에 따른 인삼뿌리썩음병균의 밀도변화

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### The Density Variation of Ginseng Root Rot according to Soil Fumigation in Ginseng Pre-planned Fields

Mun Won Seo, Ji Eun Hong, Sang Kuk Kim and Seung Ho Lee\*

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#### ABSTRACT

**Background :** As ginseng is cultivated for many years, it is damaged by various soil pathogens. A soil-borne pathogenic fungus, *Ilyonectria radicola* (*Cylindrocarpon destructans*) species complex causing ginseng root rot is the major pathogen on ginseng. In order to control this pathogen, this experiment was performed to repeatedly cultivate ginseng by suppressing root rot by soil fumigation in the repeated ginseng cultivation fields.

**Methods and Results :** We selected two fields (Hwaseong, Hoengseong) in which ginseng was planted and analyzed the density of ginseng root rot pathogen before and after soil fumigation. Soil samples before and after soil fumigation were collected, and their DNA was isolated and real-time PCR was performed. In the case of field in Hwaseong, the average density of ginseng root rot pathogen decreased to  $1.42E+02$  before soil fumigation, but to  $3.13E+01$  after fumigation. Also, Hoengseong had an average of  $1.32E+02$  before soil fumigation, but decreased to  $4.91E+00$  after fumigation, and the density of ginseng root rot pathogen decreased.

**Conclusion :** Soil fumigation was confirmed to be effective in reducing ginseng root rot. After fumigation, it is necessary to treat the soil with antagonistic microorganisms to suppress the growth of pathogens.

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## 지역 및 기간에 따른 인삼 지상부 병해의 변화

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### The Changes in Aerial Diseases of Ginseng according to Region and Period in 2021

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#### ABSTRACT

**Background :** In ginseng, leaf blight (*Alternaria panax*, *Alternaria alternata*), anthracnose (*Colletotrichum panacicola*) and gray mold (*Botrytis cinerea*) are the main aerial diseases. These diseases occurred on the leaves, stems and fruits of ginseng and cause great damage in the process of ginseng growth.

**Methods and Results :** We selected one ginseng cultivation field for each province for disease forecasting and investigated leaf blight, anthracnose, gray mold occurring in June, July and August. In the case of leaf blight, it was confirmed that disease rate gradually increased over time, and Gyeongbuk had the highest disease rate in August with 16.76%. For ginseng anthracnose, Jeonbuk in July had the highest disease of 2.8% and Gyeonggi in August had the second highest incidence of 2.63%. Lastly, gray mold had the highest disease rate of 0.97% in Gangwon. Overall, the aerial disease rate of ginseng was highest in leaf blight, followed by anthracnose and gray mold.

**Conclusion :** The aerial diseases investigation of ginseng can be used as basic data for ginseng control in each region for each disease.

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고온에서 발현량이 증가하는 천궁, 감초 유전자의 유연관계 분석

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**Phylogenetic Analysis of Genes with Large Differences in Expression Level  
according to Temperature in *Cnidium officinale*, *Angelica gigas***

Hye Ju Seong<sup>1)</sup>, So Hee Shin<sup>1)</sup>, Yong Il Kim<sup>2)</sup>, In Uk Jung<sup>3)</sup> and Woo Suk Jung<sup>1)\*</sup>

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**ABSTRACT**

**Background :** The two medicinal herbs, *Cnidium officinale* (CO), *Angelica gigas* (AG) are climate-sensitive medicinal herbs. Due to global warming, their growth and yield are greatly affected. In this study, we aimed to select genes with large differences in expression level according to temperature in the *Cnidium officinale*, *Angelica gigas* and compare their sequence with other plants (medicinal crops, food crops and model plants) to analyze relationship at the transcriptome, domain level.

**Methods and Results :** We cultivated the two plants in a temperature gradient greenhouse (TGG) located at the National Institute of Horticultural and Herbal Science, Pyeongchang, Korea. The leaves of CO and AG at 2, 3°C higher than the normal temperature was sampled and rapidly frozen in liquid nitrogen. Total RNA was extracted using the Qiagen RNA Extraction Kit (Qiagen). We used edgeR to detect DEGs and database was downloaded from Phytozome, Uniprot, Riken. For the alignment of sequences, we used Cluster Omega.

