

2021년 (사)한국약용작물학회 춘계학술발표회 및 정기총회

The Korean Society of Medicinal Crop Science



포스트 코로나19 시대의 농업, 무엇을 대비해야 하나?



일시 2021년 5월 13일(목) ~ 14(금)

장소 부여 롯데리조트/  에어밋(Airmeet) ·  유튜브(Youtube) 생중계

주최  (사)한국약용작물학회
The Korean Society of Medicinal Crop Science

후원  KCST
한국과학기술단체총연합회

한 국 약 용 작 물 학 회

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부 회 장 : 김관수(목포대학교) 김동휘(국립원예특작과학원) 김명조(강원대학교) 김상국(경북도원 생물자원연구소)
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고 문 : 손용룡 이정일 박상일 최선영 방재옥 성락춘 성낙술 김성민 유창연 송범현 박충범 정일민 조동하

감 사 : 이성우(국립원예특작과학원) 노일래(경상대학교)

총 무 이 사 : 방경환(국립원예특작과학원)

편집위원장 : 임정대(강원대)

편 집 위 원 : 김관수(목포대) 김주성(제주대) 김영옥(가톨릭관동대) 이미영(한국한의약연구원)
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Ateeque Ahmad(인도)

심 사 위 원 : 권순옥(부산대) 김금숙(국립원예특작과학원) 김선익(충청남도농업기술원) 김승현(전국대)
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최소라(전북농업기술원) 추병길(전북대) 표미경(금산국제인삼약초연구소) 한신희(국립원예특작과학원)
현태경(충북대) Philippe Seguin(캐나다) Christie Peebles(미국) Jiangfeng Zhu(중국)

본 학회 사무(총무)와 학회지(편집)에 관련되는 모든 문서는 다음 주소로 보내시기 바랍니다.

총 무 : 방 경 환

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후원  KC-ST
한국과학기술산업진흥원

2021년 (사)한국약용작물학회 춘계학술발표회 일정

■ 주 제 ■ 포스트 코로나19 시대의 농업, 무엇을 대비해야 하나?

■ 일자 및 장소 ■ 2021년 5월 13일(목) ~ 14일(금), 부여 롯데리조트/에어릿, YOUTUBE 생중계 

■ 5월 13일(목) ■

13:00 ~	등록 및 에어릿 접속(온라인)	
13:40 ~ 14:00	개회 및 내빈소개 개회사(한국약용작물학회장), 축사(국립원예특작과학원장)	
학술강연 <1부>		▶ 좌 장 : 김금숙 과장(국립원예특작과학원)
14:00 ~ 14:35	약용작물 산업화 정책방향 ▶ 남기현 사무관 (농림축산식품부)	
14:35 ~ 15:10	포스트 코로나 대응 약용작물 부가가치 제고 연구 방안 ▶ 윤영호 과장 (국립원예특작과학원)	
15:10 ~ 15:45	녹차 및 홍차에서 코로나19 바이러스의 성분의 효소 억제 증명 ▶ 박준수 교수 (연세대학교)	
15:45 ~ 16:10	휴 식	
학술강연 <2부>		▶ 좌 장 : 임병우 교수(건국대학교)
16:10 ~ 16:45	개인 맞춤형 면역능 향상을 위한 약용작물의 활용성 증대 ▶ 유영춘 교수 (건양대학교)	
16:45 ~ 17:20	젊은 과학자 세션 / Establishment of 3D lung organoids for <i>in vitro</i> fibrosis modeling ▶ 최세리 박사과정 학생(안전성평가연구소, 서울대 약학대학)	
17:20 ~ 17:40	휴 식	
17:40 ~ 18:30	정기총회	

■ 5월 14일(금) ■

10:00 ~ 12:00	일반 구두 학술발표회 / 청년과학자 short communication
	▶ 좌 장 : 백종섭 교수(강원대학교)
12:00 ~ 12:20	장려금(구두, 청년과학자 short communication) 시상
12:20 ~	폐 회

개 회 사

한국약용작물학회 회원 여러분!

안녕하십니까?

2021년도 5월 가정의 달을 맞아
한국약용작물학회 춘계학술발표회를 이곳 부여의
롯데리조트에서 개최하게 된 것을 매우 기쁘게
생각합니다.



요즘 코로나19로 인하여 우리 학회의 학술행사 개최에 대하여 많은
걱정과 고민을 해오던 가운데 한국과총(한국과학기술자총연합회)의
방침에 의거 하이브리드 방식(회원 참석자 감축/온라인 방송 겸용)으로
진행하게 된 점 많이 이해해 주시기 바랍니다.

금년도 우리 학회는 창립된 지 30주년을 맞는 뜻깊은 해이기도
합니다. 오늘 창립 30주년을 맞아 현장 대면 및 온라인 비대면
학술행사로 회원 여러분께 인사드릴 수 있다는 것이 그나마
다행스럽고 이렇게라도 학술행사를 진행할 수 있다는 것이 매우
영광스럽기도 합니다.

그동안 어려운 여건하에서도 한국약용작물학회에 대한 많은
관심과 애정으로 학회의 발전을 위해 노력해주신 회원여러분께
감사드립니다. 우리 학회의 학술지가 최근 한국연구재단의 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 강원대학교 임정대 편집위원장님

및 학회 사무국을 비롯한 회원 모두의 한결같은 노력과 협조의 결실로 나타난 결과라고 생각합니다. 이에 회원 모두의 마음을 담아 깊은 감사의 인사를 드립니다.

오늘 학술행사의 축사를 맡아주신 국립원예특작과학원 황정환 원장님 감사드립니다. 귀중한 연구결과를 발표해 주실 농림축산식품부의 남기현 사무관님을 비롯한 다섯 분의 주제 발표 연사님과 좌장님으로서 수고해 주실 농진청 김금숙 과장님과 건국대학교 임병우 교수님께 감사드립니다. 2일차 학술행사에서는 젊고 유능한 청년과 학자 구두발표 코너가 신설되어 일반 구두발표와 함께 특색 있게 진행될 예정입니다. 이날 진행을 맡아주실 강원대학교 백종섭 교수님 및 구두 발표자 여러분께도 심심한 감사를 드립니다.

현장에 참여하지 못한 회원 여러분! 부디 끝까지 온라인 방송으로 참여해 주시어 좋은 연구정보 교류의 학술행사가 되기를 희망합니다. 아울러 온라인 학술행사 진행을 위해 노력해주시는 루비콘테크 관계자 여러분께도 깊은 감사를 드립니다.

끝으로, 오늘 행사를 준비해 주시고 협조해 주신 농촌진흥청 인삼특작부 관계관님과 학회 사무국 및 편집위원장님께 깊은 감사를 드리며 금년도 회원여러분의 안전한 방역수칙 준수로 늘 건강하시고 희망찬 나날이 되시기 바랍니다.

감사합니다.

2021. 5. 13.(목) 한국약용작물학회 회장 차선우 드림

축 사

안녕하십니까?

국립원예특작과학원장 황정환 입니다.



오늘 한국약용작물학회 차선우 회장님과
학술강연 연사분들 그리고 학회회원님 등이
참여하는 춘계학술발표회 및 정기총회가,
코로나 확산방지를 위해 대면과 비대면이 병합된 하이브리드
방식으로 진행하게 된 것에 대해, 아쉬운 마음이 앞서지만 이렇게
라도 함께하며 약용작물 분야 정책·산업동향과 최신 연구정보를
공유할 수 있게 되어 매우 뜻깊게 생각하며 환영합니다.

세계의 모든 나라는 코로나로 인해 매우 어려운 상황에 직면해
있고, 산업·경제·사회·문화 등의 전반과 우리의 일상을 완전히
바꾸어 놓고 있습니다. 이에 따라 혁신을 넘어선 변화가 요구되고
있으며 국민의 건강에 대한 관심은 그 어느 때 보다 높아지고
있습니다.

이와 더불어 저출산, 고령화, 1인가구 증가 등에 따른 트렌드가
변하고 있으며, 이상기상의 상시발생은 농산업의 성장과 발전에
위협을 주고 있습니다.

우리 청에서는 급변하는 트렌드와 대내외 환경에 발 빠르게 대응
하고 있습니다. 더불어 농업인의 소득증대와 국민의 건강 증진 및
관련 산업의 동반성장을 위해 산학관연이 힘을 합쳐 신품종·
신소재·신기술의 개발과 보급을 적극적으로 추진하고 있습니다.

약용작물은 예로부터 한약재로 이용하여 왔으나, 최근에는 고부가 기능성 소재의 주 원료로 이용이 증가하고 있습니다. 이와 더불어 건강기능식품 시장은 다양한 계층의 수요 증가로 지속적인 성장이 예상되고 있습니다. 따라서 약용작물로부터 새로운 소재 발굴을 확대하고 산업화까지 연계한다면, 코로나 이후 직면하고 있는 국가 경기회복에도 기여할 수 있을 것으로 기대를 모으고 있습니다.

한편 이번 학술발표회는 「포스트 코로나19 시대의 농업, 무엇을 대비해야 하나?」라는 주제로 약용작물 미래 연구·정책 방향과 육종·재배 등의 생산 분야 및 코로나 예방·치료 등을 포함한 기능성 분야의 최신 연구내용을 발표하고 공유하며 고민하는 시의 적절한 학술행사라고 생각합니다.

아울러 국내 우수학술지 선정과 Scopus 등재 등으로 나날이 위상을 높여나가고 있는 한국약용작물학회가 더욱 더 성장하길 기원하겠습니다.

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감사합니다.

국립원예특작과학원장 황 정 환

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학술 강연

1부

좌장 김금숙 과장
(국립원예특작과학원)

약용작물 산업화 정책방향

남기헌 사무관
(농림축산식품부)

약용작물 산업화 정책방향

2021. 5. 13.



농림축산식품부

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1

일반현황

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1 일반현황

약용작물의 정의

✓ 약용작물이란 ?

- ❶ 식물의 전체 또는 잎, 나무껍질, 꽃, 열매, 씨 등이 직접 약에 쓰이거나 제약 원료로 쓰이는 식물
 - ❷ 질병을 예방, 치료하기 위해 예전부터 사용되어온 식물로서 농업계에서는 농산물로 약용식물, 약료작물이라고도 함
- ➡ 인류가 질병을 치유하거나 고통을 덜어주기 위한 약료를 생산할 목적으로 재배하는 식물을 말함

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1 일반현황

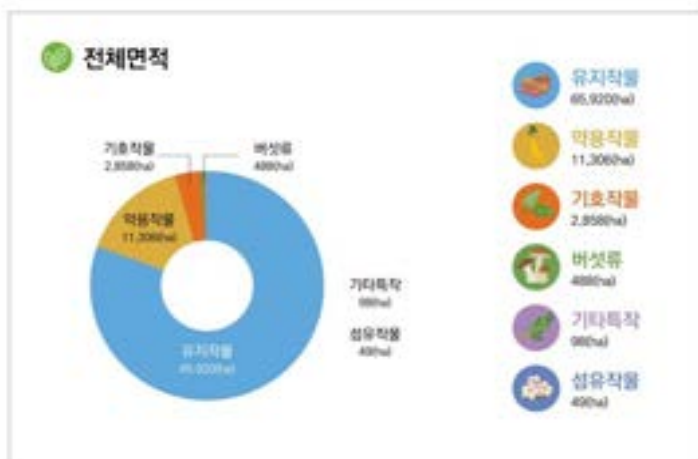
농업의 범위(농업·농촌 및 식품산업기본법)



4

1 일반현황

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
기 타	241	1,635
합 계	235,887	287,458

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1 일반현황

■ 약용작물 - 56종 조사(2019년)



구분	농가수(호)	전체면적(ha)	수확면적(ha)	생산량(M/T)
약용작물(56종)	30,241	11,306	10,052	64,111

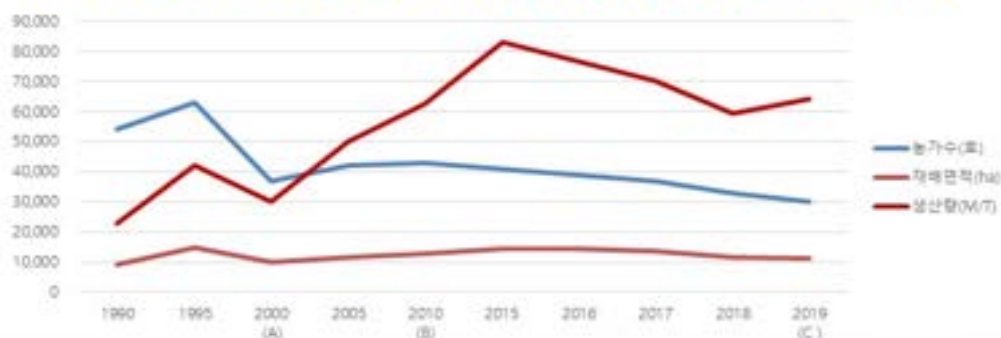
갈근(칠훈), 감초, 강활, 강황, 건강(생강), 길명자, 고본, 구기자, 길경(도라지), 단삼, 당귀(일), 당귀(합), 당삼(만삼), 대황(금문대황, 장군물), 독활(망두물), 두충(두충나무), 맥문동, 목단피(목단, 모란), 백수오(은조물), 백지(구릿대), 백출(삼주), 복분자(복분자말기), 사삼(잔대), 산수유, 산약(마), 삼백초, 석창포, 시호, 식방풍(갯기름나물), 양유(더덕), 어성초(약모밀), 오가피(오갈피나무), 오미자, 우슬(쇠무릎), 익모초, 애엽(쑥, 황해쑥), 의이인(율무), 위유(통굴레, 옥죽), 자소엽(차즈기), 작약, 지모, 지황, 천궁, 천마, 치자, 택사(질경이택사), 하수오, 한인진(더위지기), 향부자, 현삼, 형개, 홍화(잇꽃), 황기, 황금(속색은물), 황정(홍충갈고리통굴레, 진황정), 기타

10

1 일반현황

약용작물 생산추이

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



연도	1990	1995	2000 (A)	2005	2010 (B)	2015	2016	2017	2018	2019 (C)	증감율(%)	
											C/A	C/B
농가수(호)	54,000	63,000	37,000	42,083	42,904	40,799	38,924	37,108	32,964	30,241	81.7	70.5
재배면적(ha)	9,179	14,954	9,936	11,494	12,804	14,232	14,458	13,458	11,715	11,306	113.8	88.3
생산량(M/T)	22,822	41,980	30,141	50,172	62,669	83,068	76,886	70,456	59,444	64,111	212.7	102.3

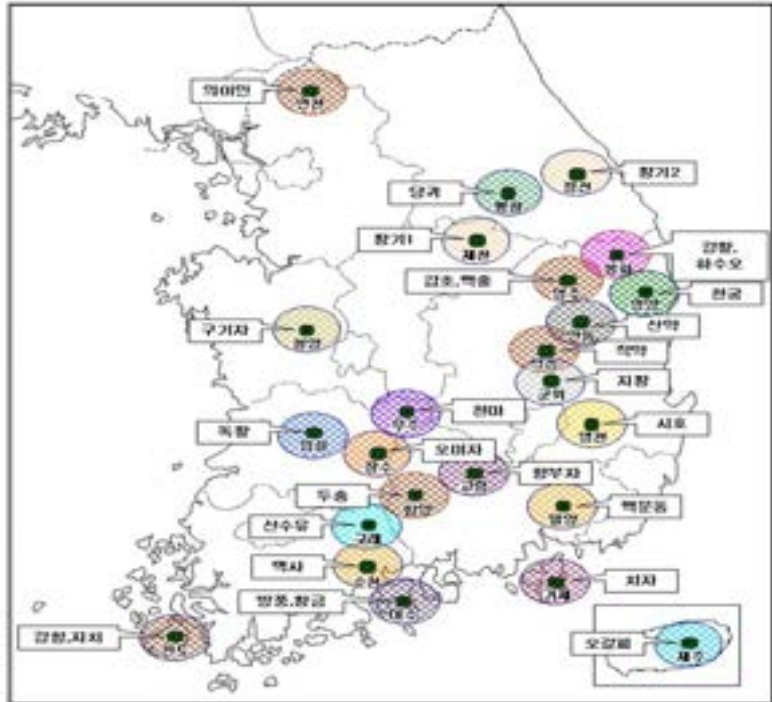
16

1 일반현황

품목별 재배현황[19년]

- 1위 : 오미자(2,165ha)
- 2위 : 양유(더덕)(2,163ha)
- 3위 : 복분자(940ha)
- 4위 : 길경(도라지)(739ha)

※ 농가당 평균 재배면적:
(‘10) 0.34ha(1,020평)
→ (‘19) 0.37ha(1,119평)



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1 일반현황

수급 및 이용 현황

- 약용작물 생산량의 약 70%는 식품용(일반식품, 건강기능)으로, 나머지는 의약품인 한약재로 이용되는 것으로 추정되며, 색소, 화장품 등 기능성 제품으로 외연 확대
- 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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1 일반현황

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

● 국내 건강기능식품 시장규모 추이



● 세계 건강기능식품 시장규모 추이



출처: 한국건강기능식품협회,
Statista, Global functional food market revenue 2019~2025

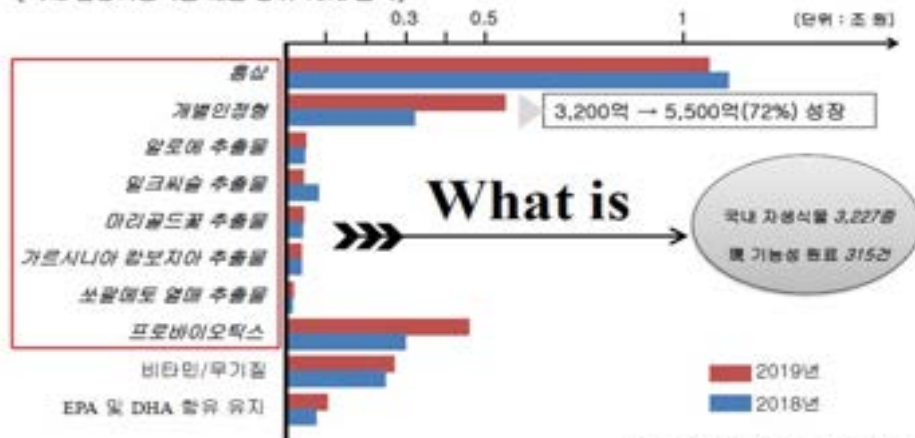
20

1 일반현황

시장 동향(건강기능식품)

- '19년 국내 건기식 중 개별인정형 제품의 성장률(72%)이 두드러짐

[국내 건강기능식품 매출 상위 10개 품목]



What is

국내 자생식물 3,227종
중 기능성 원료 315건

출처: 식약처, 2020년 식용의약품통계연보
한국식품안전관리연구원

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1 일반현황

시장 동향(건강기능식품)

- 천궁, 당귀, 작약 등 약용작물로 건기식을 생산하는 콜마BNH가 업계 4·5위 차지



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1 일반현황

시장 동향(보완대체의약)

- 질병예방, 건강관리 등에 대한 관심 증가로 한의약 등 보완대체의약에 대한 수요 및 세계 시장규모는 지속적으로 증가(연평균 15%)할 것으로 전망

〈세계 보완대체의약 시장규모〉

(단위: 억 달러)

구분	2019년	2021년	2023년	2025년	2027년	2030년	CAGR
북미	243.3	315.5	412.5	540.5	713.7	1,110.7	14.8%
유럽	276.7	361.4	474.5	624.9	828.4	1,287.9	15.0%
아시아태평양	199.8	263.6	350.5	466.2	623.3	983.2	15.6%
남미	55.9	72.5	94.4	123.5	162.6	249.9	14.6%
중동아프리카	40.5	52.1	67.4	87.5	114.5	174.2	14.2%
합계	816.1	1,065.1	1,399.3	1,842.6	2,442.5	3,805.9	15.0%

* 출처: MarketResearch.BIZ, Global Complementary & Alternative Medicine Market (2020. 03)

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1 일반현황

국내 정책, 지원

● [농식품부, 농진청] 생산 및 유통분야

⇒ 약용작물 재배, 생산, 유통분야 지원, 작물 재배연구

- 약용작물 브랜드, 계열화, 산업화 지원, 생산지도, 품종개발 및 보급 등
- 행정통계조사(1975년~) : 56개 품목, 재배면적, 생산량, 가격동향 등

● [복지부, 식약처] 한의약분야 가공 및 소비단계

⇒ 수확 후 한약재 제조, 가공, 소비단계 관리

- 한약재 안전 및 품질관리 규정, 유통실명제 및 제조·포장기준 마련 등
- (복지부) 한약재 수급조절대상 품목 지정 운영 : '14년부터 14개에서 11개로 축소
 - 11개 품목 : 구기자, 당귀, 백문동, 산수유, 오미자, 일당귀, 작약, 지황, 천궁, 천마, 황기
- (관세청) 수입유통이력 품목 운영 : 황기 등 5개 품목(인삼제품, 홍삼 별도)
 - 5개 품목 : 황기, 당귀, 지황, 작약, 도라지(길경) ('20년 '천궁' 제외)