**Conclusion :** We detected DEGs from the normalized mRNA sequencing results of CO and AG leave samples grown in an environment 2 to 3 degrees higher than the normal temperature. 50 genes with increased expression and 48 genes with decreased expression were commonly detected in CO and AG, but most of them were different genes. It seems that CO, AG have different mechanisms for responding to ambient heat stress. Among the detected DEGs, we selected genes showed more than three-fold change in both directions and genes detected in both CO and AG. These genes was compared with other plants (*Arabidopsis thaliana*, *Daucus carota*, *Solanum tuberosum*, *Medicago truncatula*). In the case of LYPLA2 (lysophospholipase II), DHX8 (ATP-dependent RNA helicase DHX8/PRP22) transcript sequence, CO are closely related to AG. LYPLA2 domain of AG is closely related to *arabidopsis*. DHX8 domain (S1 motif, Helicase ATP-binding, Helicase C-terminal) and NRT (nitrate/nitrite transporter) transcript sequence of CO are closely related to *Daucus carota*. The phylogenetic tree of NRT domain shows that AG is closely related to *Daucus carota*.

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강원지역 황기 친환경인증농가의 재배실태 및 인식도 조사

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강원도농업기술원 인삼약초연구소

**A Survey on the Cultivation and Perception of *Astragalus membranaceus*  
Environment-Friendly of Farmers in Gangwon Area**

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Byeong Dae Goh

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**ABSTRACT**

**Background :** Astragalus is a representative medicinal crop, with a national cultivated area of 196ha and an environment-friendly certified cultivation area of 39.3ha. Gangwon area is the main producing area of astragalus, which accounts for 50.5% of the nation's cultivated area, or 99ha. Therefore, this study was performed to use astragalus as a basic data for expanding the environment-friendly cultivation area of astragalus by examining the cultivation and perception of environment-friendly cultivation of astragalus environment-friendly certified farmers in Gangwon area.

**Methods and Results :** An interview survey was conducted on 63 questions, including the general status of farmers and cultivation techniques, among 6 organic certified farmers and 8 non-pesticide certified farmers among 24 astragalus environment-friendly certified farmers in Gangwon. As a result of the survey, the age of astragalus environment-friendly certified farmers ranged from 40s (28.5%) to 60s (28.5%), and those in their 50s accounted for the most at 43.0%. As for the environment-friendly scale of astragalus cultivation by farmer, the proportion of astragalus cultivation in the total farming scale was low by farmer, as most farmers had a cultivated area of 1,001 to 3,000m<sup>2</sup> (35.7%) and an income of 1 million won or less (46.2%). In the agricultural technology used for environment-friendly cultivation of astragalus, 35.7% of farmers with a ridge height of 30 cm or more, and 64.3% of other farmers cultivated in a level low. Also in the Seeding method, there were more Drill planting and broadcast planting (78.6%) than spot seeding (3 farmers, 21.4%). In the case of basal fertilization, 35.7% of the farmers using environment-friendly materials such as expeller cake or livestock manure accounted for 64.3% of those who did not apply it. In the case of mulching, 33.3% of certified organic farmers did, but non-pesticide certified farmers did not. Pinching was carried out by 9 farmers (64.3%), and there was no significant difference by type of environment-friendly certification of the farmers.

Soil analysis for soil management was conducted by 11 farmers (78.6%), but the input of soil ameliorater was very insufficient at 1 farmer (7.1%).

**Conclusion :** Based on these results, it is judged that more precise and systematic research targeting farmers is needed to promote the development and application of environment-friendly cultivation methods for the expansion of organic cultivation of astragalus.

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\*\* (Acknowledgement) This work was carried out with the support of "cooperative Research Program for Agriculture Science and Technology Development(PJ015733) Rural Development Administration, Korea



## 인삼 연속지 토양훈증에 따른 뿌리썩음병균의 밀도변화

김영창\*, 유진, 서수정, 장인복, 장인배, 서문원  
농촌진흥청 국립원예특작과학원 인삼특작부 인삼과

### The Density Change of Root Rot Pathogens according to Soil Fumigation in Ginseng Continuous Cropping Fields

Young Chang Kim\*, Jin Yu, Su Jeoung Suh, In Bok Jang, In Bae Jang and Mun Won Seo  
Ginseng Research Division, Department of Herbal Crop Reserch, NIHHS, RDA, Eumseong 27709,  
Korea.

#### ABSTRACT

**Background :** When ginseng is continuously grown in one field, root rot disease occur in the roots due to the root rot pathogens (*Ilyonectria radiculicola* species complex). To reduce the occurrence of root rot, it is generally cultivated in virgin land. But due to the lack of virgin land, soil fumigation, filling, and cutting are emerging as new methods. This study was conducted for effective control of root rot pathogens according to soil fumigation.

**Methods and Results :** The density of ginseng root rot pathogens was analyzed before and after soil fumigation in three ginseng continouse cultivation fields (Hongcheon, Hoengseong, Goesan). Soil samples were collected before and after fumigation, and DNA was isolated and real-time PCR was performed. In result, the average density of root rot pathogens before fumigation was  $1.70E+02$  in the Hongcheon field, but it was  $6.31E+01$  after fumigation, which decreased about 10 times. Also, the average density before fumigation was  $6.12E+01$  and the density after fumigation was  $3.90E+01$ , which is slightly decreased in Hoengseong field. In Goesan field, it was  $2.07E+02$  before fumigation, and  $4.19E+00$  after fumigation, and the pathogen density decreased about 100 times. Goesan field was  $2.07E+02$  before fumigation, and  $4.19E+00$  after fumigation, and the pathogen density decreased about 100 times.

**Conclusion :** It was found that fumigation of soil reduce the density of root rot disease pathogens in ginseng continuous crop failure. In order to increase the efficiency of soil fumigation, it is necessary to manage soil moisture and proper soil depth during fumigation.

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\*\* (Acknowledgement) 본 연구는 농촌진흥청 연구사업(과제번호: PJ0158952021)의 지원에 의해 이루어진 결과로 이에 감사드립니다.



**색 인**







<b>(F)</b>		<b>(ㄱ)</b>		김영국	107
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<b>(H)</b>		강병만	22, 23, 53, 113	김영상	19, 102
Huo Yue	97, 98	강옥화	5	김영창	7, 9, 10, 118
<b>(I)</b>		강정아	112	김영호	102
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<b>(L)</b>		고은정	44, 108	김용호	19
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<b>(M)</b>		구성철	1, 15, 20, 34, 43, 46, 54, 55, 74	김윤지	112
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Md Rana Soyel	39, 62	권민희	95	김익제	102
Md. Adnan	69, 70, 71, 72, 73, 78, 80	권아름	38	김장욱	50
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Mohanapriya Murugesan	100	권태형	39, 62	김정미	103
Muhammad Awais	101	길진수	43	김정인	63
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<b>(R)</b>		김광섭	16, 18, 44, 108	김주희	94, 96
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Ramya Mathiyalagana	100	김기현	19, 102	김준용	113
Reshmi Akter	98	김단희	2	김준희	22, 23, 113
Rongbo Wang	76	김동춘	41, 42, 44, 108	김지석	58, 104
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Suleman abid	101	김명조	75, 82, 83	김진성	99
<b>(X)</b>		김미란	31	김창수	24, 48, 91
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<b>(Y)</b>		김민정	2	김태원	26, 28, 29, 37, 79, 85, 86
Yaxi Han	98, 100	김민주	77, 88, 90, 92	김하림	77, 87, 88, 90, 92
Yue Huo	100	김병성	41, 42, 44, 108	김현호	27, 30, 38, 49, 51, 68, 105, 106
<b>(Z)</b>		김상곤	81, 84	김형돈	40, 61, 64, 66, 67
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		김상준	87, 92	<b>(L)</b>	
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		김선익	27, 30, 38, 49, 51, 68, 105, 106	남효훈	16, 17, 18
		김성엽	63	노석찬	53
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		김세정	2, 99	<b>(ㄷ)</b>	
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		김솔	92		
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		김연주	76		



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		신소희	116	이동열	81, 84
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		심지형	47	이범석	60
				이병주	40, 64
<b>(ㄷ)</b>		<b>(ㅇ)</b>		이보희	13, 56, 109, 110
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<b>(ㄷ)</b>		오기광	69, 70, 71, 72, 73, 78, 80	이은별	94, 96
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서현호	19	유진	7, 8, 9, 118	이정우	50, 52, 59
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성혜주	116	윤다혜	5, 36, 89	이정훈	1, 32, 33, 35, 67, 102
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 홍지은 50, 103, 111, 114, 115  
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 황지영 60