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1 일반현황

국내 안전관리

● [농식품부] 식품용 약재 안전관리 및 유통 과정 원산지 단속

⇒ 식품용은 농수산물품질관리법 및 농수산물의 원산지 표시에 관한 법률 등에 따라 관리

- 안전성조사 및 원산지관리는 국립농산물품질관리원(농관원)에서 담당

● [복지부, 식약처] 의약품은 약사법과 한의약육성법 등 적용

⇒ GMP 인증 의무화

- '11년 한약재 자가규격제도 폐지(모든 한약재는 한약제조업소에서 가공, 포장 후 판매) 및 '15년부터 한약재 안전 및 품질관리기준(GMP)에 따라 제조
- 의약품도매상, 약국개설자 및 한약업사의 한약재 원산지표시는 식약처에서 담당

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2

문제점

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2 문제점

유통 및 소비 측면

● 외국산 수입 증가 및 부정유통 → 소비자 불안감 상존

- 오미자, 황기 등 국내산과 가격차가 큰 품목은 부정유통 우려
 - 국내 미생산 품목 및 가격차가 큰 품목은 외국산 수입이 불가피

● 계열화 미흡, 전문 홍보·판매장 부족 → 소비자 접근성 제약

- 일부 농협 중심의 제한된 품목에 대한 단순 수집·매취·판매로 안정적 판매 및 품질경쟁력 확보에 한계
- 국산한약재 전문 판매는 생약농협 직영매장, 유통센터 등 20개소에 국한, 농가에서 한의원 등에 직접 판매하려면 한약제조업허가(GMP) 필요

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2 문제점

고부가가치 산업화 측면

- **특화단지 육성 미흡, 가공시설 노후화 및 부족 → 품질경쟁력 취약**
 - 관광·체험 등 6차 산업 관련 특화단지는 제천, 산청 등 일부에 국한
 - 농가단위 단순가공으로 품질 불균일 및 규격화 미흡, 신뢰 확보에 한계
- **고부가가치 산업화 마인드 부족 및 기존 시설의 체계적인 활용 미흡**
 - 관련 시설 분산 관리, 지자체의 종합적인 접근 부족으로 시너지효과 발휘에 한계
- **신소재에 대한 관심은 증가하나, 고비용 등으로 민간추진의 한계**
 - 까다로운 인허가 절차, 장기간의 임상시험 등으로 개별기업 투자 어려움
 - 기업은 과학적 근거가 풍부한 외국산 원료의 수입 및 제품화를 선호

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2 문제점

생산 기반 측면

- **경사진 밭에서 주로 경작, 기계화가 어려워 경쟁력 제고에 한계**
 - 작물별 전용기계 개발 및 지원 미흡
 - 인건비 등 생산비 증가로 단위면적 확대에 한계
- **주산지 형성 등을 통한 규모화·조직화 등이 미흡**
 - 품목별 주산단지가 지정 고시 되어있으나, 기후변화, 작목전환 등으로 활용에 한계
- **생산단계 안전성관리 취약 및 우수품종·고품질 생산기술 미흡**
 - 소량 다품목 형태 재배, 미등록 농약사용 우려가 높음
 - 품목 다양성으로 체계적인 품종개발 한계, 표준재배법 개발 보급 미흡

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2 문제점

추진 기반 측면

● 생산자 등에 대한 체계적인 교육 및 홍보 프로그램 미흡

- 비정기적으로 기술센터 등에서 이론 중심 교육에 치중
- 정부와 민간(대학, 협회 등)이 연계한 전문 교육·홍보사업 부재

● 지역별, 품목별 특화된 정책수립을 위한 통계기반 미흡

- 약용작물 56개를 포함 '특용작물 생산실적'을 조사, 책자로 발간
 - 행정조사 담당자의 전문성 부족 등으로 조사 신뢰성이 낮아 자료 활용에 애로

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정책방향

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3 정책방향



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3 정책방향

분야별 과제

1	소비확대 및 유통관리	1. 판로확대 및 가치홍보 지원 강화 2. GAP 인증확대 및 친환경농산물 인증 내실화 추진 3. 생산단계 안전성조사 강화 4. 부정유통 근절을 통한 국내산 소비확대 유도
2	고부가가치 창출	1. 국내원료 이용 스타제품 육성을 위한 융복합 R&D 2. 스타제품과 연계한 차별화된 특화단지 육성 3. 가공업 육성 및 집하·가공시설 현대화 지원 4. 체험·치유 및 휴식과 연계하는 6차 산업화 추진
3	생산기반 구축	1. 주산지 육성 등 안정적 생산기반 확보 2. 수급조절 기능 강화 3. 우수품종 육성 및 보급 확대 4. 안전생산 기술 개발 보급
4	협업과 민간역량 강화	1. 관계기관 업무협업 강화 2. 전문인력 양성 및 민간역량 강화 3. 제도개선 및 생산·수급 통계 기반 구축

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분야별 세부추진과제

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4 분야별 세부추진과제

4-1. 소비확대 및 유통관리 강화

● 판로확대 및 가치홍보 지원 강화

- 스타제품 육성을 통한 신수요 창출 및 소비확대 추진
 - 약용작물 기능성 관련 역사·스토리를 연구 개발하여 홍보에 활용
- 농업과 기업, 소비자 협력을 통한 국산한약재 소비촉진
 - 기업체·생산자 MOU 체결, 공영홈쇼핑 통한 GAP 약용작물 판매 확대 등

- 온라인 판매 및 직거래 시스템 활용을 통한 판매 촉진
 - 국산 한약재 판매를 전문으로 하는 e-Marketplace 활성화 지원
- 수출촉진을 위한 생산자단체(협회)의 해외 마케팅 강화
 - NH무역 등의 현지 마케팅 조직 및 시설 등의 연계활용으로 효율성 제고
 - 박람회 참가를 통한 GAP 약용작물 우수성 홍보 및 판매활동 지원
- 홍보·마케팅 활성화 지원
 - GAP 약용작물 종합홍보·판매관 개설 지원

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4 분야별 세부추진과제

4-1. 소비확대 및 유통관리 강화

● GAP인증 확대 및 인증 내실화 추진

- GAP 인증 관련 시·군 업무담당자 설명회 및 교육 정례화 등을 통한 인증활성화
 - * (농관원) 매년 1,000~2,000명 수준 교육, (농진청) 새해 영농교육, 시군당 2-300명
- 안전 농산물 생산확대를 위한 안전성 분석비 지원(농관원)
 - 약용작물 인증에 필요한 토양, 용수, 농약 등 분석비 지원
- 약용작물 적용 농약 직권 등록을 통한 GAP인증 확대기반 구축(농진청)
 - '25년까지 30개 품목 150개 약종 선정 약효·약해시험 추진 완료
 - 2021년 생약협회 주관, PLS 시행 대비 GAP 교육 과정 운영(3회)
- 식품 안전과 품질보증 구현을 위한 사후관리 강화(농관원)
 - GAP인증 농산물의 온라인 유통품 인증정보 일제점검(출하 성수기)
 - GAP 인증기관 특별점검 강화(기관별 연 1회 이상)

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4 분야별 세부추진과제

4-1. 소비확대 및 유통관리 강화

● 생산단계 안전성 조사 강화

- 재배농지, 용수 등에 대한 안전성조사 지속 실시로 한약재 안전성 확보
 - 매년 농산물 안전성조사 계획에 따라 잔류농약 등 유해물질 검사 추진
 - * 조사 계획(전체) : ('20) 60천건 → ('21) 60천건
- 사전 예방적 안전성 교육·홍보 강화
 - 농진청, 지자체 등과 협업하여 부적합 발생 지역·품목 중심 사전 컨설팅 등 농약 안전사용 지도
 - 부적합 발생 주요 농약과 사용 가능 대체농약 정보 제공 등
 - * 관련 정보는 리플릿으로 제작·배포하여 교육 추진 시 활용

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4 분야별 세부추진과제

4-1. 소비확대 및 유통관리 강화

● 원산지 위조·변조 등 부정유통 근절 감시망 확충

- 약재류 원산지표시위반 단속 강화를 통한 소비자 신뢰 제고
 - 위반 우려업체 선정 단속 및 주요 약재시장 원산지표시 단속 강화(시장별 연 2회)
 - 통관정보 모니터링을 통해 수입업체별로 유통단계별 추적조사
 - 표시 대상 : 국산 약용작물은 66개 품목(백수오 '16년 추가), 수입산은 모든 품목
 - 민간 감시 기능을 통한 자율적 부정유통 방지 분위기 확산
 - 생약협회 회원 등 생산자 교육을 통한 부정유통신고 활성화 유도

● 과학적 원산지 식별방법 개발·활용으로 단속효율성 제고

- 이화학 분석을 이용한 한약재 원산지 식별방법 연구 개발
 - 이화학 분석 대상 품목 : (21) 구기자, 당귀, 산수유, 오미자, 작약, 천궁, 황기 등(33개)
 - 국산 약용작물 66개 품목에 대해서는 육안 식별법 개발 운용 중

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4 분야별 세부추진과제

4-2. 고부가가치 창출

● 국내 원료 이용 스타제품 육성을 위한 융복합 협업 연구

- (목표) 산업체 협업 '25년까지 1,000억 원대 매출 품목 10개 이상 육성
- (산업육성) 특용작물 주산지 중심 생산·가공·판매 및 수출연계 스타제품 육성

< 전략품목 산업 육성 체계 >



- 신소재 개발 산업화 및 천연물의약 등 기초기술 개발을 위한 R&D 지속 추진
 - 기능성분 추출 및 기능성 평가기술 응용 천연물 의약 소재 개발

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4 분야별 세부추진과제

4-2. 고부가가치 창출

● 스타제품과 연계한 차별화된 특화단지 육성

- 고부가 산업화 기반 구축을 위한 차별화된 단지 육성
 - 특색 있는 약초중심 산업화 단지 육성을 통해 수급문제 대응 및 6차 산업화
 - * 스타제품 육성 연구와 병행 추진: ('16~'25) 200억원/10개소
 - 품목특성에 맞는 생산·가공 체험 등 프로그램 개발, 맞춤형 산업화 지원 추진
 - <사례> 고창 복분자주 명품화 사업, 문경 오미자 지역특산물화 사업 등

- 지역자원의 체계적인 활용이 가능한 생산·가공단지 육성
 - 천연색소산업화 지원센터 구축 및 활성화 지원(나주, 안동)
 - 약용작물산업화지원센터(60억원, 매년 1개소) 구축 및 활성화 지원

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4 분야별 세부추진과제

4-2. 고부가가치 창출

● 가공업 육성 및 집하·가공시설 현대화 지원

- 부가가치 제고를 위한 가공품 생산·판매사업 활성화
 - 지역별 주요 약용작물을 활용한 향토산업 육성 지원
 - * 향토산업육성 목표: (~'15) 31개소 → ('25p) 60
- 위생·안전성 확보 및 국산약재 경쟁력 강화를 위한 집하·가공시설 개선
 - '특용작물생산시설현대화사업'을 통해 노후시설 개·보수 지원
 - * 개선 계획: (~'17) 4개소 → ('20) 20 → ('25p) 40(누계)
- 권역별 약용작물 전용 APC 설치 운영 지원
 - 계약재배 통한 안정적 판매처 확보 및 체계적·안정적 출하시스템 구축
 - * 지원 계획: (~'17) 4개소 → ('20) 6 → ('25p) 10

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4 분야별 세부추진과제

4-2. 고부가가치 창출

☑ 외연 확대로 부가가치 제고



- ✓ 천연색소 산업 등 약용작물을 활용한 부가가치 제고
 - 건강식품 및 기능성 식품 개발 및 신선편이 가공기술 개발
 - 의료, 관광, 문화 등 다양한 분야의 콘텐츠를 접목한 소재 발굴

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4 분야별 세부추진과제

4-2. 고부가가치 창출



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4 분야별 세부추진과제

4-2. 고부가가치 창출

<약용작물(한약재)을 이용한 기능 분야 1>

개발분야	내 용
의약품	○ 비타민제, 피부치료제, 당뇨치료제, 관절염치료제 등 (예) 화인알치마, 노인성 치매 예방과 치료에 특효가 있는 천연물질(INM176) 상품화. INM176은 신농본조경에 나오는 천연약재로부터 추출한 물질
기능성 식품	○ 기능성 영양제 등 * (예) 썬바이오텍의 '헤모힘플러스' - 생명공학과 방사선 기술을 이용하여 개발한 조혈 및 면역기능 탁월한 신물질 - 혼합추출물(당귀, 천궁, 백작약), 저당, 벌꿀 등
건강식품	○ 환, 엑기스, 한방음료, 한방병, 한방떡, 한방쿠키, 한방죽, 향신료 등 식품첨가물, 천연색소 음료 등
다류	○ 침출차, 액상차, 한방차, 발효차, 꽃차 등
주류	○ 침출주, 발효주, 증류주 등
장류	○ 고추장, 된장, 간장, 청국장, 식초, 장아찌, 부각, 튀각 등
화장품	○ 스킨, 크림, 팩, 미용제품, 탈모방지제, 아토피 개선제, 비듬방지제, 색조화장품 등

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4 분야별 세부추진과제

4-2. 고부가가치 창출

<약용작물(한약재)을 이용한 기능 분야 2>

개발분야	내 용
생활용품	방향제 ○ 향기주머니, 젤타입 방향제(차량용), 향초 등
	주거용 ○ 벽지, 장판, 벽돌, 침구류(베개) 등
	천연염색 ○ 스카프, 손수건, 모자, 의류(내의, 외의) 등
	세제류 ○ 비누, 샴푸, 린스, 바디샴푸, 식기세척제 등
	식사 ○ 쌈채류, 식용약초반찬, 향신료 등
헬스케어	○ 사우나, 온천, 찜질방, 실내인테리어, 한방삼림테라피, 생활 습관병(고혈압, 당뇨병, 동맥경화증, 비만 등) 치료, 정신수양용향, 뜸, 마사지용 등
기타	○ 축산사료 이용, 한방슬러지 이용 퇴비 및 액비화 등

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4 분야별 세부추진과제

4-3. 생산기반 구축

● 집단화된 주산지 육성 등 안정적 생산기반 확보

- 주산지 및 주요품목 위주로 고품질 생산기반 정비
 - 지역별 특화품목 중심, 기계화가 용이한 집적화된 재배단지 조성
 - * (농식품부고시) 시군구별 50ha이상 특작류 재배시 시도지사가 해당 시군을 주산지로 지정
 - * 약용작물(7종) 주산지: 참당귀(평창, 봉화), 황기(정선, 제천, 영주), 오미자(홍천, 제천, 단양 등), 구기자(청양), 산수유(구례), 복분자(장성), 지황(금산)
 - 특용작물 재배·생산시설현대화 지원 등을 통해 생산성 제고
 - * 특용작물시설현대화사업: ('16) 28억원 → ('18) 32 → ('20) 35 → ('21) 45

● 약용작물 전용 농기계 개발 및 공급 추진

- 오미자 열매, 당귀 뿌리 등 재배 및 수확특성에 맞는 농기계 개발 R&D 추진
- 농기계 임대사업에 주요산지 적극 참여 및 이용률 제고(지자체)
 - * 발농사용 농기계 임대사업소: ('14까지) 336개소 → ('18) 443 → ('25p) 820

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4 분야별 세부추진과제

4-3. 생산기반 구축

● 수급조절 기능 강화

- 약용작물계열화사업 활성화로 안정적인 생산·유통기반 구축
 - 인삼계열화 사업과 통합 운영을 통해 금리인하 효과 유도
 - * 계약자금: 금리 0.0%, 구매자금: 금리 2.5%
 - * 계약·구매 용자조건 변경: '18년부터 3년 거치 일시상환

● 생산자 단체 활성화를 통한 자율 수급조절능력 제고

- 약용작물 자조금 조성을 통하여 생산자단체 기능과 역할 강화
- 자율적 생산 출하·조절 활동으로 가격안정 도모
 - * 오미자 전국생산자조직 결성 및 자조금 조성 시범 추진('14.7월~)

● 농업과 기업의 상생협력을 통한 동반성장 추진

- 식품클러스터 입주기업 연계, 원료용 약용작물 안정적 판로확보 및 소비확대

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4 분야별 세부추진과제

4-3. 생산기반 구축

● 우수품종 육성 및 보급 확대

- 약용작물 유전자원 수집·보존 및 기원검증 등 산업화지원 확대
 - 약용식물 유전자원을 지속적으로 확대
 - * 약용식물자원 확보 계획: ('15) 880 → ('20) 1,100 → ('25p) 1,500종
 - 국내 약용식물자원 기원 검증으로 산업화 지원

● 고품질 다수성 품종 개발·보급 확대

- 집중육성 대상작물을 선정하여 개발(당귀, 황기 등 10, 수입대체 감초 등 3작목)
- 우량종자 생산·보급 국가관리체계 구축 및 보급 확대
 - * 농진청, 종자보급센터 등 포함한 약용작물우량종자 보급 협의체 구성 추진('17년)
 - * 종자보급률: ('15) 19.3% → (20) 22.7 → ('25p) 30

● 다용도성 품종개발 및 보급(농진청)

- 식품·의약 공용 품목 증가로 기능성 신소재 등 다용도성 개발 확대

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4 분야별 세부추진과제

4-3. 생산기반 구축

● 안전생산 기술 개발 보급

- 작물별 표준재배법 및 수확 후 관리기술 개발 보급(농진청)
- 친환경, 우수농산물 생산기술 개발 보급(농진청)
 - 구기자, 오미자, 천궁 등을 중심으로 친환경농자재 선발 및 해충 유인물질 개발 등 친환경 저투입 생산기술 개발 보급
 - * 친환경 기술 개발 계획: (~'15) 13작목 → ('20) 18 → ('25p) 25
 - 우수농산물관리(GAP) 인증확대를 위한 기술 개발 보급
 - * 표준재배지침(SOP) 보급: (~'15) 54작목 → (20) 60 → ('25p) 70
- 농약 직권 등록을 통한 작목별 문제병해충 작물보호제 선발(농진청)
 - 살균, 살충, 종자소독 방제약제 선발을 위한 약효·약해 시험 추진

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4 분야별 세부추진과제

4-3. 생산기반 구축

지원 사업

- **특용작물 생산시설 현대화 사업**(법인 10억원, 개인 2억원, 보조 50, 융자 30)
 - 재배시설 개·보수 및 개·증축, 냉·풍해 방지, 관수시설, 차광막 시설
 - 재배에 직접 관련된 기기 구입(세척기, 건조기, 절단기, 선별기, 석발기, 포장기, 탈피기 등)
 - 단, 농기계, 농자재, 소모성자재, 저온차량은 제외
- **약용작물 산업화 지원센터 구축**(60억원, 국비50, 지방비 50, 지자체 운영)
 - 약용작물 제품화 연구, 민간업체 산업화 지원, 우수기술 보급 및 DB구축, 체험·교육
 - 전문연구·실용화 시설, 제품화 장비지원, 해외수출 지원, 전문인력 육성 등 산업화 뒷받침
- **약용작물 종자 기반구축사업**(20~30억, 국고 50, 지방비 50, 지자체 운영)
 - 시설 : 온실, 망실하우스, 조직배양실, 건조·정선시설 등 중요 생산 품질관리 시설
 - 장비 : 파종기, 수확기, 선별기, 발아시험기 등 중요종식 및 품질관리 장비
 - (단, 승용·승합차량 및 범용 트랙은 지원대상에서 제외)
- **약용작물 원종 종식 보급사업**(10억, 국고, 실용화재단, '19년 신규추진)

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4 분야별 세부추진과제

4-4. 협업과 민간역량 강화

- **약용작물 전문인력 양성 및 민간역량 강화**
 - 기관별 역할 분담 및 조정으로 교육 효율성 제고
 - (농진청) 교육프로그램 개발 보급, 교관요원 교육 등 컨트롤 타워 역할
 - (시·도) 농업마이스터대학에 약용작물 과정 추가
 - 강원도 농업기술원 '고품질약초재배반' 과정 등 5개 과정 개설 매년 200명 교육 추진
 - (시·군) 적합품목 중심 교육 프로그램(6개월 과정 등) 개설로 역량 강화
 - 계획: ('14) 15개 기술센터 → ('25) 50개소 운영/2,000명 교육
 - 지방 주요 대학의 사회교육 기능을 적극 활용하여 인력 양성
 - 계획: ('14) 5개 대학 → ('25) 10개소 운영/500명 교육
 - 농식품공무원교육원 및 민간 교육훈련 기능 적극 활용
 - 민간단체의 '약용작물 산업화 전문 인력 양성' 등 교육과정 후원