**부록**

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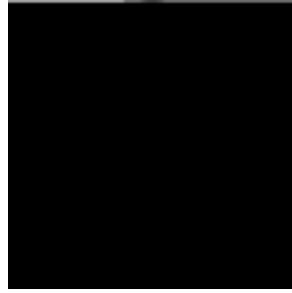
# **임시총회 회의자료**

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# **(사)한국약용작물학회**

## **2021년도 임시총회**

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2021.11.4.(목), 온라인



**(사)한국약용작물학회**  
The Korean Society of Medicinal Crop Science



# 1. 경과보고

## 1. 2021학회년도 춘계학술발표회 개최 결과 \* 불임1 참조(4~5쪽)

☐ 일자·장소 : 5월 13일(목)~14일(금), 부여롯데리조트 \* 에어팟/youtube 생중계

☐ 참석인원 : 180여명

☐ 주요내용

○ 심포지엄 : “약용작물 산업화 정책방향” 등 5주제 발표

○ 학술발표 : 총 123건(구두 2건, 청년과학자 7건, 포스터 114건)

\* 류병렬 회원의 “주요 cannabinoid의 신속 동시분석 방법에 의한 대마 (*Cannabis sativa* L.) 원료의 칸나비노이드 전환특성” 등 우수 구두발상 2건, 이보희 회원의 “화수 구기자 T자형 2단 울타리 재배법” 등 우수발표상 11건 선정

\* 충북대학교 김문교 학생의 “국내 대추 품종의 구분을 위한 InDel 마커의 개발” 등 7명에게 격려금 지급

☐ 결산결과

○ 수입 : 18,400,000원, 지출 : 15,630,130원 → 잔액 : 2,769,870원

## 2. 학회지 발간 사항(한국연구재단 KCI우수등재지, Scopus 등재 총 30편)

☐ 29권 1호(2021년 2월 28일) : 논문 7편

☐ 29권 2호(2021년 4월 30일) : 논문 6편

☐ 29권 3호(2021년 6월 30일) : 논문 6편

☐ 29권 4호(2021년 8월 30일) : 논문 7편

☐ 29권 5호(2021년 10월 30일) : 논문 4편



### 3. 과총 「제31회 과학기술우수논문상」 이재근 소장 수상

- ☐ 소속 및 직위 : (주)화진바이오코스메틱/연구소장
- ☐ 논문명 : 산삼 부정배양근의 진세노사이드 함량 증진과 성분 변환(28권 6호)

### 4. 회의 및 학회운영 발전에 관한 사항

#### ☐ 이사회(제2차)

- 일시 / 장소 : 2021. 7.22. (수) / 서면대체
- 주요 안건
  - 2021년 춘계학술발표회 결산, 14대 임원 선출, 2021년 추계 학술발표회 개최, 학회 기타 학회 발전에 관한 토의 건

#### ☐ 이사회(제3차)

- 일시 / 장소 : 2021.9.16.(목) / 온나라 zoom
- 주요안건 : 2021년 추계학술발표회 개최, 30주년 기념 심포지엄 개최(2022년 5월/부산) 관한 토의 건
- 참석자 : 한국약용작물학회 김동휘 회장 등 18명

### 5. 기금 현황

구분	예치 날짜	예치 은행	금액(원)	비 고
기금	2020.12.31.	농협	208,000,000	만기일(2021.12.31) 금리(연 0.55%)
소 계			208,000,000	



#### 4. 주요 업무 추진 현황

일자	추진내용
21.2.28.	학회지 발간(29권 1호, 논문 7편)
21.3.24.	한국약용작물학회 제1차 이사회 개최(비대면)
21.4.30.	학회지 발간(29권 2호, 논문 6편)
21.5.13.~14.	춘계학술발표회 및 정기총회 개최 (공로상 이성우 회원, 학술상 장인배 회원 수상)
21.6.24	2021년도 학술활동지원사업 선정(국내학술지, 국내학술대회) (학술지 : 13,400,000원, 학술대회 5,160,000원)
21.6.30	과총 2021년 제31회 과학기술우수논문상 선정(이재근 회원)
21.6.30	학회지 발간(29권 3호, 논문 6편)
21.7.22	한국약용작물학회 제2차 이사회 개최(서면)
21.8.30	학회지 발간(29권 4호, 논문 7편)
21.9.6.	학회 운영진 회의(온라인 zoom)
21.9.10.	과총 2021년 제31회 과학기술우수논문상 수상(이재근 회원)
21.09.16	한국약용작물학회 제3차 이사회 개최(ZOOM)
21.10.30	학회지 발간(29권 5호, 논문 4편)



## 붙임 1

### <2021년 한국약용작물학회 춘계학술발표회 결산 보고>

- 기간 : 2021년 5월 13일(목)~14일(금)
- 장소 : 부여롯데리조트, 에어밋/유투브 생중계
- 참석인원 : 180명
- 논문발표 : 구두 2건, 청년과학자 7건, 포스터 114건
- 행사 경비 결산액 : 2,769,870원

\* 수입 18,400,000원 / 지출 15,630,130원

○ 수 입 : 18,400,000원

구 분	수 입 내 역			금 액(원)
지원금	. 한국과학기술단체총연합회			5,160,000
등록비	. 학생회원	50,000 × 24인 =	1,200,000	13,240,000
	. 정회원	100,000 × 70인 =	7,000,000	
	. 비회원	120,000 × 42인 =	5,040,000	
총 계				18,400,000



○ 지 출 : 15,630,130원

구 분	지 출 내 역	금 액(원)
편집인쇄비	· 발표요지 170부(발송작업 및 택배비 포함)	3,165,030
대관료	· 부여 롯데리조트 사비홀	2,500,000
온라인	· 에어밋 등 온라인 학술행사 진행	1,716,000
연사 및 좌장수당	· 연사 300,000 × 4인 · 좌장 100,000 × 2인	1,400,000
장려금	· 구두발표 장려금 100,000 × 2인 · 청년과학자 장려금 200,000 × 7인	1,600,000
학술발표상	· 구두발표 100,000 × 2인 · 포스터발표 50,000 × 11인	750,000
기념품	· 접이식 텀블러	3,326,020
행사 진행	· 연사 등 참석자 식대 979,180 · 행사 진행 경비 1,193,900	2,173,080
기타	· 계약금 입금(20.04월)	-1,000,000
총 계		15,630,130

※ 계약금은 2020년 선지급/결산(학회운영비에 포함)완료되어 지출금액에서 차감



## 참고

### <한국약용작물학회 14대 임원 명단>

번호	직책	성명	소속	비고
1	회장	김동휘	국립원예특작과학원	
2	부회장	김관수	목포대학교	연임
3	〃	김광신	(사)한국생약협회	신임
4	〃	김금숙	국립원예특작과학원	신임
5	〃	김상국	국립원예특작과학원	연임
6	〃	김행중	전남생약농업협동조합	연임
7	〃	김현호	충청남도농업기술원	연임
8	〃	노일래	경상대학교	신임
9	〃	박교선	국립원예특작과학원	신임
10	〃	박상언	충남대학교	연임
11	〃	심재석	임실생약	연임
12	〃	윤영호	국립원예특작과학원	신임
13	〃	이 이	충북대학교	연임
14	〃	이범구	(주)동성제약	연임
15	〃	이성우	경상북도농업기술원	신임
16	〃	임병우	건국대학교	신임
17	부회장/ 편집위원장	임정대	강원대학교	
18	감사	김연복	한국농수산대학교	
19	감사	김영창	국립원예특작과학원	
20	총무이사	방경환	국립원예특작과학원	



번호	직 책	성 명	소 속	비고
1	상임이사	강영화	경북대학교	연임
2	"	김선익	충남농기원 인삼약초연구소	연임
3	"	김재광	인천대학교	연임
4	"	마경호	인삼특작부	연임
5	"	모영문	강원도농업기술원	연임
6	"	박용순	한양대학교	연임
7	"	성봉재	충남농기원 인삼약초연구소	연임
8	"	성정숙	국립식량과학원	연임
9	"	양태진	서울대학교	연임
10	"	여준환	한국한의학진흥원	연임
11	"	오세량	한국생명공학연구원	연임
12	"	원준연	중부대학교	연임
13	"	이가순	충남농기원 인삼약초연구소	연임
14	"	장수원	한국인삼공사	연임
15	"	정명근	강원대학교	연임
16	"	조상원	(재)금산국제인삼약초연구소	연임
17	"	최수지	국립원예특작과학원	신임
18	"	표미경	(재)금산국제인삼약초연구소	연임
19	"	황대일	(재)진안홍삼연구소	신임
20	"	황승미	(재)진안홍삼연구소	신임