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4 분야별 세부추진과제

4-4. 협업과 민간역량 강화

● 제도 개선 및 생산 · 수급 통계 기반 구축

- 약용작물 생산 · 판매 관련 현장 애로사항 파악 및 제도 개선 추진
 - * 약용작물 규제 분석을 통한 산업 활성화 방안 연구('16년, 농촌경제연구원)
 - * GMP기준 충족 시 GAP 인증 중복 검사 면제 추진('17년 농관원 고시 개정 추진)
- 신뢰성 있는 기초통계 구축·제공으로 지역정책 개발 및 의사결정 용이성 제고
 - 재배 · 생산량의 정확한 통계를 위해 주요 품목 실측조사(연차별 용역)
- 수출입 통계 개발을 통한 수급 정보 시스템 구축
 - HS 세번 재분류로 주요 약용작물의 수출입 등 정보 파악 용이성 제고
 - * 재분류 추진: (~'15) HS 10단위 18개 품목 → ('18) 30개 품목 이상으로 분류
 - 식품 · 의약품용 한약재류 수급상황 파악이 가능하도록 통계 개발 활용
- 가격정보 시스템 구축 활용(생약협회 및 유통공사 협조)
 - 도매가격과 산지가격 및 해외 수급동향 파악 용이성 제고

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2021년 중점 추진계획(안)

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5 2021년 중점 추진계획(안)

● 약용작물 산업계 네트워크 구축 → 신뢰회복 및 동반성장 기반 마련



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5 2021년 중점 추진계획(안)

● '16년 특용작물산업 발전 종합대책 중간점검 → '25년 목표 달성 도모

- 산업계 네트워크를 기반으로 종합대책 전반기('16~'21년) 분야별 추진상황 점검
 - 과제별 추진현황, 여건 변화 사항, 목표치 조정 필요성 등 검토
- 종합대책 후반기('22~'25년) 산업 활성화를 위한 보완계획 마련
 - 대내외 여건 변화 사항을 반영하여 추진과제, 성과지표 및 '25년 목표치 등 조정
 - 과제별 추진상황에 대한 주기적 관리체계 마련

● 약용작물 홍보 웹사이트 구축 → 인지도 제고 및 소비활성화 도모

- 다양한 연령대 소비자, 귀농·귀촌 희망자, 타작물 재배 농업인 등에게 수 많은 약용작물을 이해하기 쉽게 알릴 수 있는 인터넷 통합 홍보 웹사이트(모바일 연동) 구축 운영
 - 각종 약용작물의 사진, 특징, 효능, 음용법, 재배지역, 생산농가, 구매방법 등 소개

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포스트 코로나 대응 약용작물 부가가치 제고 연구 방안

윤영호 과장
(국립원예특작과학원)



목 차

- I 산업현황과 진단
- II 연구개발 성과
- III 고부가 산업화 전략





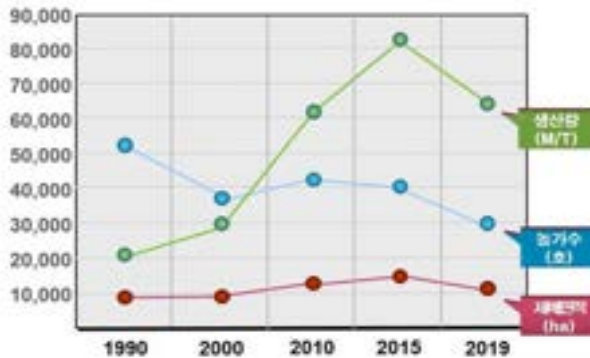
1. 약용작물 산업 현황

생산, 소비현황

❖ 2000년 이후 웰빙, 건강 추구로 생산 증가, 소비 성장

- 소득향상, 웰빙문화 확산으로 약용작물 지속적 성장 추세
- 식품·소재 수요증가로 식·약공용작물 성장세 뚜렷

* 식·약 공용 약용작물 : ('00) 1,215억원 → ('19) 7,676 (6.3배 증가)



▶ 약용작물 주산지

❖ 재배 면적 순위(2019)

- 1위 : 더덕(2,372)
- 2위 : 오미자(2,232ha)
- 3위 : 도라지(1,180)
- 4위 : 복분자(1,036)
- 5위 : 산약(728)
- 6~10위 : 울무, 당귀, 독활, 산수유, 황기

❖ 수입량 순위(한약재+식품)

- | | |
|---------|-----------|
| 1위 : 감초 | 6위 : 지황 |
| 2위 : 황기 | 7위 : 천궁 |
| 3위 : 작약 | 8위 : 결명자 |
| 4위 : 울금 | 9위 : 참당귀 |
| 5위 : 백출 | 10위 : 구기자 |

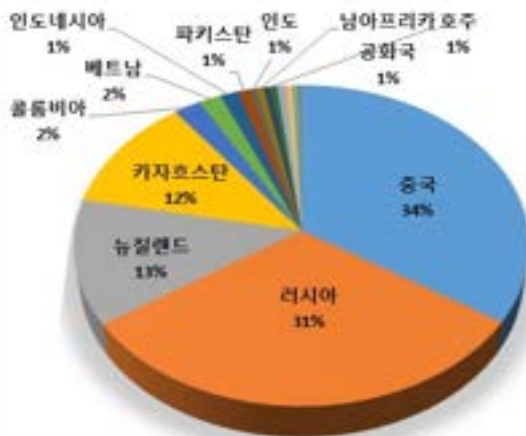


✓ 10개 작물이 국내 약용작물 전체 재배면적의 76% 점유

수입현황

❖ 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 \$



한약재 수입동향('19)

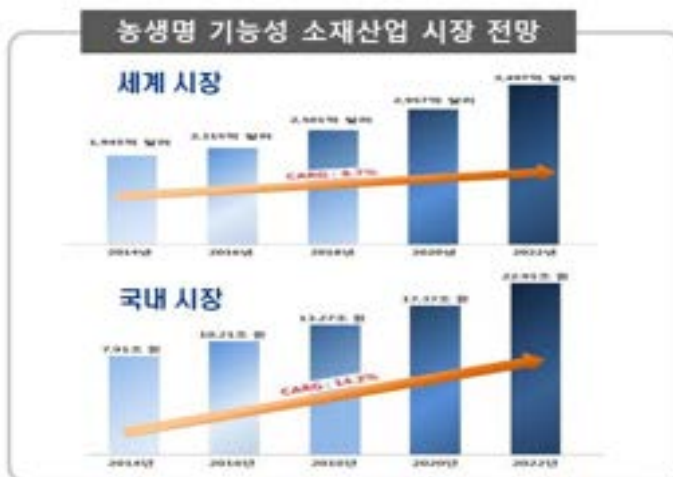


이용현황

❖ 한약재 위주 약용작물 이용 감소 : ('08) 5,468억원 → ('18) 7,607

❖ 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



▶ 산업화 성공 사례

❖ 지역특화 명품화 : 문경 오미자

- 생산, 가공 및 관광산업과 연계(6차산업화 추진)
- * 문경(경북) 재배면적: ('01) 22→('19) 1,117ha



❖ 우수 품종 육성·보급 : 지황

- 신품종(토강, 다강) 점유율 증가 : ('11) 0.4(1)→('19)150ha(75%)
- 지황 생산량 증가 : ('11) 563kg/10a→('19)755
- 지황 수입액 감소: ('07) 142억원→('15)100



❖ 면역강화 건기식 판매 증가 : 업체사례

- Covid-19 팬데믹으로 업체 매출 증가
- * '19년 4/4 분기 대비 '20년 4/4분기 100% 증가
- * '20년 단일품목 매출액 1,000억원



우수품종 + 스타상품 + 지역특화 조합으로 성장 동력 창출 가능

주요 정책현황

❖ 농식품부, 농진청 : 약용작물 진흥에 관한 업무

- 약용작물 재배, 생산, 유통, 품종개발 및 보급 등 지원
- 특용작물 산업 발전 종합대책 수립(2016. 3)
 - 국산 한약재 소비확대 및 유통관리 강화,
 - 고부가가치 창출, 생산기반 구축, 협업과 민간역량 강화
- GAP 인증 : ('11) 549ha → ('20) 3,976

❖ 복지부, 식약처 : 소비단계 안전성 강화를 위한 규제

- 수확 후 한약재 제조, 가공, 소비단계 관리
- 한의약육성법 제정('03), 시행
- 제4차 한의약육성발전 5개년 종합계획 수립('21-'25)
 - 근거 강화 및 신뢰도 제고, 한의약 접근성 제고,
 - 한의약 산업 육성, 선진 인프라 구축 및 국제경쟁력 강화
- GMP제도 도입('15)

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

배수로 따라 동종이초뿌리---학박사 안전관리 구역도
없다



소비자 불신

이용단계

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

신수요 대응 부족



성장동력 미 창출

약용작물 산업은 성장 잠재력에 비해 발전속도는 느린 상황

II

약용작물 R&D 주요 성과

1. 품종 개발
2. 안정·안전 생산기술 개발
3. 산업화 소재 개발
4. 기술보급 및 확산

1. 품종 개발

❖ 신품종 육성 : 34작물 107품종(~'20)

작목	품종	작목	품종	작목	품종	작목	품종
감초	원감 등 3	동굴레	건강백세	작약	의성 등 7	까마중	보라농
김국	만향 등 5	마	대화마 등 3	지모	지삼 등 2	독활	백미향
강활	대강	맥문동	청심 등 3	지치	대홍		
의성개나리	연정	백지	백지1호	일천궁	울릉종		
갯기름나물	식방풍 1호	산국	상괘	토천궁	신토		
결명자	명윤결명	삼주	다출 등 7	홍화	청수 등 4		
구기자	청양 등 16	시호	삼개 등 2	지황	토강 등 12		
도라지	장백 등 3	오미자	청순	황기	풍성 등 2		
참당귀	만추 등 3	오갈피나무	천수 등 2	단삼	다산 등 2		
일당귀	진일 등 2	율무	조현 등 9	우슬	우강		



뿌리 수량이 많은 '백출' '다출'



글리시리진 고품유 감초 '다강'



국내 최초 단삼 '다산'



꽃대발생이 늦은 당귀 '만추'

▶ 품종 개발·보급 사례

❖ 지황 : 병해충에 강한 '토강' ('09) 수량 많은 '다강' ('10)



→ 우수품종 보급으로 생산량 증가, 농가소득 향상 및 중국 수입대체

- 지황 신품종 보급률 : ('11) 0.4ha → ('17) 80(50%) → ('19) 145(80%)
- 농가 조수익 향상 : 3백40만/10a증가 (생산량 87.5% 증가)
- 생산 : ('08)583톤 → ('19)1,008 (8.7%/년↑), 수입 : ('08)1,225 → ('19) 778 (4.9%/년↓)



❖ 감초 : 글리시리진 고함유 ‘원감’ (‘13)

- 국내 수요 대부분 수입 의존(‘19, 국내 219톤, 수입량 2,020톤)
- 중간 교잡종(감초x광과감초) 국내 최초 육성품종
- 만주감초 대비 글리시리진 고함량(글리시리진 3.96%)

→ 수입대체 가능 국내 최초 육성 품종(성분고함유, 내병다수성)



감초(좌), 원감(우)

❖ 삼주 : 고품질, 다수성 삼주 ‘다출’ (‘08)

- 수입량 563톤(연도)로 국내 재배 시 수입대체 효과가 높음
- 중간 교잡종 (국내자생 삼주 x 도입 큰꽃삼주)
- 팽창재래 대비 수량이 높고, 약효성분(Atractylon) 함량 높음



팽창재래(좌), 다출(우)

▶ 약용작물 유전자원 보존 관리

❖ 농업유전자원센터와 약용작물과가 이원화하여 보존

- 농업유전자원센터 : 종자 중심, IT 등록 295종 5,675유전자원 보유
- 인삼특작부 : 영양체 보존, 작약 등 IT 등록 830종 8,382자원 보유

약용식물원 : 쥐오줌풀 등 910종

생약표본 : 도라지 등 750점

석엽표본 : 참당귀 등 10,602점



한국약용자원표본관



난.아열대 약초온실



약용자원 증식

2. 안정 · 안전생산 기술 개발

❖ 기후변화 대응 고품질 · 안정생산기술 개발

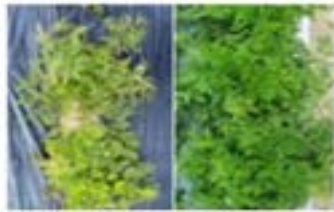
- 일천궁 고온경감 스마트 멀칭 신소재 개발 : 업 고사율 30% ↓, 생육 25~37% ↑
- 약용작물 종자 생산방법 매뉴얼 보급 : 원지 등 4작목

❖ 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 혼연 과정 삭제 제안(정책제안)



천궁 고온경감 효과



농약직권등록시험



병해충 농약등록



병해충관리책자

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)

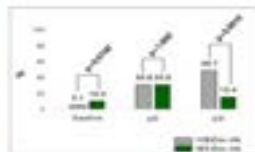
- (항스트레스) 인삼, (관절건강) 황기복합물, (간건강) 흑삼, 강황, (인지능) 기린초 (면역증진) 산수유, (항당뇨) 쓴썩바귀, (미백) 감초, 도라지

❖ 기능성 소재 산업체 기술이전('16~'20)

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



인삼 '뼈건강'



오가피열매 '혈압조절'



흑삼 기술이전 제품



인삼 기술이전 제품

4. 기술보급 및 확산

❖ 우량품종 개발·보급을 위한 중앙·지방 협의체 운영

- 농식품부, 농진청 주관 「약용작물 종자보급협의체」+「중앙지방연구협의체」 운영
- 전국을 5개 권역으로 나누어 보급종자 생산기반 구축 및 보급 추진
- ⇒ 우량종자 보급 : ('11) 11.3 → ('13) 18.5 → ('15) 19.4 → ('17) 19.8 → ('19) 21.8

❖ 개발 우량 품종의 농가 조기 보급을 위한 보급경로 다양화

- 종자보급센터(안동, 장흥, 함양, 제주, 제천), 실용화재단(익산), 민간 통상실시 등
- ⇒ 지황 통상실시 확대('17~'24): 실용화재단, ㈜바이오애그 등 기관·민간 4 (26톤)

❖ 생물소재 국산화를 위한 농가/기업 계약재배 매칭 지원

- (기업)원료구매 등 애로사항요청 → (농진청)니즈해결 → (농가)원료재배·제공
- ⇒ 원예원/생물자원관/한국바이오협회/기업·농가 다자간 업무협약 체결('20년 11월)



연구협의체 온라인 워크숍



지황 조직배양묘 대량 보급



생물소재 국산화 MOU

Ⅲ

고부가 산업화 전략

1. SWOT 분석
2. 비전 및 전략목표
3. 산업화 추진체계
4. 분야별 추진계획
5. 기대효과

1. SWOT분석

강점(Strength)

- 국산 원료에 대한 인식 제고
- 수준 높은 품종육성 기술 보유
- 고품질 원료 안정생산기술 보유
- BT, IT, NT 등 세계적 수준의 관련 첨단기술 이용 가능

약점(Weakness)

- 수출확대를 위한 안전생산기반 미흡
- 생산성 향상 · 생력화 기술 개발 부진
- 품질 고급화 · 부가가치 향상 기술 미흡
- 산업체 활용할 빅데이터 구축 미흡

기회(Opportunity)

- 고령화 · 웰빙 관련 농산업 시장 확대
- 안전성, 기능성 중심의 소비문화 확산
- 신식품 정책에 따른 식품R&D 확대
- 관련산업 기능성 소재 확대 전망

위협(Threat)

- 대외시장개방 확대, 나고야의정서 발효
- PLS 시행 등 국내 안전성 기준 강화
- 농산물 안전성·부정유통에 대한 소비자 신뢰 감소
- 재배환경 악화로 안정생산 위협

SO 전략

- 고품질 생산기술 개발을 통한 국내 소비 시장 안정화
- 수출용 인삼특작 명품 브랜드화로 글로벌 시장 확대
- BT, IT, NT 등 첨단기술 융복합화로 고부가가치 소재 개발

WO 전략

- 친환경, 안전생산기술 개발
- 생산성 향상 및 생력재배기술 적극 개발
- 고품질 품종 및 종자 개발·보급체계 구축
- 효능·기능성의 과학적 규명 및 빅데이터 구축

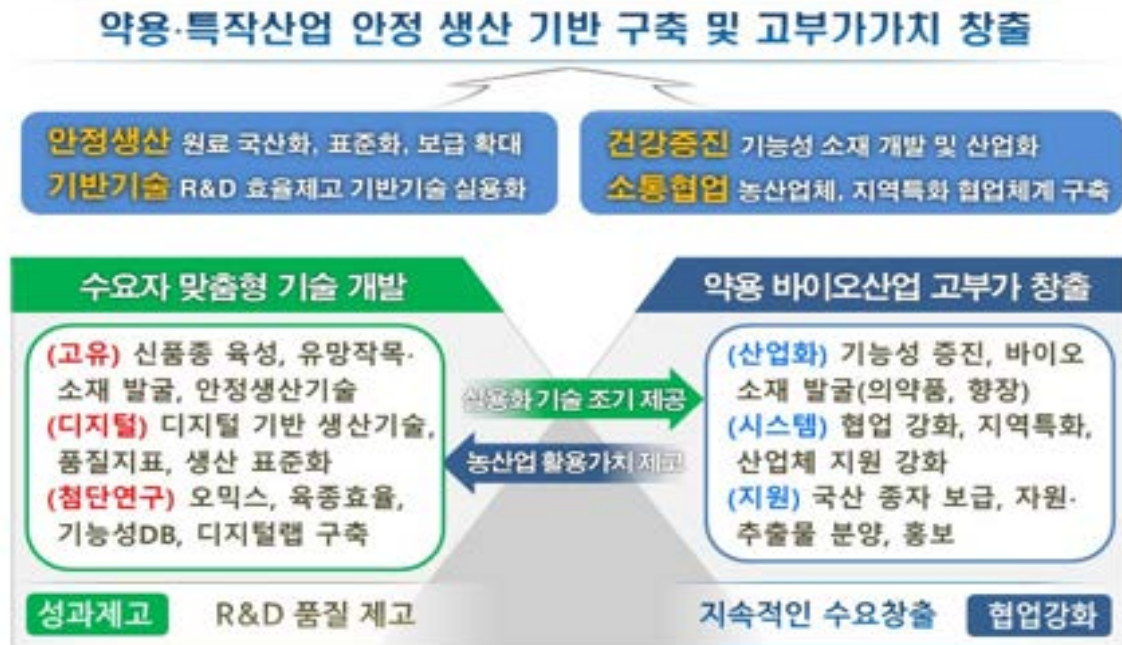
ST 전략

- 고부가 기능성 소재 R&D 강화
- 안전생산 강화 및 유통체계 확립
- 시장 요구에 대응한 제품 개발 강화
- 반려동물용 제품개발 연구 확대

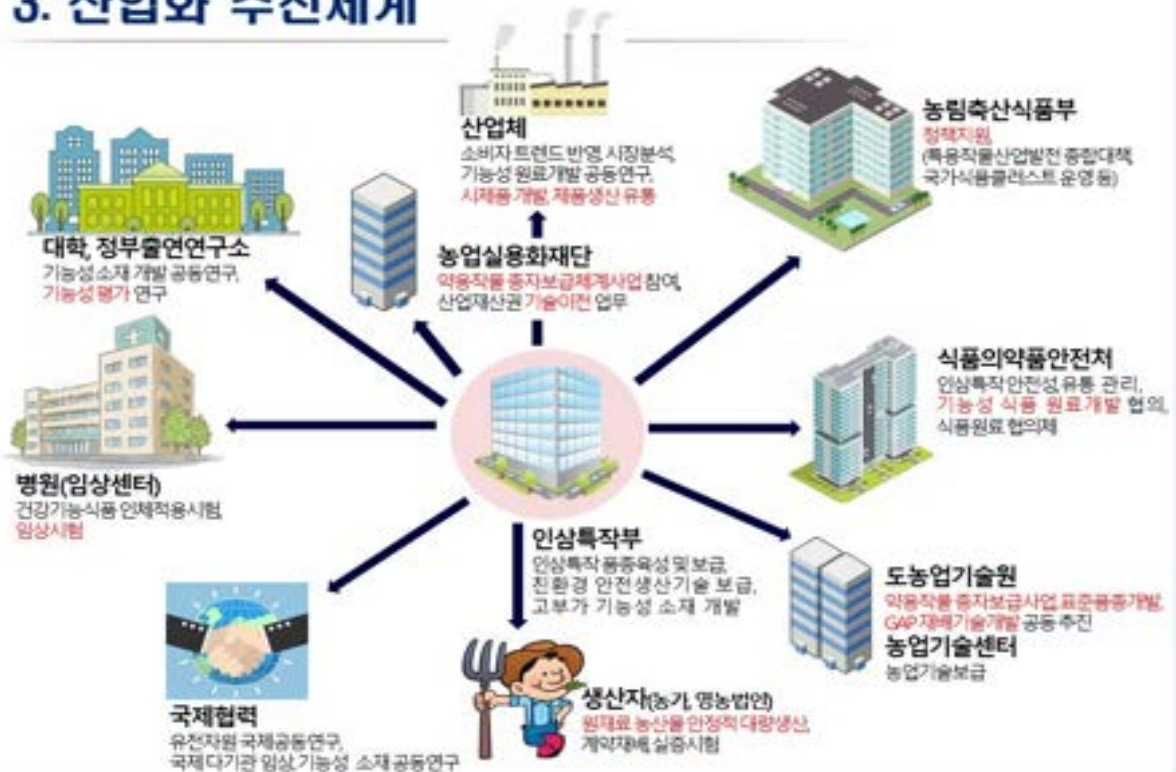
WT 전략

- 시장개방에 대응, 세계시장 타겟 제품 개발
- 기후변화 대응 품종 및 기술 개발 지속
- 안전성 강화 기술 개발 및 보급 강화
- 관련법 개정에 의한 특용작물 발전기반 확보

2. 비전 및 전략목표



3. 산업화 추진체계



4. 분야별 추진계획

품종개발

❖ 전략 육종 작목 : 사용량과 성장 잠재력이 높은 작목

- ▶ 사용량 多, 수입량 多, 국내재배 小 : 감초, 지황, 작약, 삼주, 천궁
- ▶ 사용량 多, 수입량 多, 국내재배 多
 - 한약재/식품 수입 : 도라지, 황기, 식품 수입 : 오미자, 더덕, 참당귀
- ▶ 사용량 多, 수입량 小, 국내재배 多 : 마, 복분자, 식방풍, 울무, 독활, 오가피
- ▶ 미래 수요 대응 : 어성초, 영경귀, 반하, 대황, 강황 등

❖ 연구방향 : 현장수요 중심, 데이터 기반 효율성 제고

- ▶ 고객 확대 : 생산자 중심 → 가공업체, 소비자 Needs 반영
- ▶ 육종체계 구축 : 내병성·성분 등 특성검정 체계 구축 등
- ▶ 육종방법 다양화 : 돌연변이 육종, 반수체·배수체 육종, 분자 육종 등

⇒ 약용 → 특용자원 연구영역 확대 : 특용자원개발연구실 신설

❖ 품종 미개발 품목 표준품종 개발 (9기관, 28작목)

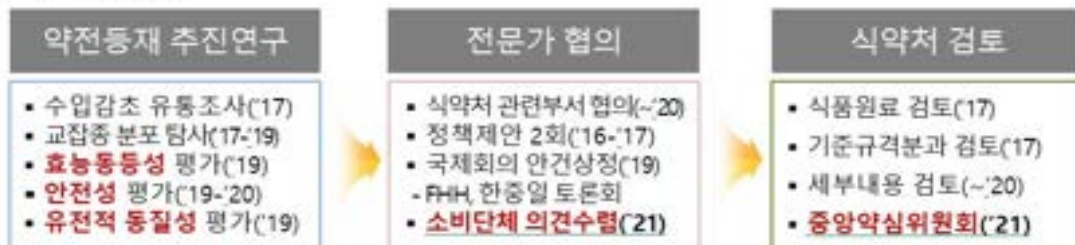
- 1단계 사업('17~'21) : 더위지기, 하수오, 형개 등 10품목
- 2단계 사업('22~'26) : 더덕, 백수오, 원지, 삼백초 등 18품목



⇒ 중앙·지방 공동연구 지속 → 국가·지방 주도 전략 특화작목 육성

▶ 감초 중간교잡종 약전등재 추진

❖ 추진경과



❖ 핵심 추진 내용

- 감초 '원감'의 약전등재 보완 요청자료 제출 및 입증 완료
 - * 교잡종/기원식물간의 효능동등성, 유전 동일성, 안전성(무독성) 입증
- 교잡종의 자연집단 서식 확인 및 신종(*G. korshinskyi*)과 동일종임을 확인

❖ 금후계획

- 식약처 주관 식물동정 및 최종 실무협의회를 거쳐 중앙약사심의회 상정(5월)

안정·안전 생산기술

❖ 연작장해 : 원인 구명, 경감기술 개발

- 원인구명: 생물학적 요인, 화학적 요인 등
- 경감기술: 토양 개선, 미생물상(Microbiome) 조성
- 작부체계: 인삼, 약초 후작물 선발, 작부체계 설정

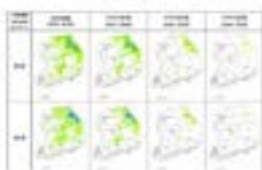


❖ 기후변화 대응 : 영향평가, 노지 디지털농업 기술

- 재배적지 선정, 변동성 평가 : 천궁, 당귀 (2작목) → 감초, 홍화, 황기 등 (5작목)
- 노지 디지털농업: 온도 경감 필름, 정밀 물관리 기술 + 데이터 수집, 진단, 분석

❖ PLS 대응 : 문제병해충 농약직권등록, 친환경 신소재 선발

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



천궁, 당귀 전자기후도



고온 경감 필름 효과 구명



PLS 대응 농약 선발

▶ 노지 디지털농업 실증포 조성



❖ 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)

새로운 용도 발굴

❖ 의료용 대마 연구 : 품종, 생산·품질 표준화

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



의료용 대마 품종

❖ 용도 다양화 : 품목 발굴, 표준화 기술

- 품목 : 울무새싹 → 대마새싹, 싹채소 등,
- 표준화 : 실내 생산 기술, 표준화 모델 개발

❖ 미래 수요 발굴 : 간편식용, 도시·치유농업용 소재 등

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

▶ **특용자원 실내 디지털 생산 연구시설** ('21~'23)

- 특징 : 온도·습도·인공광·양액 등 정밀 환경조절
 - 구성 : 육묘·재배·교배·가공·분석실, 제어실
- 의료용 대마 등 실내 생산 가능 **고부가 작물 발굴**
연중생산 시스템 구축을 통한 **품종육성 기간 단축**
유효성분 중심 고품질 생산 표준체계 확립



☞ 식물공장형 고부가 비즈니스 모델(BM) 개발

▶ 특용자원 기능성 추출물 생산 활용 시스템 구축 ('22~'24)

- 특징 : 추출물 은행 및 DB, 디지털 관리 시스템
 - 구성 : 원료 준비실, 조제실, 보관실, 추출실, 저장고
기능성 품질평가실, 성분분석실, WEB시스템
- 원료관리~추출물 평가 등 연구 인프라 구축
자원 정보 표준화 등 개방·공유 서비스 제공



식·의약 소재 활용, 시장 다양성 맞춤 기능성 소재 창출

혈액체계 구축

❖ 중앙지방연구협의체, 종자보급 협의체 운영 강화

- 우수 약용작물 품종 개발·생산·보급을 위한 컨트롤 타워 역할 강화
* 약용작물 표준품종 개발, 종자 효율적 보급 방안 논의 및 추진상황 점검

❖ **인삼특작 대외소통 강화**

- 운영 : 『인삼특작포럼』 내외부 200여명
 - * 산, 학, 관, 연, 농민·청년농업인, 단체, 소비자 등
- 내용 : 다양한 분야 전문가 소통 및 중장기 발전계획 수립
 - * 정기총회, 관련산업 전문가 모임, 현안 토론회 등

❖ **인삼특작분야 청년 창업농 육성 지원**

- 운영 : 『청년 창업농 지원단』 30명
- 내용 : 청년 창업농 성장 단계별 맞춤형 지원
성공·실패 사례 공유, 현장소통, 기술확산



5. 기대효과

수혜자	As-is	→	To-be
농업	<ul style="list-style-type: none"> 생산성 위주 농업의 포화 농업의 지속가능성 위기 (임여농산물, 농업부산물 폐기) 		<ul style="list-style-type: none"> 새로운 기능성 소재개발로 부가가치 향상 - 농산업의 미래성장산업으로의 전환 부산물 활용 기능성 소재 개발 확대
농가	<ul style="list-style-type: none"> 소재개발과 농가소득연계부족 (농가소득 창출 미흡) 		<ul style="list-style-type: none"> 생산단지조성, 재배표준화로 안정적 생산 원료의 안정적인 생산과 공급처 확보
산업체	<ul style="list-style-type: none"> 국내 소재·원물 수급 애로 (대량생산 등 품질 표준화) 		<ul style="list-style-type: none"> 국내 소재·원물 안정적 수급처 확보 원물 품질 표준화, 대량생산체계 확립 생산공정 표준화로 산업화 구축
소비자	<ul style="list-style-type: none"> 천연식물소재 제품 요구 		<ul style="list-style-type: none"> 천연물 유래 소재·제품을 통한 국민건강 사회변화에 맞는 다양한 제품



경청해 주셔서 감사합니다.

**녹차 및 홍차에서
코로나19 바이러스의 성분의
효소 억제 증명**

**박준수 교수
(연세대학교)**

녹차 및 홍차에서 코로나19 바이러스의 성분의 효소 억제 증명

Tea Polyphenols EGCG and Theaflavin Inhibit the Activity of
SARS-CoV-2 3CL-Protease *In Vitro*

박준수

연세대학교 생명과학기술학부

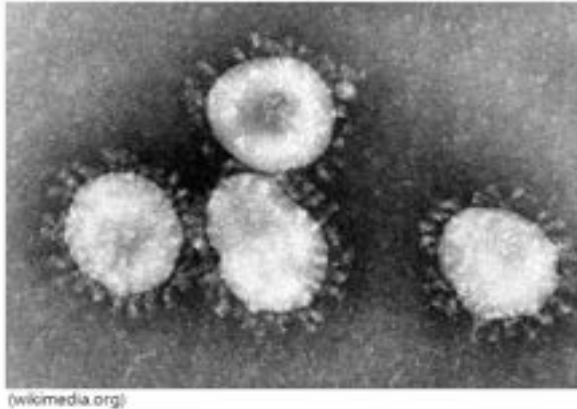
코로나로 인한 인명피해 현황 (2021.04)

전 세계						
150,293,090 (+500,770) 확진자	3,165,032 (+9,740) 사망자	128,335,318 (+531,730) 과리해제	2.11% 치명률			221 (-) 발생국
대한민국						
120,673 (-) 확진자	1,821 (-) 사망자	110,248 (-) 과리해제	1.51% 치명률	8,766,498 (-) 중증사자	77,166 (-) 검사중	8,568,659 (-) 결과통정

(<http://coronaboard.kr>)

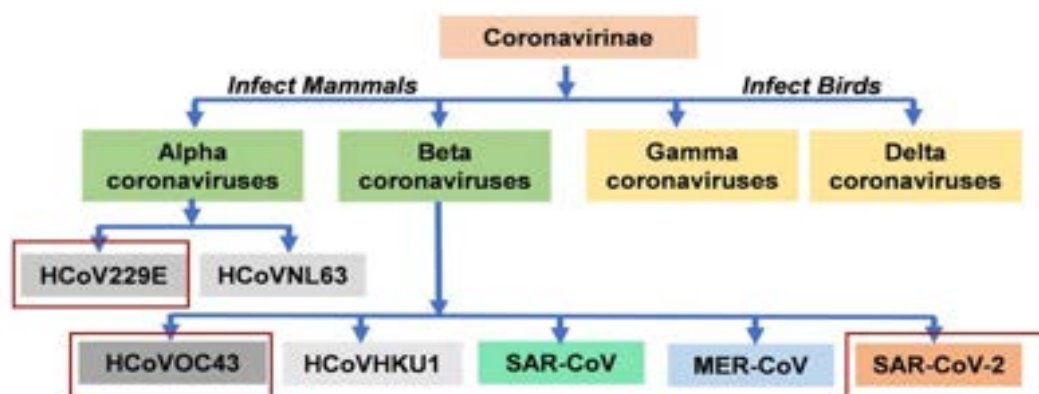
- Spanish flu (1918-1919) 40~50M death
- HIV/AIDS (1981-present) 25~35M death
- **COVID-19 (2019-present) 3M death**
- Asian flu (1957-1958) 1.1M death
- Hong Kong flu (1968-1970) 1M death
- Swine flu (2019-2020) 200K death

Coronavirus



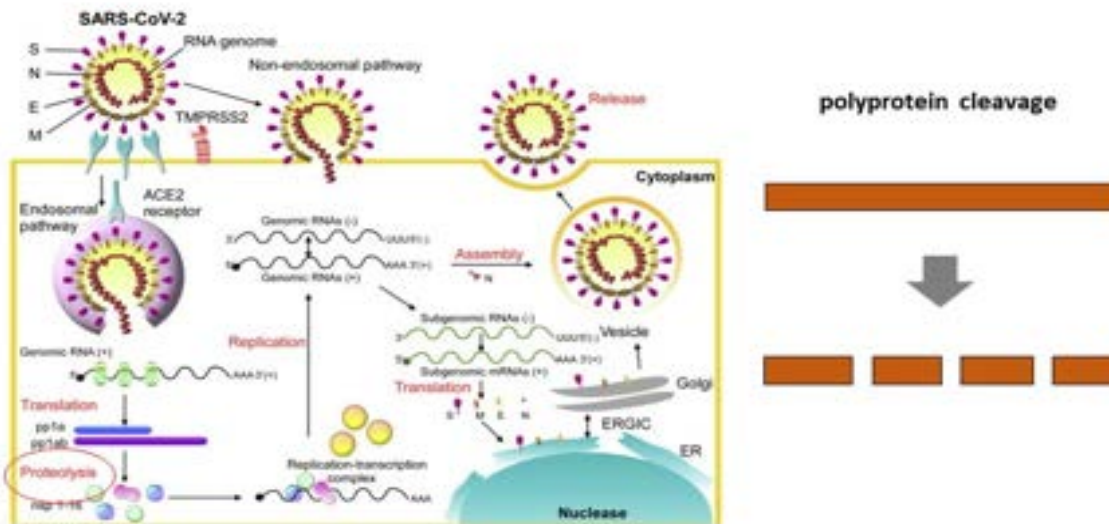
- Solar corona shape
- positive sense ssRNA virus
- Genome size: 26~32 kb
- One of the largest RNA virus

Human coronavirus (HCoV)



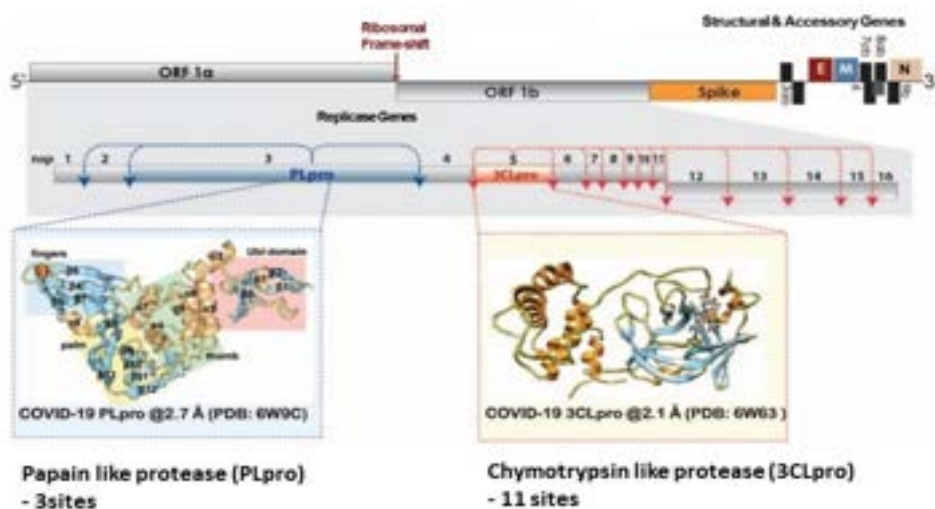
(Hokello, J et al Ann Transl Med (2020))

Coronavirus life cycle



Liu et al (2020) Biomedical Journal

Coronavirus protease



ChemMedChem, Volume 15, Issue 11, Pages: 567-532, First published: 23 April 2020, DOI: (10.1002/cmdc.202000223)

Viral protease inhibitors

HIV protease inhibitors

- saquinavir, indinavir, ritonavir, nelfinavir, amprenavir, lopinavir, atazanavir, tipranavir, darunavir

HCV protease inhibitors

- telaprevir, boceprevir, narlaprevir, danoprevir, vaniprevir

Coronavirus 3CL protease (Mpro) is the target for antivirals



Molecular dynamic simulations analysis of ritronavir and lopinavir as SARS-CoV 3CL^{pro} inhibitors

Veena Nukoolkarn^{a,*}, Vannajan Sanghiran Lee^b, Maturus Malaisree^c, Orngira Anaksakulwong^d, Sapet Hansongthai^{e,*}

^aDepartment of Pharmacology, Faculty of Pharmacy, Mahidol University, Bangkok 10120, Thailand
^bComputational Simulation and Modeling Laboratory (CSML), Department of Chemistry, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand
^cComputer Chemistry Unit (CCU), Department of Chemistry, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand
^dDepartment of Chemistry, Faculty of Science, Rajabhat University, Phrae 52000, Thailand



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bioRxiv is receiving many new papers on coronavirus SARS-CoV-2. A reminder: these are preliminary reports that have not been peer-reviewed and should not guide clinical practice.

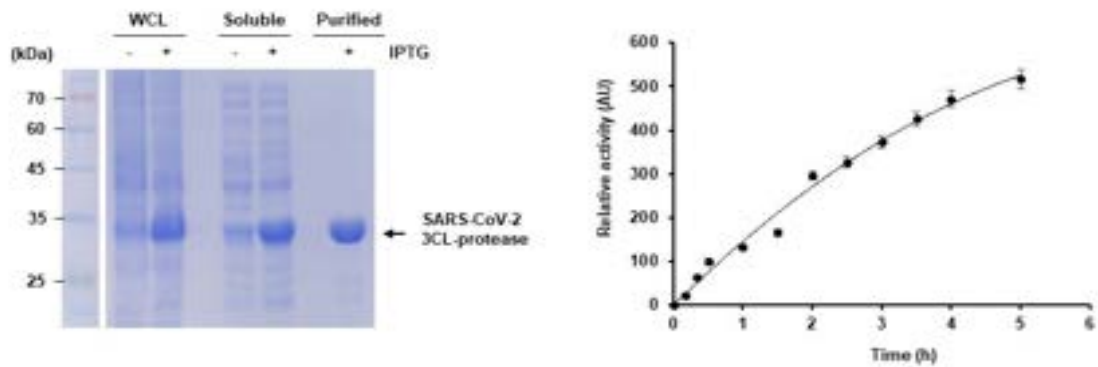
New Results

Comments (1)

Nelfinavir was predicted to be a potential inhibitor of 2019-nCoV main protease by an integrative approach combining homology modelling, molecular docking and binding free energy calculation

Zhen Xu, Cheng Peng, Yalong Shi, Zhongdan Zhu, Kaijie Mu, Xinyi Wang, Wiliang Zhu
doi: <https://doi.org/10.1101/2020.01.27.919427>

Expression of SARS-CoV-2 3CL-protease



FRET-based assay

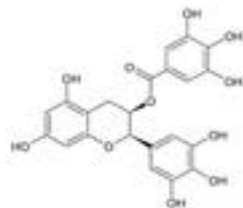
(Park J et al. eCAM (2020))

Screening of 3CL-protease inhibitors

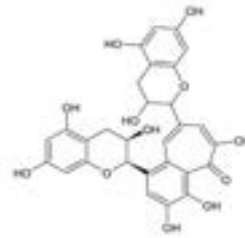


Natural product single compound library+ Herbal extracts

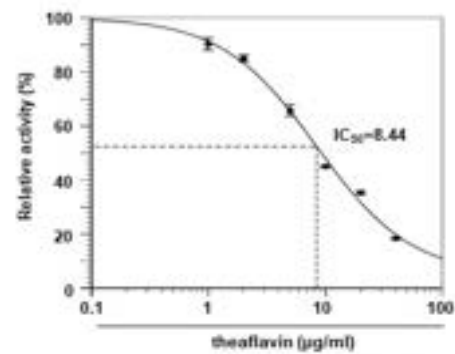
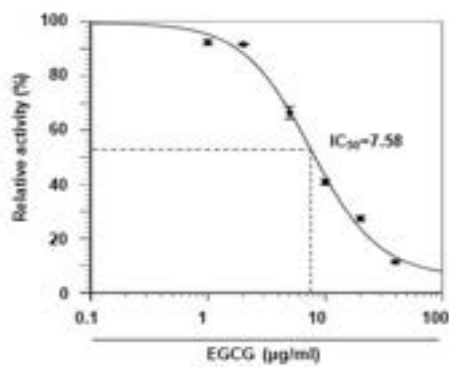
EGCG and theaflavin inhibit 3CL-protease activity



Epigallocatechin-3-gallate (EGCG)

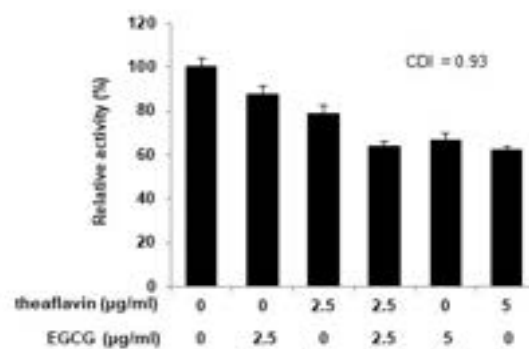


Theaflavin



(Park J et al. eCAM (2020))

EGCG and theaflavin have an additive effect



(Park J et al. eCAM (2020))

Related previous researches

Year	Author	Title
1998	Clark et al.	An in vitro study of theaflavins extracted from black tea to neutralize bovine rotavirus and bovine coronavirus infections
2005	Chen et al.	Inhibition of SARS-CoV 3C-like protease activity by theaflavin-3, 3'-digallate (TF3)
2005	Matsumoto et al.	Inhibitory effects of epigallocatechin gallate on the propagation of bovine coronavirus in Madin-Darby bovine kidney cells
2012	Nguyen et al.	Flavonoid-mediated inhibition of SARS coronavirus 3C-like protease expressed in <i>Pichia pastoris</i>

Green tea consumption- a possible correlation?