**부록**

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**학술발표상  
수상자 목록**

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# (사)한국약용작물학회 학술발표상 수상자 목록

## >> 2018년도 추계학술발표회

수상번호	주저자	소속	초록제목
구두 제 18-3호	남효훈	경상북도농업기술원	NDVI를 활용한 약용작물 생육진단
구두 제 18-4호	SanjidaKhanom	전남대학교	인삼유래 CYP유전자의 지베렐린 생합성 유전자 조절을 통한 식물 생장조절과 제초제 저항성 기능
포스터 제 18-12호	남효훈	경상북도농업기술원	이미지 분석을 통한 일천궁 고온피해 진단
포스터 제 18-13호	안효섭	전라남도농업기술원	파종시기와 시비방법에 따른 배초향종자 수량 특성
포스터 제 18-14호	김승한	경상북도농업기술원	인삼에서 엽록소 형광분석에 의한 스트레스의 지표화
포스터 제 18-15호	김수동	충청남도농업기술원	흰털오가피 삽목시기와 생장조절제 처리가 발근에 미치는 영향
포스터 제 18-16호	박창하	충남대학교	RNA-Seq를 이용한 석산의전사체 프로파일 분석
포스터 제 18-17호	김장욱	국립원예특작과학원	인삼 논재배 직파 적응 품종 및 우량계통 선발
포스터 제 18-18호	이호선	국립농업과학원	들깨 국내 재래종 및 육성종 유전자원의 균형형 저항성 검정
포스터 제 18-19호	손동균	국립원예특작과학원	감초 품종개발을 위한 유전자원 생육특성 및 글리시리진 함량
포스터 제 18-20호	김규엽	식품의약품안전평가원	DNA 분자마커를 이용한 강황의 종 감별
포스터 제 18-21호	표미경	금산국제인삼약초연구소	홍삼가수분해농축액 (GS-E3D)의 피부 안전성 평가를 위한 인체접촉시험
포스터 제 18-22호	허성일	(재)홍천메디칼허브연구소	유용미생물발효를 적용한 고려엉겅퀴의 면역증강효능연구
포스터 제 18-23호	이민지	식품의약품안전평가원	생약표준품 지표성분의 안정성 평가 연구
포스터 제 18-24호	Indra Batjikh	경희대학교	음나무 뿌리를 이용한 산화 아연 나노파티클 생합성 및 메틸렌 블루의 분해를 위한 광촉매 활성
포스터 제 18-25호	김민조	국립원예특작과학원	잇꽃씨추출물의 스코폴라민으로 유발시킨 기억상실 마우스에서 산화적 스트레스와 콜린성 기능 장애 억제를 통한 기억력 개선 효과
포스터 제 18-26호	이지은	(재)경기도경제과학진흥원	독활 뿌리의 디테르페노이드와 페놀릭 유도체
포스터 제 18-27호	한정아	경기도농업기술원	인삼뿌리썩음병의 원인균인 <i>Cylindrocarpum destructans</i> 와 <i>Fusarium solani</i> 를 동시 진단할 수 있는 새로운 real time PCR 진단법 개발
포스터 제 18-28호	박봉균	한국한의학연구원	고삼투압 유발한 사람 각막세포에서 호장근열수추출물의 효능 실험
포스터 제 18-29호	안태진	국립원예특작과학원	Phytophthora someana에 의한 큰꽃삼주역병 보고