Polyphenols and teaflavins in green and black teas against SARS-CoV-2 (Covid-19)

By Bernard Suter · September 21, 2020 · CC Unclassified

I recently described the work of Indian researchers demonstrating the effectiveness of polyphenols contained in green tea to inhibit the protease enzyme of the coronavirus SARS-CoV-2, which causes COVID-19: <https://wordpress.com/view/www.bernardsuter.net>

However, a new publication by South Korean researchers also reports the same effectiveness of polyphenols in green and black teas, now including other molecules, epigallocatechin gallate in green tea and theaflavin, the main polyphenol in black tea, in inhibiting the 3C_{pro} protease enzyme: "Tea polyphenols EGCG and theaflavin inhibit SARS-CoV-2 3C_{pro} protease activity in vitro" <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7495261/>



BERNARD SUTER

It would be wise to follow the evolution of the cases of Covid-19 in populations that regularly use green tea and black tea in order to show a possible correlation with a potential protection of these populations, particularly in Asian countries (China, Japan, South Korea, Taiwan, etc.)

Could green tea catechins reduce the risks?

Table 3

Adjusted for the onset COVID-19 morbidity (per one million population) and mortality (per one million population) in relation to per/capita green tea consumption.

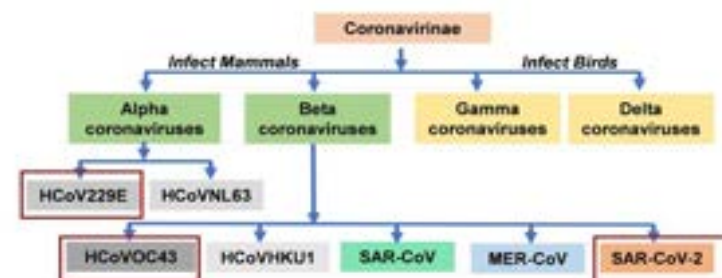
	Group 1 (countries with 'high' green tea consumption)	Group 2 (countries with 'low' or undetermined green tea consumption)	Group 3 (countries with 'low' green tea consumption)
	N=20	N=105	N=78
COVID-19 morbidity	571 (88-1023)	1724 ^{***} (350-5195)	2611 ^{***} (566-5673)
COVID-19 mortality	8 (3-23)	37 ^{***} (8-155)	62 ^{***} (13-192)

^{***}Values are: median, IQR. ^{**}(P<0.01) and ^{***}(P<0.001) denote significance level of difference as compared to Group 1 (Wilcoxon (Mann-Whitney U Test) for Unpaired Data). Values represent epidemic situation five month after the onset of the disease (see Methods for more details).

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THE PREPRINT SERVER FOR HEALTH SCIENCES

Higher green tea consumption is associated with lower COVID-19 morbidity/mortality at the level of ecological study

229E and OC43 – human coronavirus model system



```

HCoV-229E 1 A C R K K A G P S C V E K C V V Y T G T L N G L W L C V C F A R V E L S H T Y - S A I D V R E Y S I M R L N H E E S T A P F C V C A
SARS-CoV-2 1 S P F K E K N P S S K V E C C V V E S E T L N G L W L C V C F A R V E C T E S K L T P H R D C T K R M M L C A S H V C R N I S H
HCoV-OC43 1 S C I V E V H D T R V E F C V V V T Y G M P L N G L W L C V C F A R V E C S A S K T N F D T H A C N T E S D G R N L F D A L S P R E Y

HCoV-229E 80 T H C V T L E K Y G O Y H H T E R R A T H G S E C P S L A C T G C A N G V F C H R P V H T E S E F F R A C E P S Y L K M G E S H Q
SARS-CoV-2 81 H C Q H V L L A V D F A P P F F E L V V S C P C E F V L A R Y H S P S V V C A M P P M P F I K S S F M S G G S V G E N I D V C A S C
HCoV-OC43 83 Q A C S C L P T T T L C S R C P A S T D C V Y Y E P G E T T F V L A T M S R C C A I M G T M S Y T I K S S F C S C C S V G V Y S H O C S A G

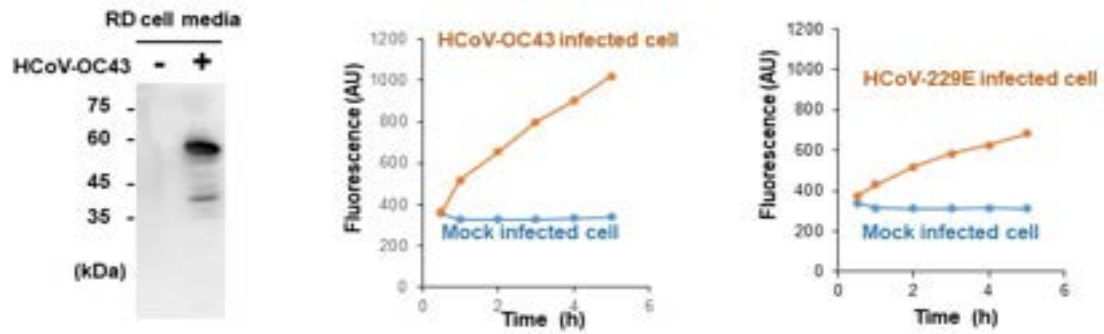
HCoV-229E 160 Y A H K C P G S S R V R E S C P V H T G C C P P H C V E R A H M C V H V V A G L T A A I L N G C T W U R G R G L F W S Y T C A A D I T F
SARS-CoV-2 161 Y A H K C P G C A C Y D L E C H Y G F F V R E T A A A G T Y T T E V H S A N L Y A A I N G D P F F H R F T T E L K G F L V M R Y T E
HCoV-OC43 161 Y A H K C P G C A C Y D L E C H Y G F F V R E T A A A G T Y T T E V H S A N L Y A A I N G D P F F H R F T T E L K G F L V M R Y T E

HCoV-229E 240 A H N G E D A - - F S I L A K P G V C V D E A L A I - Q V N H G P C R C I L G I S E L D E F I K R V C W P Q V V C C
SARS-CoV-2 241 P S T O H D I S G P S A G C E A C M C S E K E L C W H M C R C I G S A L D E D E F T P Q V V C C S V T T C
HCoV-OC43 241 Q V R S L L - - E D A L I H M G V S L E A L A I - K R N I N G F O R G I N G C S F E D E R P P S V T C C L A G E K G

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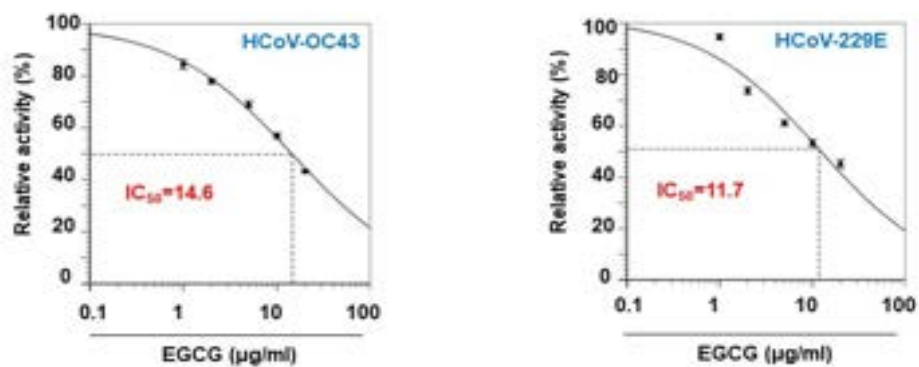
(Park J et al, BBRC[2021])

229E and OC43 show 3CL protease activity



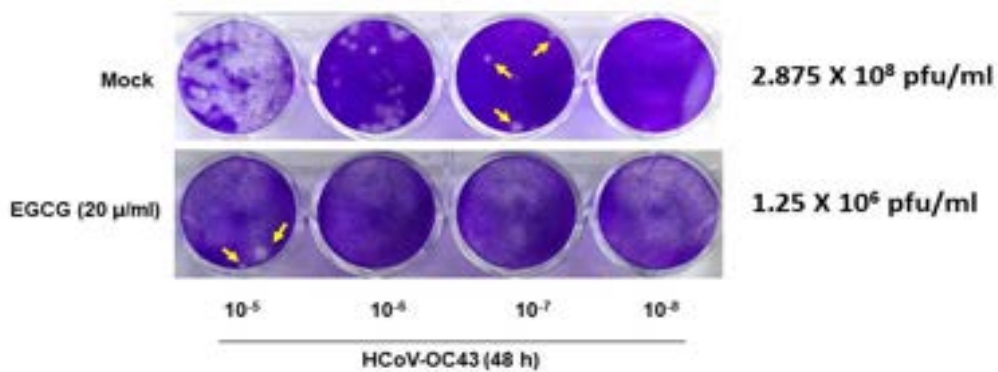
(Park J et al, BBRC(2021))

EGCG inhibits 3CL-protease activity of OC43 and 229E



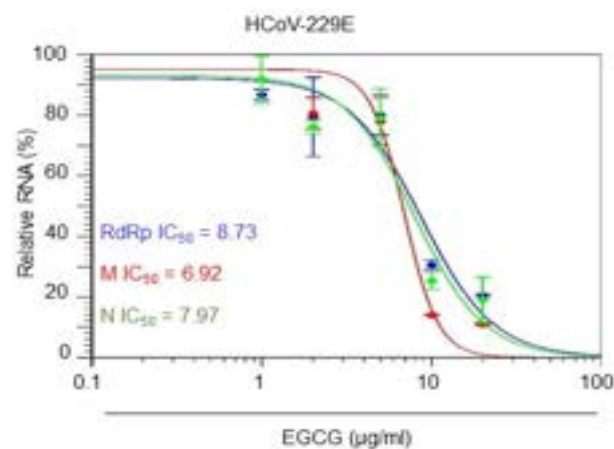
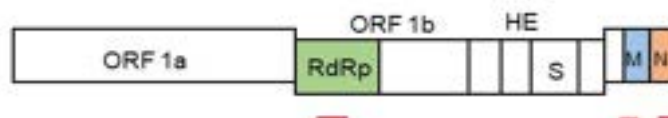
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EGCG reduces HCoV-OC43 induced plaque formation



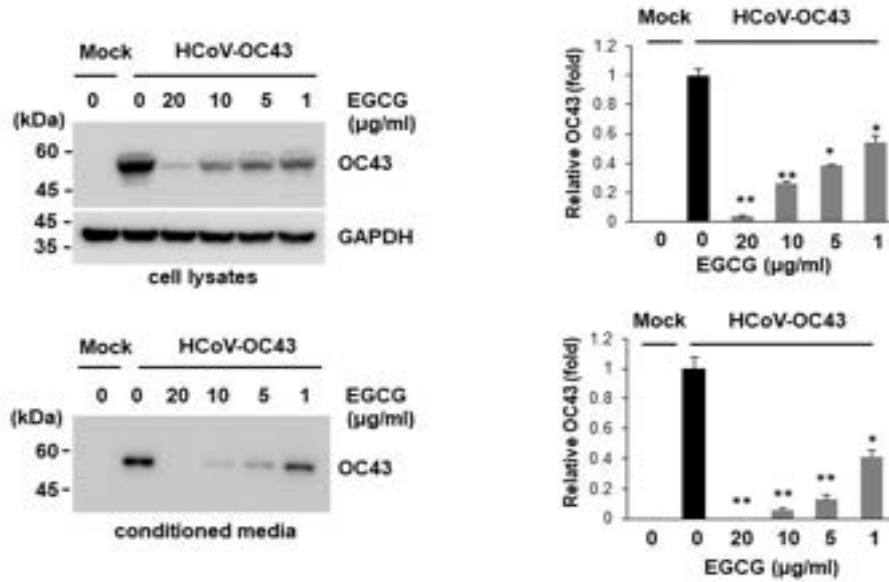
(Park J et al, BBRC(2021))

EGCG inhibits coronavirus replication-HCoV-229E



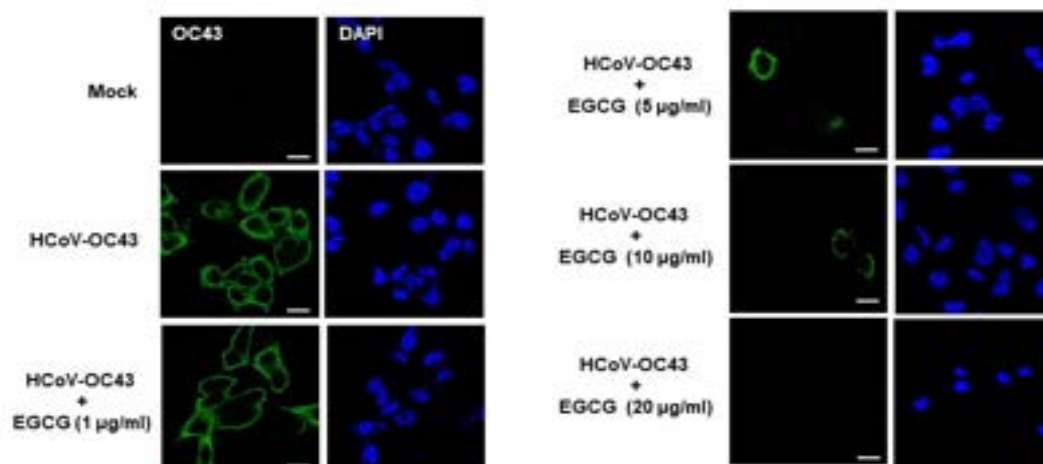
(Park J et al, BBRC(2021))

EGCG inhibits coronavirus replication-HCoV-OC43



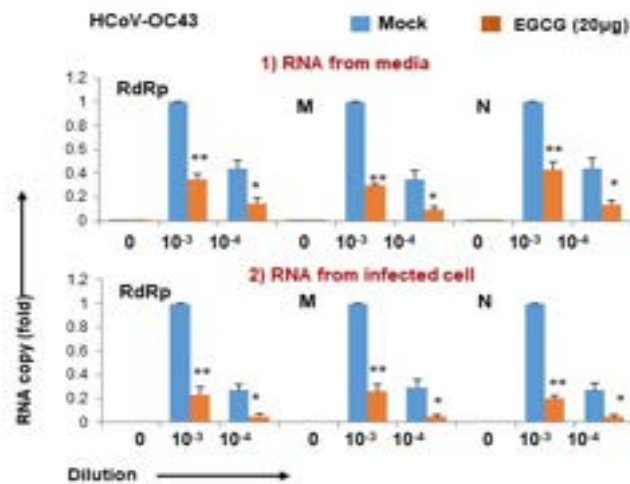
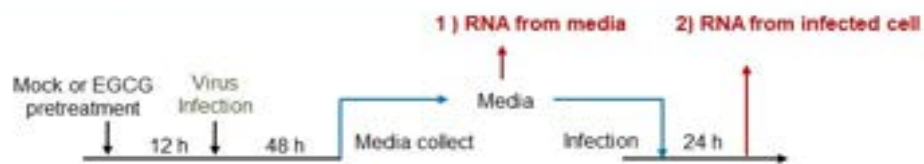
(Park J et al, BBRC(2021))

EGCG inhibits coronavirus replication-HCoV-OC43



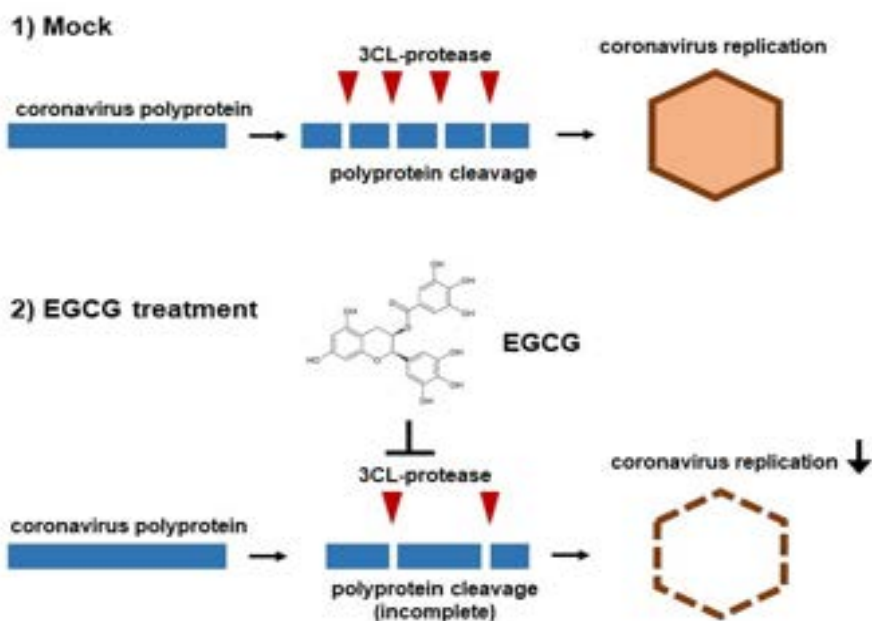
(Park J et al, BBRC(2021))

EGCG inhibits coronavirus infectivity-HCoV-OC43



(Park J et al, BBRC(2021))

Mechanism



(Park J et al, BBRC(2021))

EGCG IC₅₀ – coronavirus 3CL-protease

virus	IC ₅₀	references
SARS-CoV-2	7.58 µg/ml (16.5 µM)	(1)
SARS-CoV-2	4.24 µM	(2)
SARS-CoV-2	7.51 µM	(3)
SARS-CoV-2	0.847 µM	(4)
SARS-CoV	24.98 µM	(2)
SARS-CoV	>100 µM	(5)
SARS-CoV	73 µM	(6)
HCoV-OC43	14.6 µg/ml (31.8 µM)	(7)
HCoV-229E	11.7 µg/ml (25.5 µM)	(7)

SARS-CoV-2 IC₅₀
0.846~16.5 µM

1. Jang, M., et al., Tea Polyphenols: EGCG and Theaflavin Inhibit the Activity of SARS-CoV-2 3CL-Protease In Vitro. *Evid Based Complement Alternat Med*, 2020. 2020: p. 5630838.
2. Chiu, W.C., et al., The inhibitory effects of PGG and EGCG against the SARS-CoV-2 3C-like protease. *Biochem Biophys Res Commun*, 2021.