## 2019년도 추계학술발표회

수상번호	주저자	소속	초록제목
구두 제 19-1호	인준교	한국인삼공사	인삼재배 전용 소형터널식 비가림 시설 개발
구두 제 19-2호	이정훈	국립원예특작과학원	감초 교잡종 국외 자생지 및 유통감초 기원동정
포스터 제 19-1호	서수정	국립원예특작과학원	인삼 종자 장기 저장을 위한 종자 수분 함량 조건 연구
포스터 제 19-2호	안영남	경기도농업기술원	광복해가림 재배시설의 모델별 미기상과 4년생 인삼의 생육특성
포스터 제 19-3호	박건환	경기도농업기술원	인삼 논 재작 가능기간 단축을 위한 처리가 생육에 미치는 영향
포스터 제 19-4호	남주희	경상대학교	딸기 부패균에 대한 항균활성을 나타내는 약용작물 선발
포스터 제 19-5호	손승완	충청남도농업기술원	품종 및 수집시기에 따른 구기자 잎의 Rutin 함량
포스터 제 19-6호	신우철	국립원예특작과학원	인삼으로부터 분리된 말로닐 진세노사이드의 동정 및 정량 분석
포스터 제 19-7호	홍충의	국립원예특작과학원	지황의 시기별, 부위별 Catalpol, Verbascoside, Aucubin의 함량 변화 분석
포스터 제 19-8호	정상미	(재)홍천메디컬허브연구소	작약, 복령, 백출 한약 복합추출물의 추출조건에 따른 지표성분 함량 비교연구
포스터 제 19-9호	최혜림	강원대학교	약용식물 블랜딩 조성물의 항산화 활성 및 항미생물 검증
포스터 제 19-10호	황호섭	국립원예특작과학원	홍화 인공교배 육성계통의 생육특성
포스터 제 19-11호	김문교	충북대학교	대추 품종 구분을 위한 Chloroplast InDel 마커의 개발
포스터 제 19-12호	전례정	(재)진안홍삼연구소	진안군 홍삼산업의 현황과 실태 조사 분석

## 2019년도 추계학술발표회

수상번호	주저자	소속	초록제목
구두 제 19-3호	김원용	(재)금산국제인삼약초연구소	흑삼 추출물의 뇌신경 보호효과에 의한 인지기능 개선
구두 제 19-4호	김병성	경상북도농업기술원	오미자 유전자원의 개화 및 수분 특성
포스터 제 19-13호	이다은	진안홍삼연구소	유효 진세노사이드의 손실이 없는 고려 흑삼 제조 설정 연구
포스터 제 19-14호	손승완	충청남도농업기술원	맥문동의 상품 등급 구분을 위한 괴근 크기, 생산지 및 품종에 따른 지표성분 함량 비교
포스터 제 19-15호	이지혜	(재)진안홍삼연구소	효소 처리를 통한 백삼 추출물의 Rd 함량 증진 연구
포스터 제 19-16호	한상윤	성균관대학교	Panax Ginseng Calyx 에탄올 추출물의 AKT신호전달경로 조절을 통한 항염증 효과
포스터 제 19-17호	김태원	경상남도농업기술원	홍화, 오미자 잔재물 추출액의 농업 현장 활용 가능성 검토
포스터 제 19-18호	성봉재	충청남도농업기술원	연근별 인삼의 새싹 인삼 재배시 재배기간별 사포닌 및 물성 변화
포스터 제 19-19호	김수현	강원대학교	5S와 45S rDNA를 이용한 큰조롱과 이엽우피소의 세포유전학적 연구
포스터 제 19-20호	Tsendayush Sarantuya	충북대학교	더덕과 만삼의 구별을 위한 엽록체 기반 InDel 마커의 개발
포스터 제 19-21호	정희정	충북대학교	한반도에서 수집한 오미자의 유전적 관계분석
포스터 제 19-22호	최혜림	강원대학교	인공광원별 단삼의 생육특성 및 생리활성 분석
포스터 제 19-23호	황명하	강원대학교	차광비율 및 고도별 차이가 맛두름 생육 특성에 미치는 영향
포스터 제 19-24호	서상영	전라북도농업기술원	인삼 하우스 재배 시 수광량이 생육과 품질에 미치는 영향
포스터 제 19-25호	서상영	전라북도농업기술원	인삼 청백필름 하우스 재배시 무기성분 처리 효과