3. Zhu, Y. and D.Y. Xie, Docking Characterization and in vitro inhibitory Activity of Flavan-3-ols and Dimeric Proanthocyanidins Against the Main Protease Activity of SARS-CoV-2. *Front Plant Sci*, 2020. 11: p. 601316.
4. Du, A., et al., Epigallocatechin-3-gallate, an active ingredient of Traditional Chinese Medicines, inhibits the 3CLpro activity of SARS-CoV-2. *Int J Biol Macromol*, 2021.
5. Chen, C.N., et al., Inhibition of SARS-CoV 3C-like Protease Activity by Theaflavin-3,3'-digallate (TF3). *Evid Based Complement Alternat Med*, 2005. 2(2): p. 209-215.
6. Nguyen, T.T., et al., Flavonoid-mediated inhibition of SARS coronavirus 3C-like protease expressed in *Pichia pastoris*. *Biotechnol Lett*, 2012. 34(5): p. 831-8.
7. Jang, M., et al., EGCG, a green tea polyphenol, inhibits human coronavirus replication in vitro. *Biochem Biophys Res Commun*, 2021(547): p. 23-28.

(Park J et al, Life(2021))

학술 강연

2부

좌장 임병우 교수
(건국대학교)

개인 맞춤형 면역능 향상을 위한 약용작물의 활용성 증대

유영춘 교수
(건양대학교)

개인 맞춤형 면역능 향상을 위한 약용작물의 활용성 증대

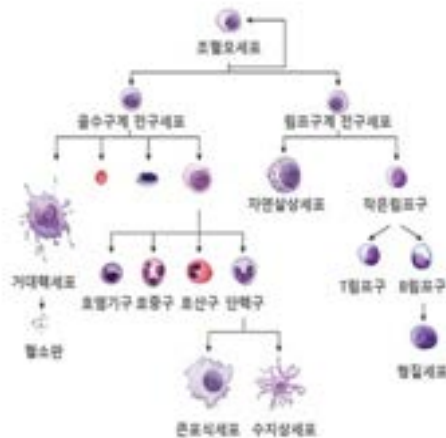
유 영춘

건양대학교 의과대학

면역이란?

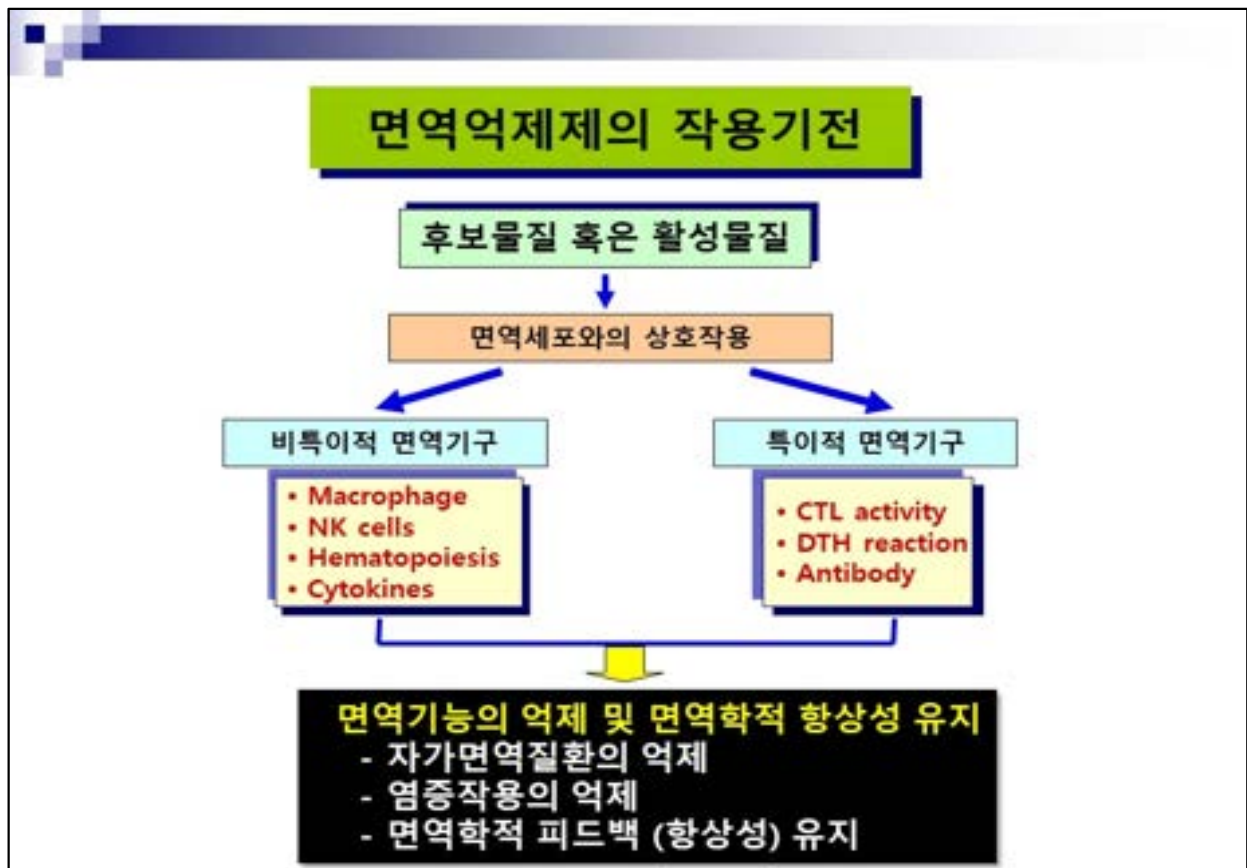
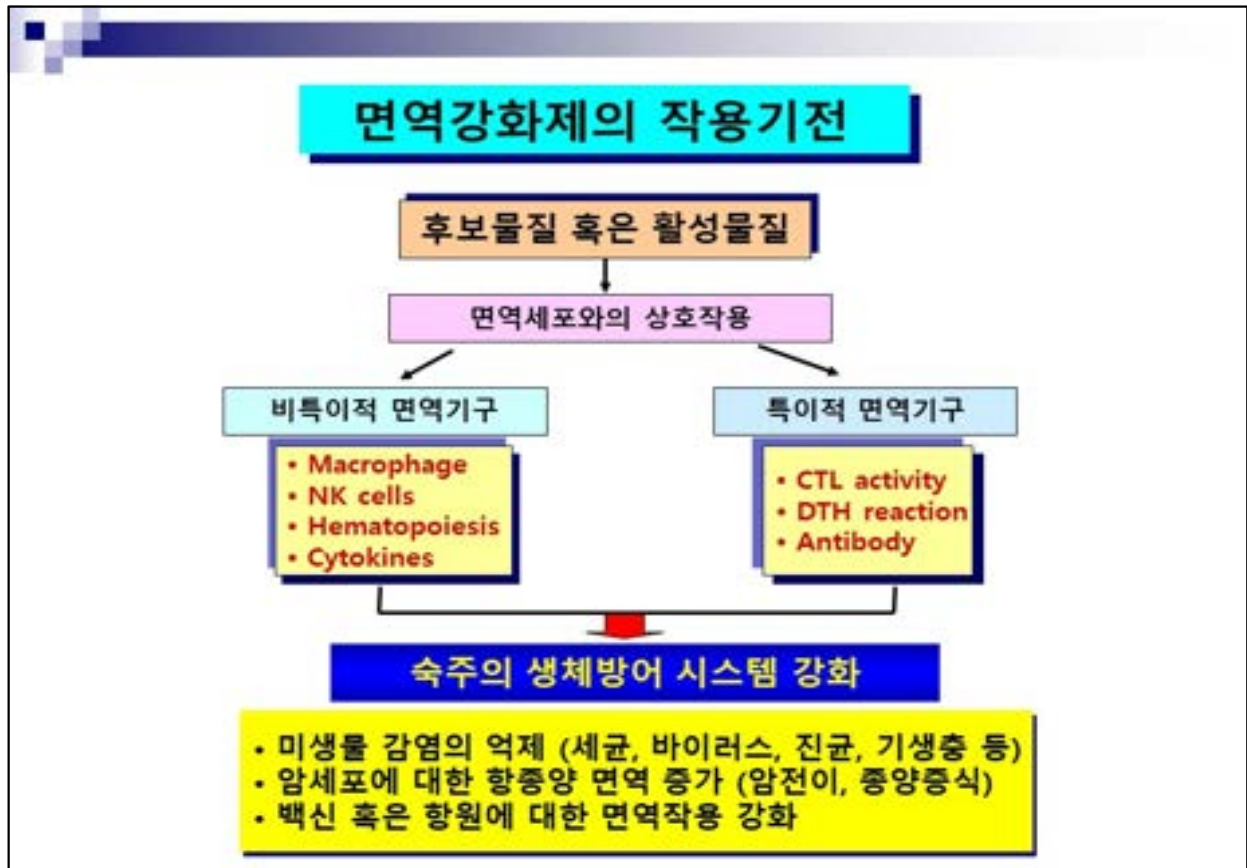
- ▶ 면역(immunity)의 의미: 라틴어 immunitas(보호되다)에서 유래
 - 1) 면역계: 면역에 관여하는 세포와 분자들의 총칭
 - 2) 면역반응: 외래물질(항원)에 대한 면역계의 종합적인 반응.
감염미생물은 물론 비감염성 외래물질에 대한 반응
- ▶ 면역반응은 침입원 제거는 물론 조직손상이나 질병도 유발하며, 자기 분자에 대해서도 면역반응(자가면역반응)을 야기할 수도 있음.
- ▶ 면역반응에 의한 최초의 예방접종: Edward Jenner에 의한 천연두 예방접종 → Vaccination('소의' 혹은 '소로부터'의 의미)

면역세포 및 면역시스템

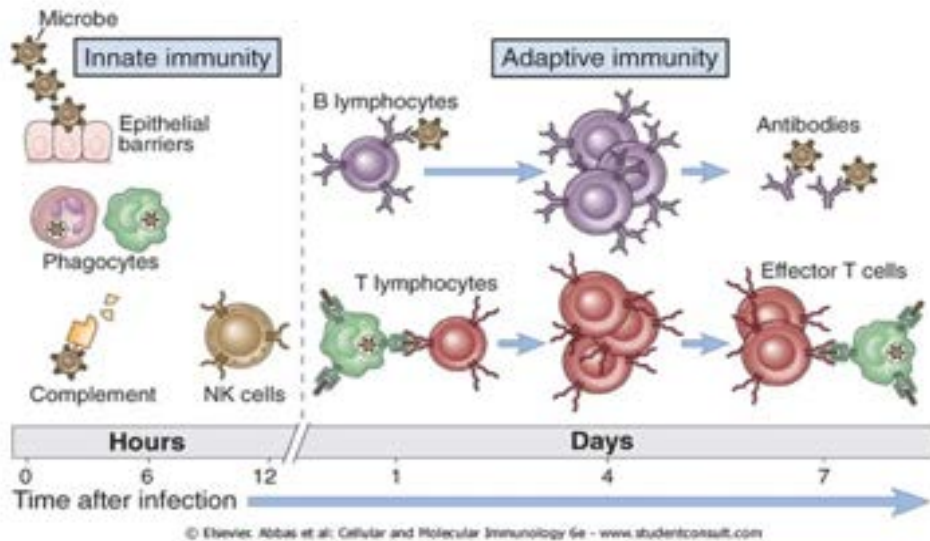


면역조절(immunomodulation)이란 ?

- 면역증강 (Immunopotentialiation)
- 면역억제 (Immunosuppression)



선천면역과 후천면역 (Innate and Adaptive Immunity)



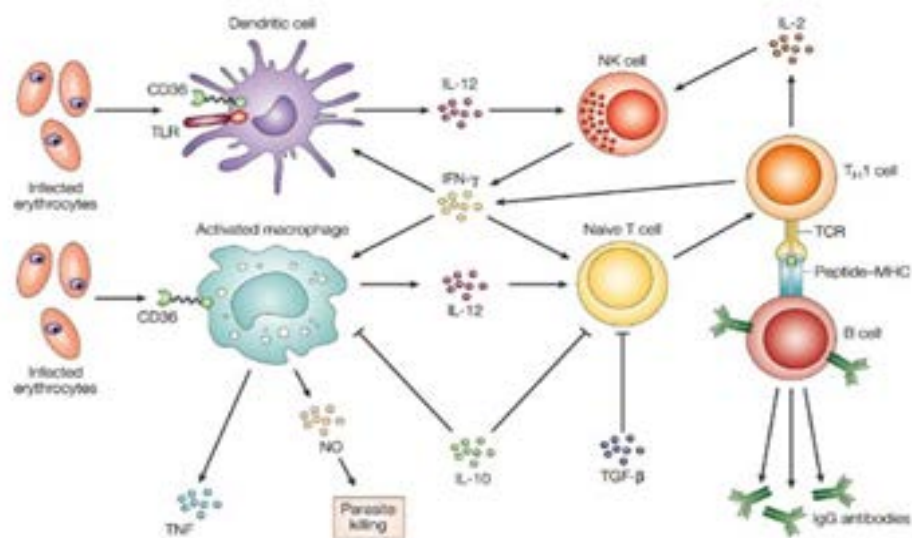
선천면역과 후천면역의 비교

	선천면역(Innate Immunity)	후천면역(Acquired Immunity)
특이성(Specificity)	유사한 미생물들의 공통된 구조물	미생물의 항원(antigen) 또는 비미생물 항원
다양성(Diversity)	제한적	매우 다양함
기억(Memory)	없음	있음
자기에 대한 반응	반응하지 않음	반응하지 않음
물리적 화학적 장벽	피부, 점막 상피, 항미생물작용 화학물질	상피의 림프구, 상피표면에서 분비되는 항체
혈액 내 단백질	보체(complement)	항체(antibodies)
세포	탐식세포(macrophages, neutrophils), 자연살해세포(natural killer cells)	림프구(lymphocytes)

선천면역 조절의 표적

- 1) 탐식세포: macrophages, Kupffer cells 등
- 2) Natural killer (NK) cells
- 3) Dendritic cells (DC)
- 4) Cytokines
- 5) Complements

대식세포, DC 및 cytokine에 의한 상호작용

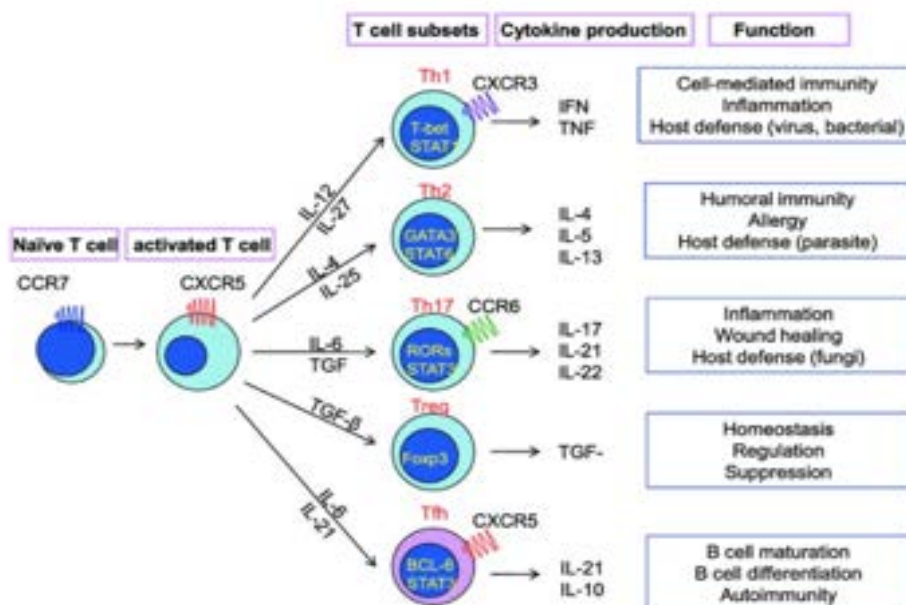


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후천면역 조절의 표적

- 1) 체액성 면역 (humoral immune responses)
 - 액성인자에 의한 면역반응 (B세포가 주됨)
 - 항체, 보체 등
 - **T세포** 의존성 혹은 비의존성 반응
- 2) 세포성 면역 (cellular immune responses)
 - **T세포**가 주된 역할을 하는 반응
 - CTL, DTH가 대표적
 - Cytokine분비에 의해 조절됨

Helper T세포의 종류



천연소재 기반 면역조절 활성소재 개발 연구

▶ 실용화 제품 유형

- 건강기능식품, 화장품, 의약소재

▶ 제품의 제형

- 경구적 섭취, 도포, 주사

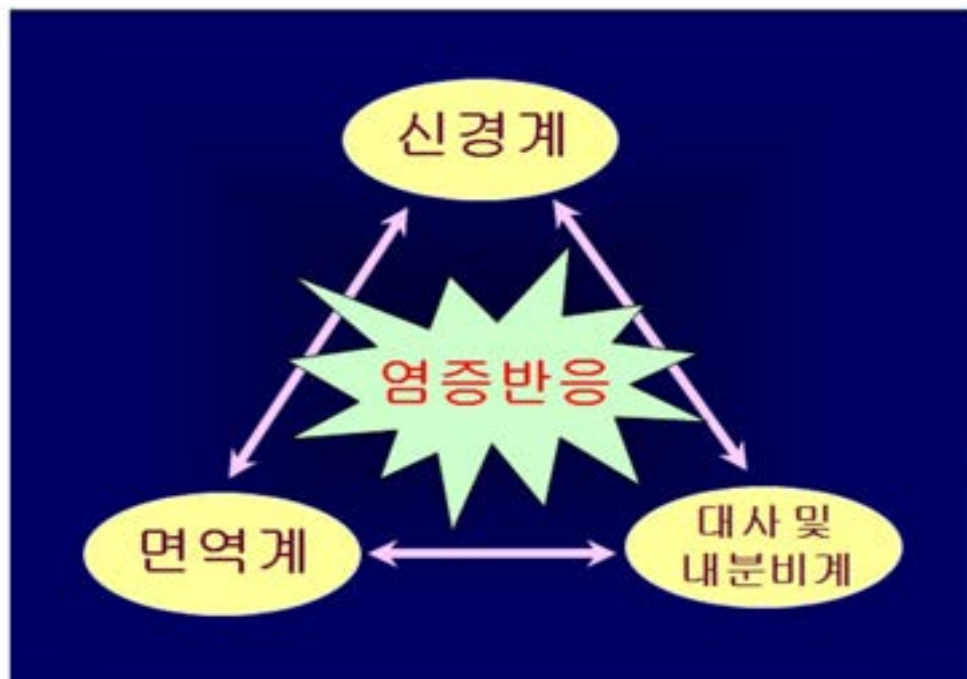
▶ 면역학적 활성 타겟

- 면역강화: 감염방어, 항암 등
- 면역억제: 알러지, 관절염, IBD, 자가면역질환, 과민반응 등
- 기타 활성: 염증관련 질환(뇌질환, 심혈관계 질환, 소화기계 질환, 피부개선 등)

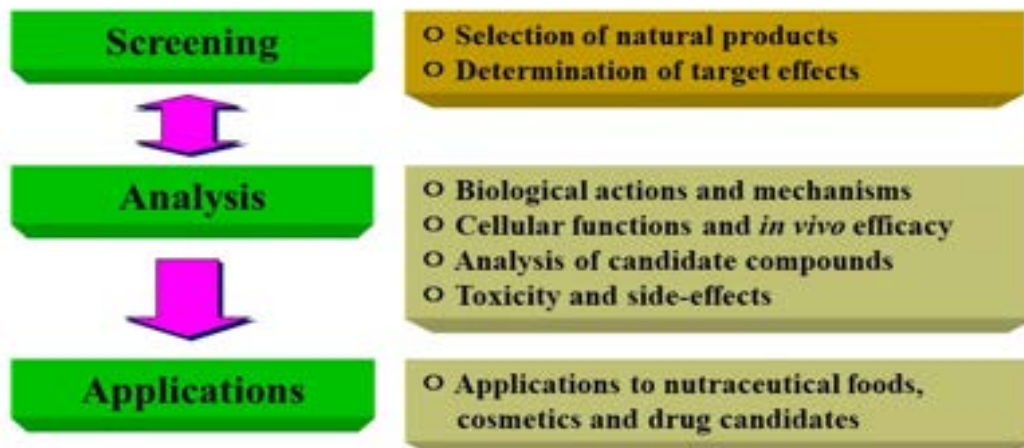
염증이란?

- ▶ 염증은 생체 조직의 손상에 대한 국소 혹은 전신적인 방어작용임.
- ▶ 염증 발생 시 혈액성분이 혈관벽을 통하여 조직으로 빠져나옴
- ▶ 염증유도에 관련된 화학물질은 히스타민과 킨니스 및 프로스타글랜딘 등.
 - 히스타민: 손상된 부위에 혈액과 림프액을 모으는 역할
 - 킨니스 : 모세혈관을 확장시켜 혈액운반을 원활하게 하고 통증이 느껴지도록 함.
 - 프로스타글랜딘: 백혈구 유입 후 통증과 열을 발생하게 함.
- ▶ 염증이 발생하면 발적, 부종, 발열 및 통증을 동반함

염증과 질병



약용작물을 활용한 면역능 증강 바이오 소재 개발을 위한 추진전략



연구 예시

1. 한국산 겨우살이의 면역증강 및 항암활성
2. 천연 식물성 소재에 의한 염증 및 뇌독성 억제활성

Topic-1

한국산 겨우살이 성분의 면역강화 및 항암활성

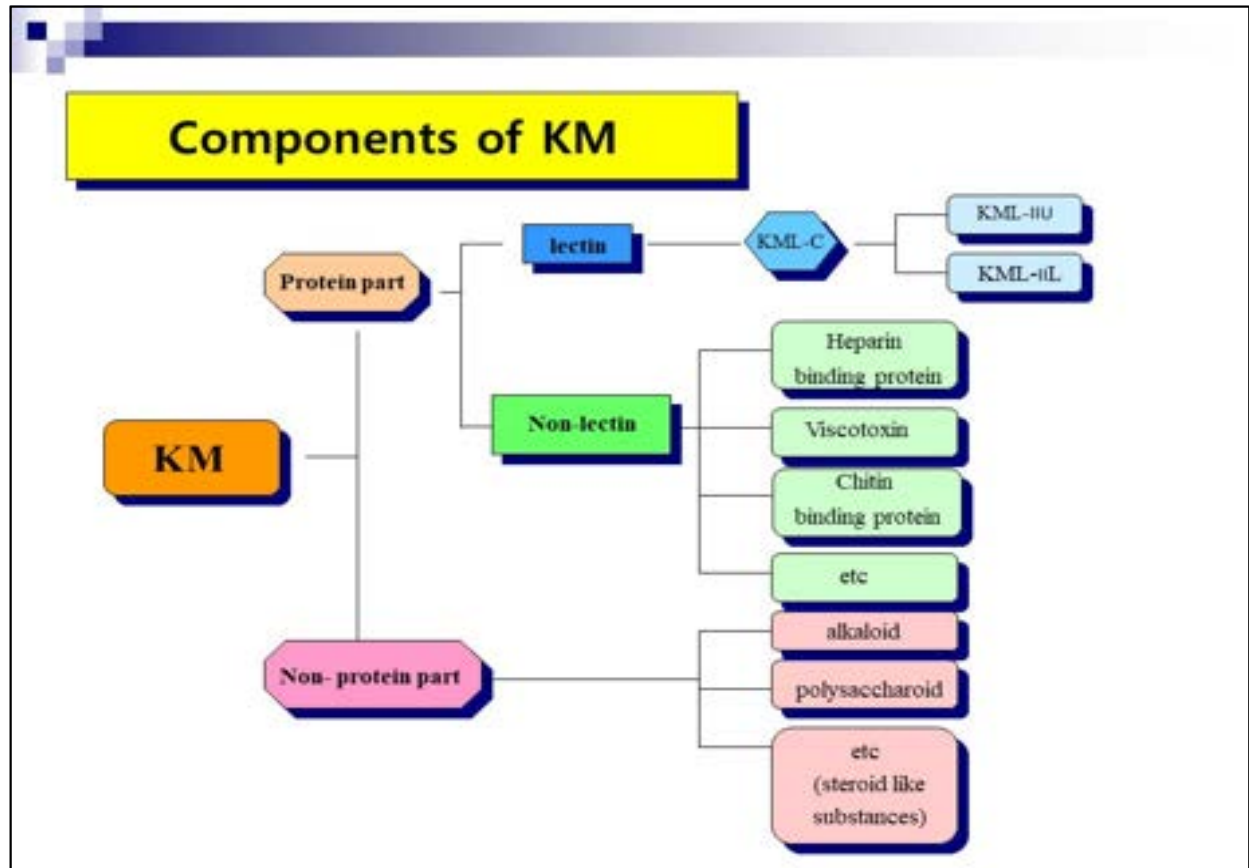
1. Immunomodulating activity
2. Antitumor activity

Korean mistletoe (KM)

- ▶ KM is a semi-parasitic plant growing on various deciduous trees. It consists of proteins, saccharides, alkaloid, and viscotoxins.