## >> 2020년도 학술발표회

수상번호	주저자	소속	초록제목
포스터 제 20-1호	권아름	충청남도농업기술원	흰털오갈피 우량종자 생산을 위한 적정 채종시기
포스터 제 20-2호	서해성	전남대학교	인삼 유래 PgCYP736A12와 PgCYP76B93의 페닐우레아계 제초제 저항성 관련 기능 연구
포스터 제 20-3호	모영문	강원도농업기술원	중북부 평야지 큰꽃삼주의 채종시기 및 저온저장기간에 따른 발아특성
포스터 제 20-4호	이재웅	한국한의학진흥원	반하 callus를 활용한 식물체 분화 및 실외 적응 연구
포스터 제 20-5호	인준교	한국인삼공사	비가림 소형터널을 적용한 무농약 묘삼의 생산
포스터 제 20-6호	갈진수	충북대학교	참당귀 염록체 기반의 종내 다형성 InDel 마커 개발
포스터 제 20-7호	허 목	국립원예특작과학원	S-allele Specific PCR 분석에 의한 황기 자가불화합성 유전자형 동정
포스터 제 20-8호	류병렬	강원대학교	분무경 스마트팜에서의 다양한 발광 다이오드 광원이 대마 식물의 광 스트레스 관련 생화학적 반응과 주요 칸나비노이드 함량에 미치는 영향
포스터 제 20-9호	Qian Qian Lee	원광대학교	HepG2 세포에서 oleic acid로 유도된 지질축적에 대한 curcuminoids의 간 보호 효과
포스터 제 20-10호	Qian Qian Lee	원광대학교	비알코올성지방간 동물모델에서 강황 (Curcuma Longa L.)에서 분리한 curcumin, demethoxycurcumin 및 bisdemethoxycurcumin의 간 보호 효과
포스터 제 20-11호	한초연	식품의약품안전평가원	우리나라 자생 강황의 재배방법에 따른 구별 패턴분석
포스터 제 20-12호	이유진	(재)금산국제인삼약초연구소	백삼추출물(GS-KG9)의 MAPKs 신호전달 경로를 통한 항염증 효과
포스터 제 20-13호	여현지	충남대학교	황금 모상근에서 플라본 생산을 증가시키기 위한 옥수수 Lc와 애기장대 PAP1 전사인자를 이용한 대사공학 연구
포스터 제 20-14호	Hengmin Han	경희대학교	E2를 유도한 전립선 비대증 세포에서의 흑삼추출물의 EMT와 세포증식 억제효과
포스터 제 20-15호	최보람	국립원예특작과학원	방풍, 식방풍의 지표성분 분석법 검증 및 대사체분석을 이용한 마커판별
포스터 제 20-16호	박충열	국립백두대간수목원	국내 마 바이러스병 조사와 Yam mild mosaic virus 전체 염기서열 결정
포스터 제 20-17호	문윤호	국립원예특작과학원	대마 수그루 암꽃과 종자형성에 미치는 에세폰 처리시기 영향

## >> 2021년도 춘계학술발표회

수상번호	주저자	소속	초록제목
OP-2021-01	류병렬	강원대학교	주요 cannabinoid의 신속 동시분석 방법에 의한 대마 (Cannabis sativa L.) 원료의 칸나비노이드 전환특성
OP-2021-02	정수아	건국대학교	Chamaecyparis obtusa 잎의 RAW264.7 세포와 HaCaT 세포에 대한 생리 활성 및 항균 효능 평가
PP-2021-01	이보희	충청남도농업기술원	화수 구기자 T자형 2단 울타리 재배법
PP-2021-02	김경대	강원도농업기술원	LED 청색, 적색 광파장 비율이 고추냉이 생육에 미치는 영향
PP-2021-03	이진희	국립원예특작과학원	일천군 재배포장에서 멀칭 필름의 종류에 따른 포장 온도경감 및 생육 증진 효과
PP-2021-04	지무근	충청남도 농업기술원	인삼 품종 구분을 위한 SNP 분자 표지 개발
PP-2021-05	김희준	(재)홍천메디칼허브연구소	석류 종자 추출물에 의한 체지방 감소 효과
PP-2021-06	한윤영	(주) 내추럴엔도텍 생약호르몬연구소	한속단 추출물의 펜토바르비탈-유도 수면증진 효과
PP-2021-07	박섫별	국립원예특작과학원	산국의 기억력 개선 효과
PP-2021-08	장선일	전북대학교	미세아교세포에서 한삼 에탄올 추출물의 항염증 효과
PP-2021-09	허희영	강원대학교	헴프 수피 추출물의 복합 작용 기전에 의한 인지기능 개선 효과
PP-2021-10	최보람	국립원예특작과학원	참당귀의 대사체 기반 원산지 판별
PP-2021-11	백완숙	경희대학교	생약 표준품 확립을 위한 품질 검증 연구