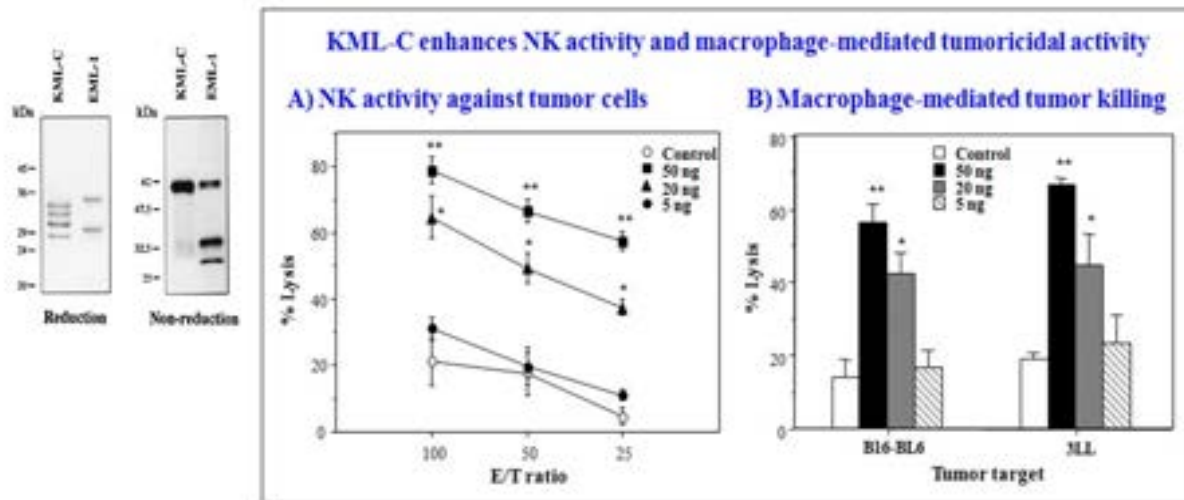


- ▶ KM has been shown to have a variety of biological activities such as antitumor activity, immunomodulation, anti-diabetic activity and anti-hypertension activity. *KM can activate immune systems and enhances host defense systems against infections and tumors nonspecifically.* The extract of KM has been used in the clinic for cancer immunotherapy in Europe since the 1920's.

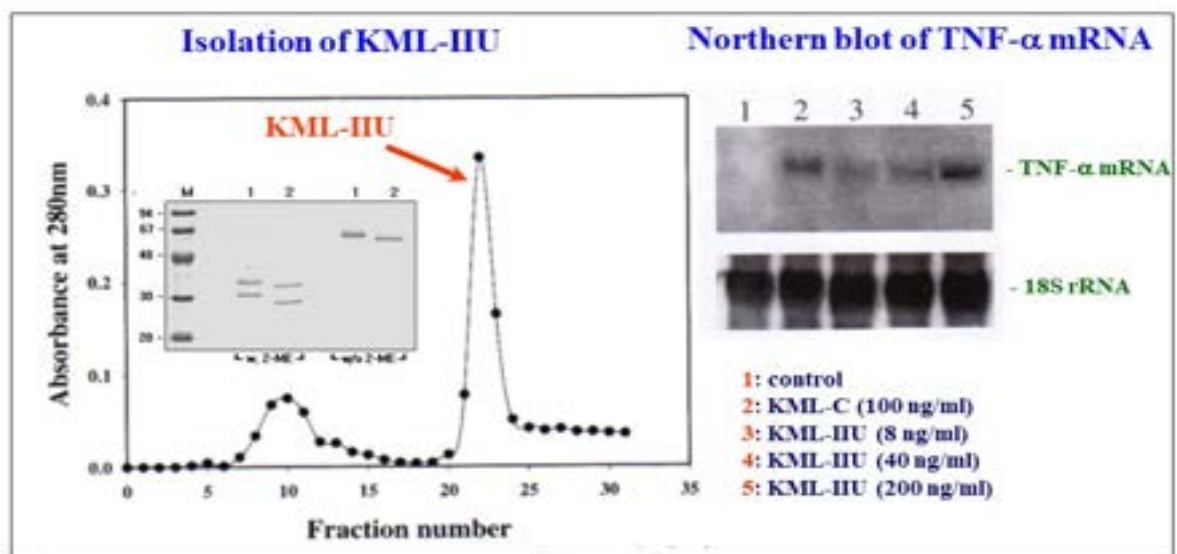


1. Immunomodulating activity of KML-C

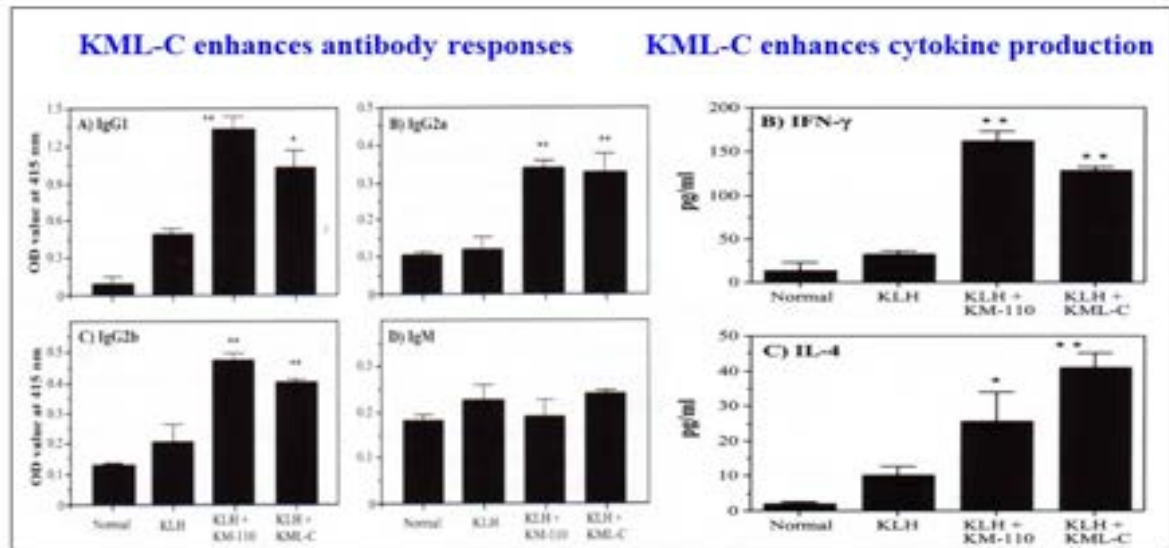
한국산 겨우살이 락틴의 선천면역 증가 활성



락틴 subchain (KML-IIU)의 TNF- α 유도 활성

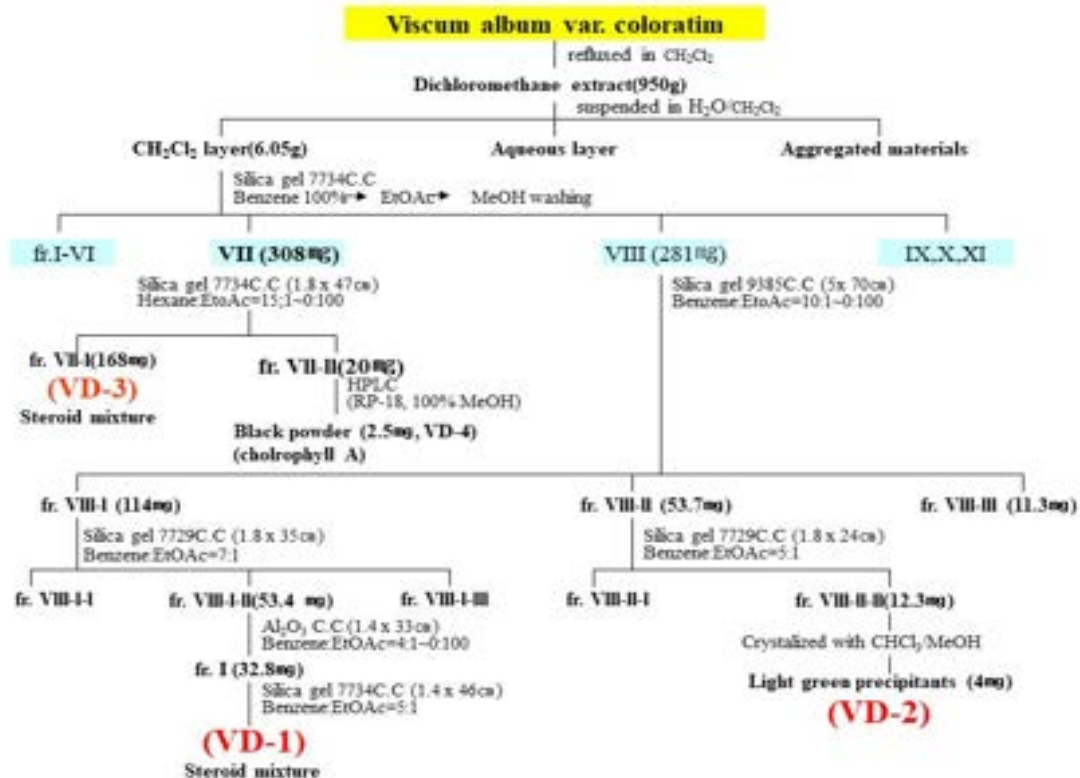
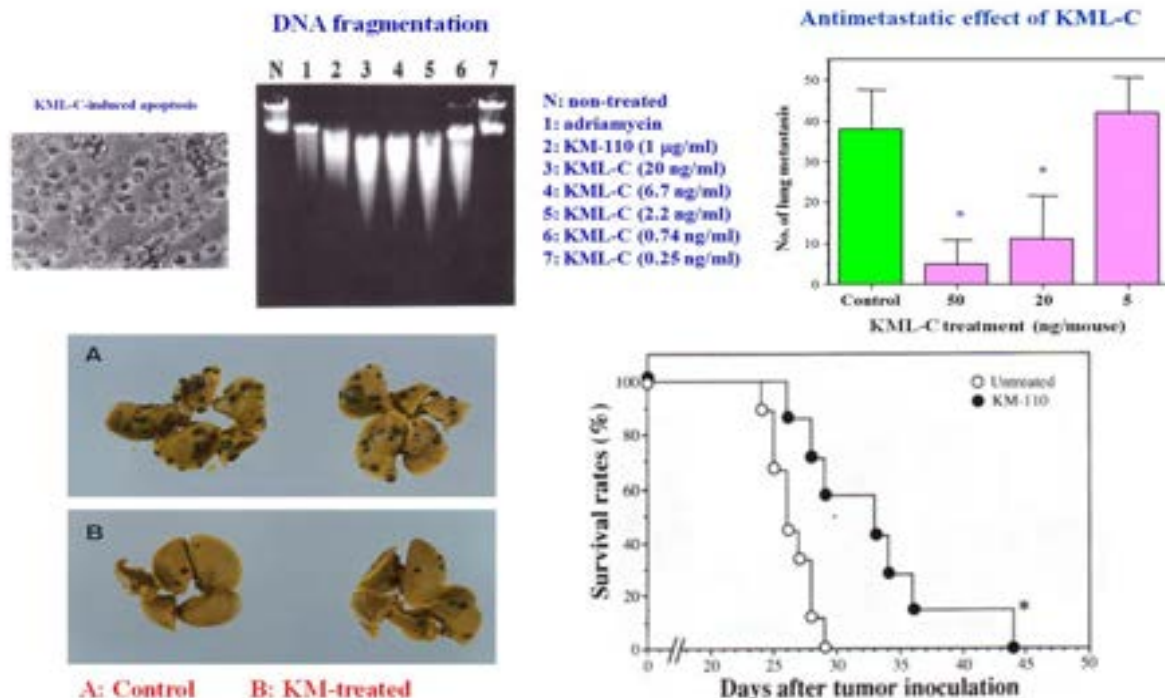


겨우살이 락틴(KML-C)의 adjuvant 활성

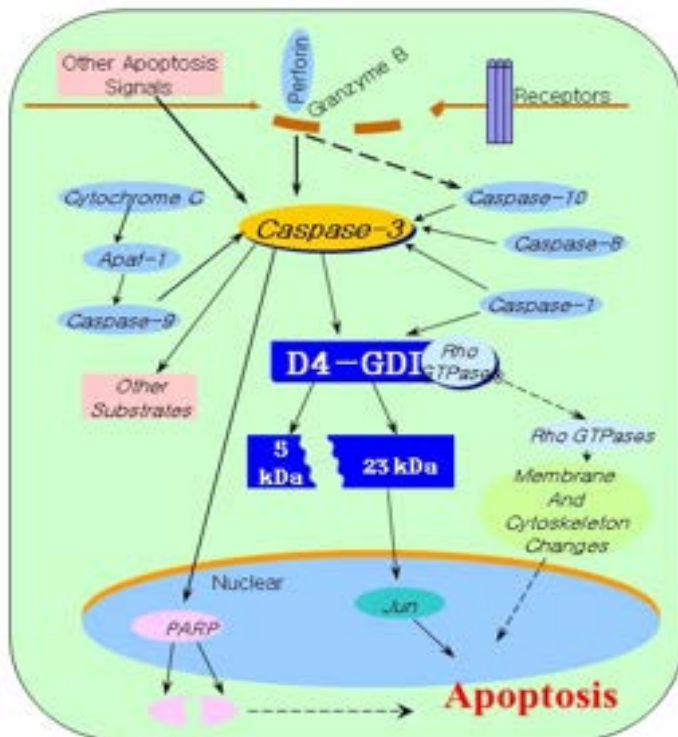
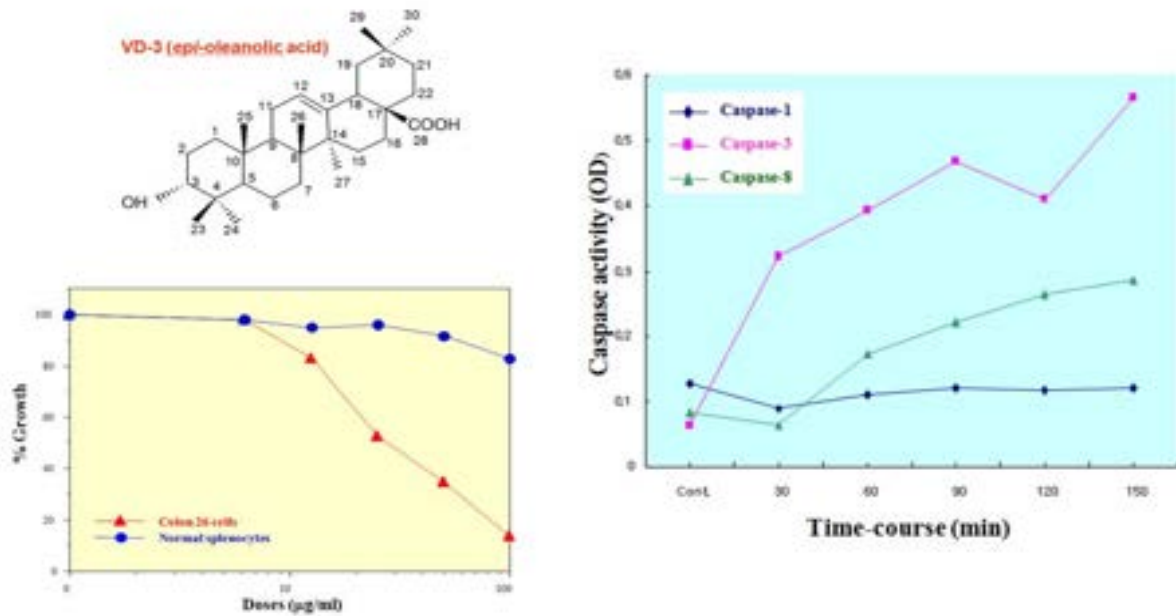


2. Antitumor activity of KML-C and organic compounds from KM

겨우살이 락틴의 암세포 apoptosis유도 및 전이 억제



VD-3에 의한 암세포 apoptosis 유도활성



D4-GDI activation by VD-3



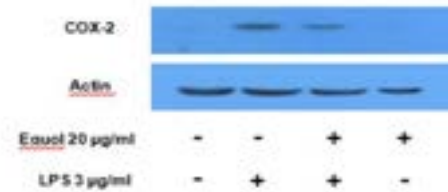
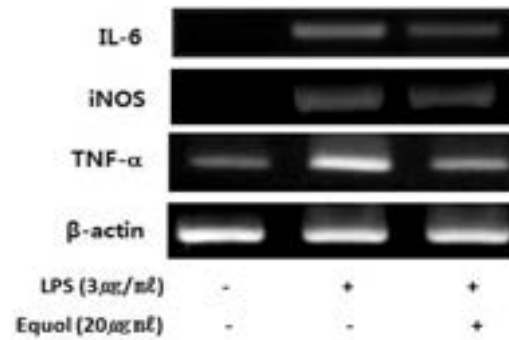
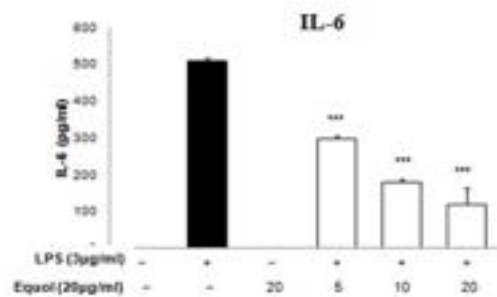
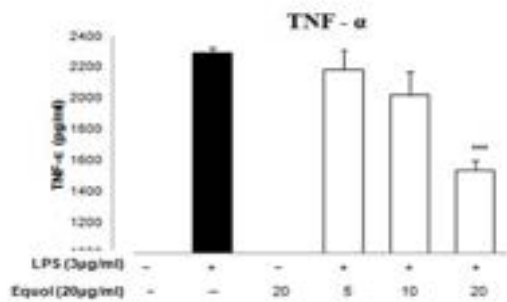
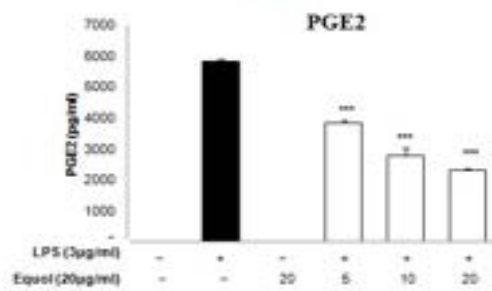
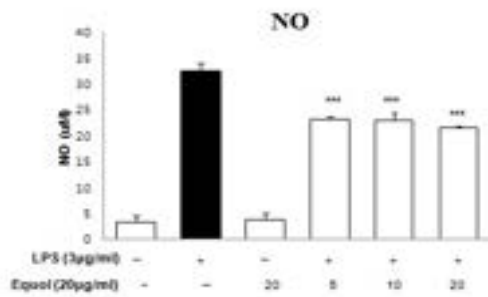
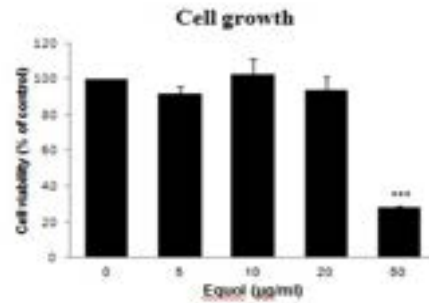
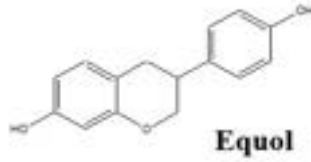
Topic-2

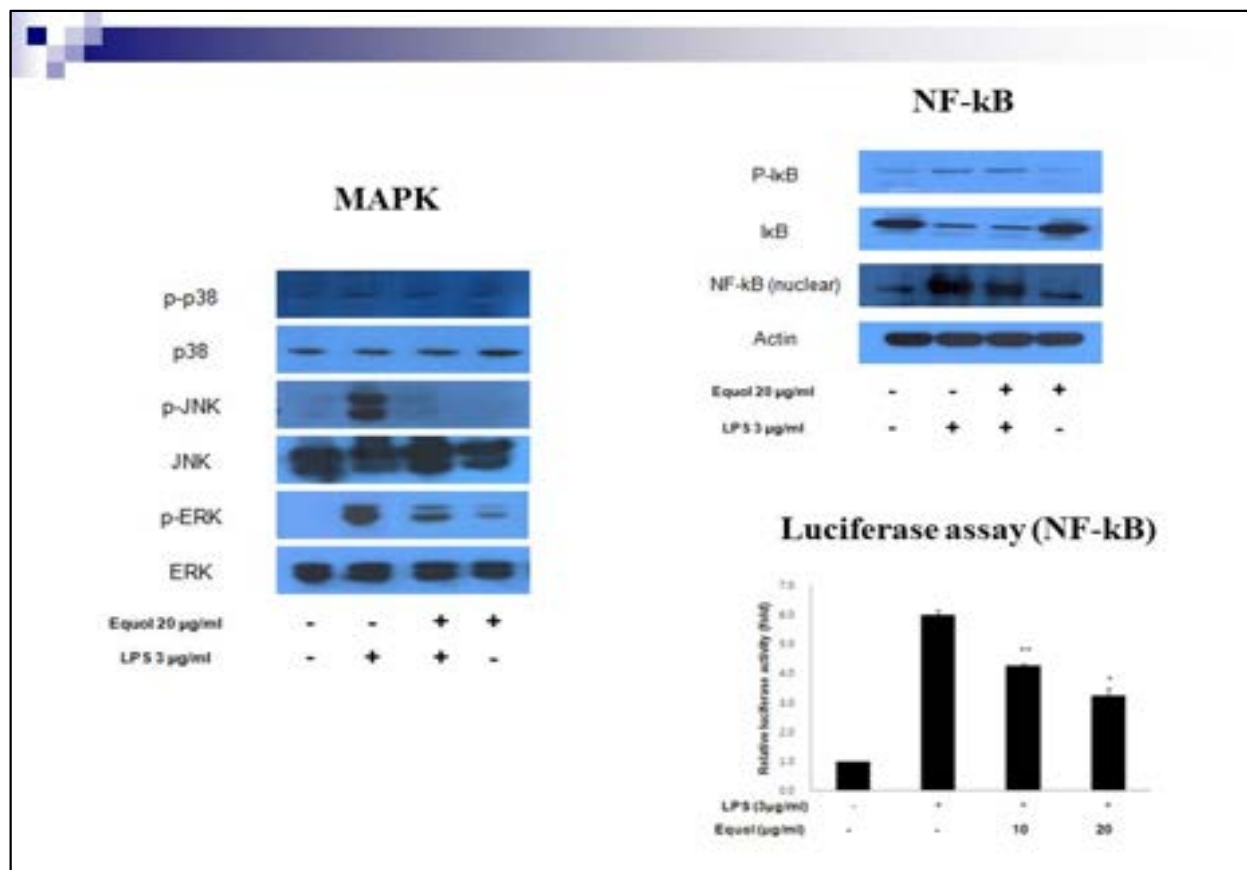
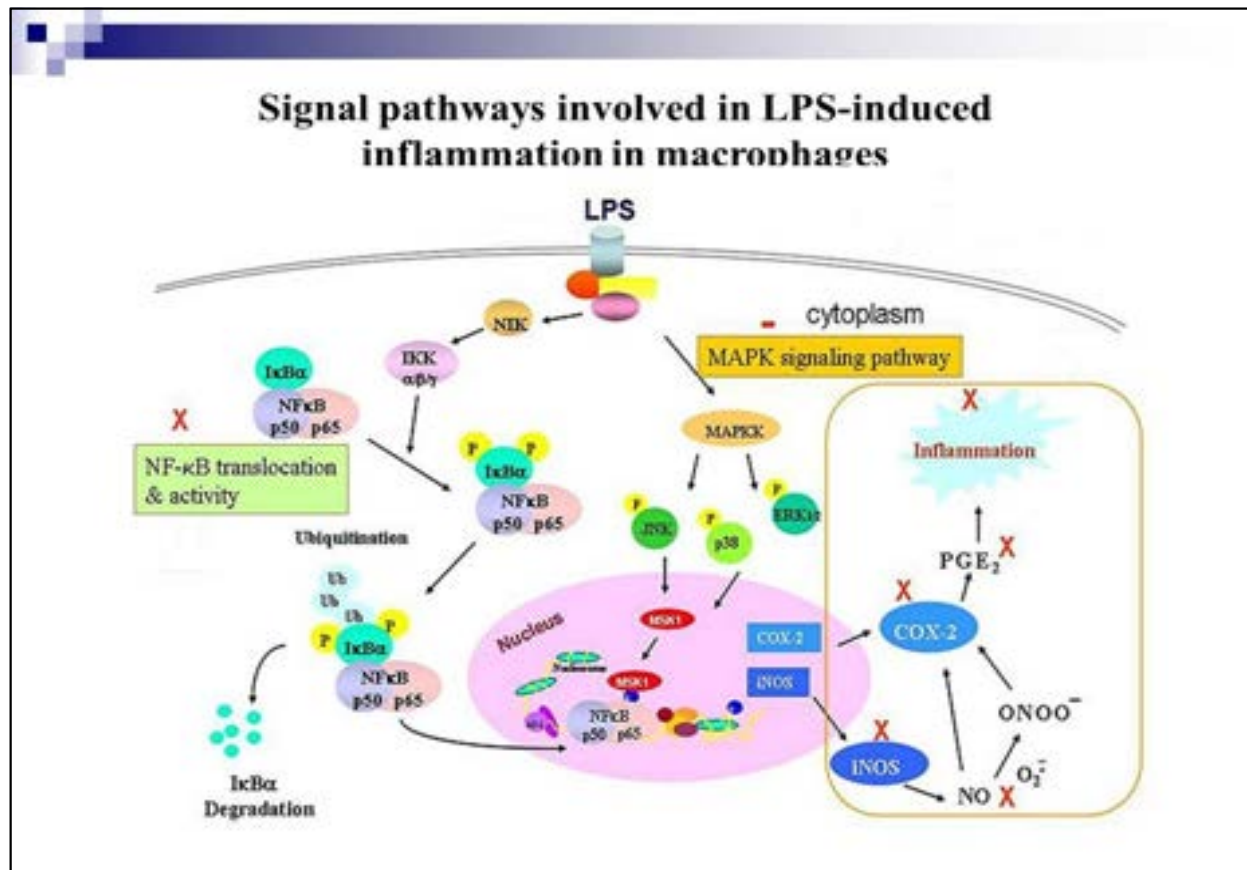
식물성 천연소재에 의한 염증 및 뇌독성 억제

1. Equol: a soy bean-derived isoflavone
2. An extract of *Cirsium Japomicum*

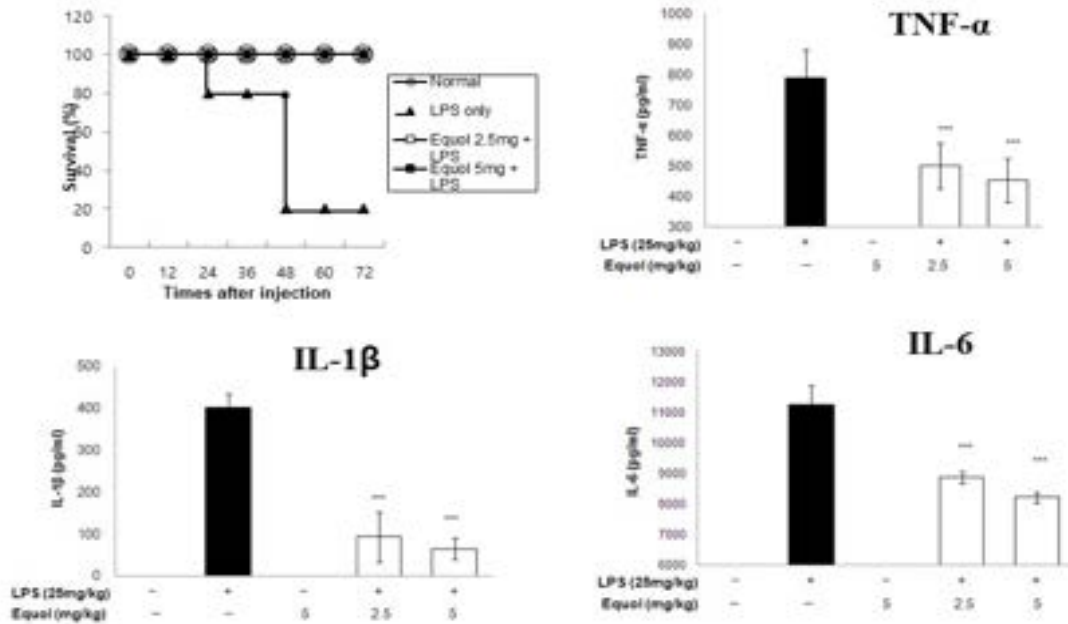
1. Anti-inflammatory effect of equol, a soy bean-derived isoflavone

Inhibitory effect of equol on NO and PGE2 production from LPS-stimulated RAW 264.7 cells





Inhibitory effect of equol on LPS-induced septic shock *in vivo*



2. Anti-inflammatory effect of an extract of *Cirsium japonicum*

Cirsium japonicum 이란?



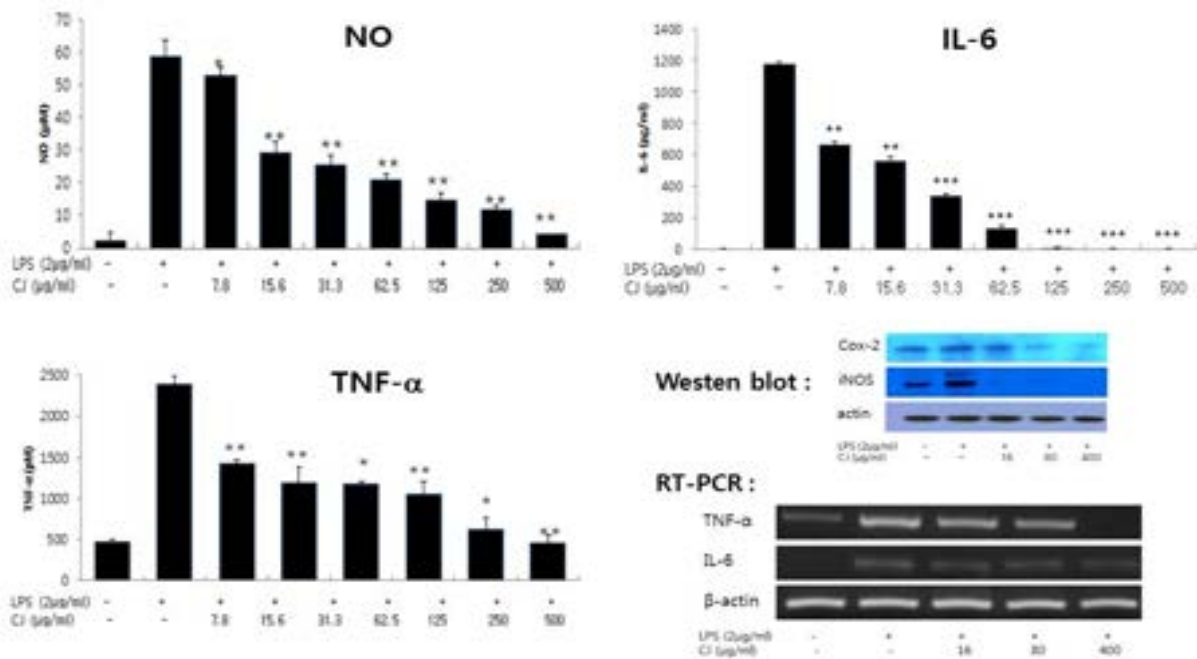
- 일반명: 영경귀
- 학명: *Cirsium japonicum*
- 서식지: 한국, 중국, 일본 등
- 성분: Flavonoids, polyacetylene, silymarin, stigmasterol, α or β amyline

< CJ의 생리활성 >

- Diabetes mellitus
- Anti-oxidant
- Componential analysis
- Liver function improvement
- Premenstrual syndrome
- Flavonoid components
- Anti-microbial
- hyperlipidemia
- Depressive disorder

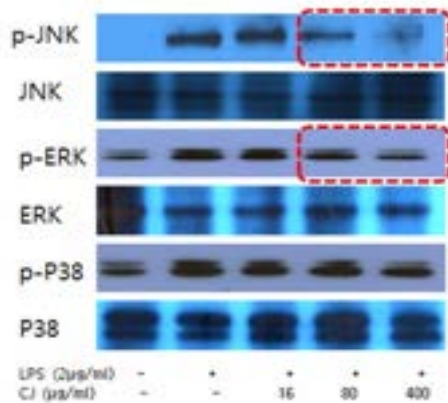
39

Inhibitory effect of CJ extract in LPS-stimulated RAW 264.7 macrophages

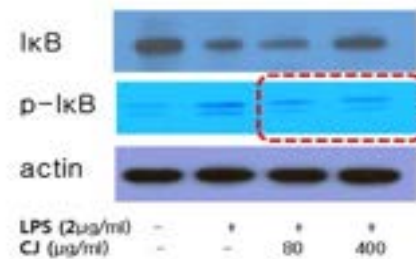


Intracellular mechanisms involved in anti-inflammatory activity by CJ extract in RAW 264.7 macrophages

A) MAPK

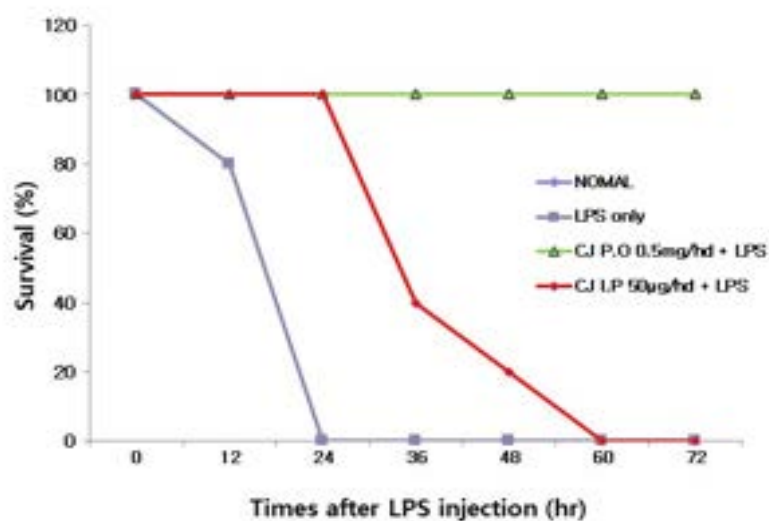


B) NF-κB

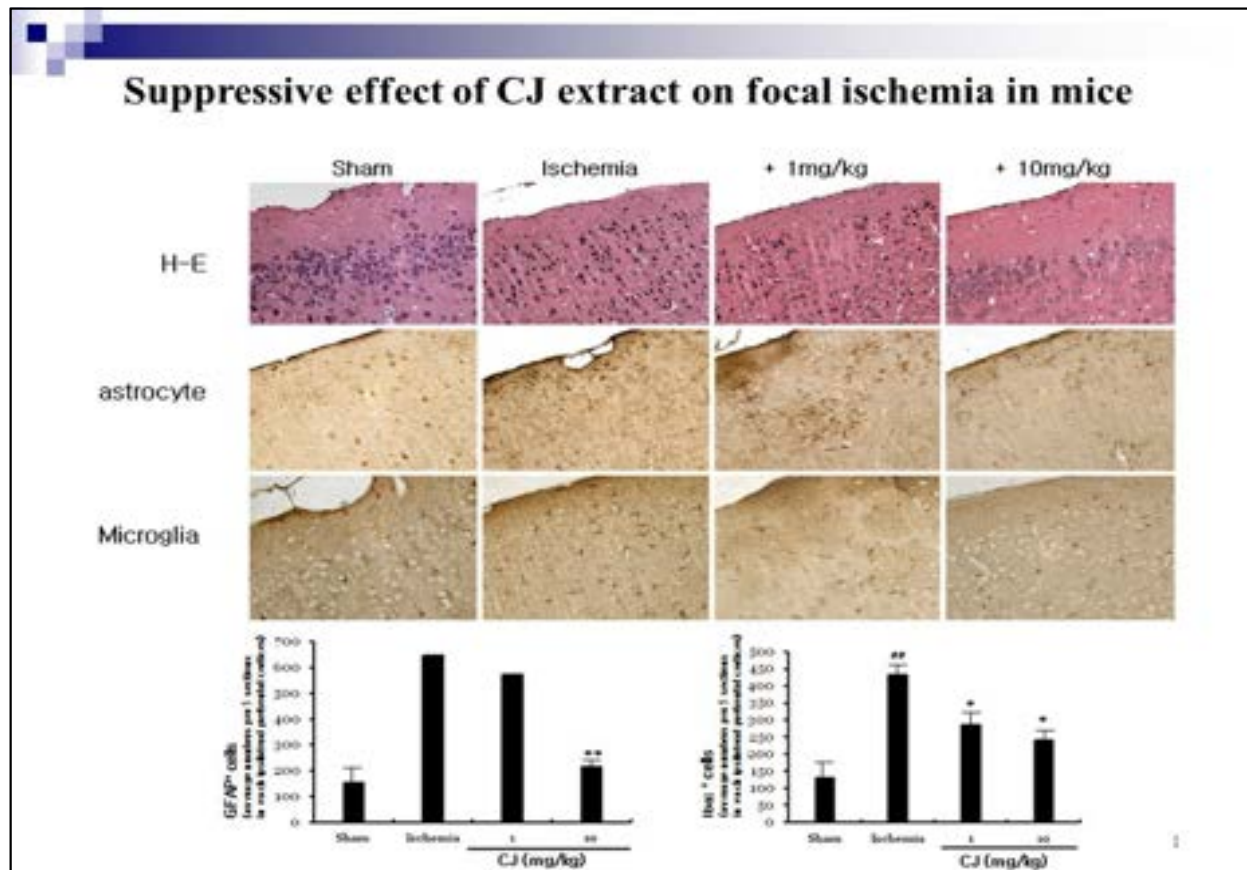


41

Suppressive effect CJ extract on LPS-induced septic shock in mice



42



감사합니다.

학술발표회

-구두발표-

(OP-1~2)

학술발표회

좌장 백종섭 교수
(강원대학교)

***Chamaecyparis obtusa* 잎의 RAW264.7 세포와 HaCaT 세포에 대한 생리 활성
및 항균 효능 평가**

정수아, 박채원, 김다희, 오승현, 임병우*
건국대학교 글로벌캠퍼스 바이오융합학과

**Evaluation of Physiological Activity and Antibacterial Efficacy against RAW264.7
Cells and HaCaT Cells from *Chamaecyparis obtusa* Leaves**

Soo Ah Jeong, Chae Won Park, Da Hee Kim, Seong Hyun Oh and Beong Ou Lim*
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University, Chungju 27478, Korea.

ABSTRACT

Background : *Chamaecyparis obtusa* leaf were used in this study, *Chamaecyparis obtusa* have a variety of ingredients, and it is well known that they are richly contained by the phytoncide, phenolic compounds and flavonoids. This study was carried out to assess the ability of *C. obtusa* leaf for antioxidant, anti inflammatory and prevent aging effects.

Methods and Results : The purpose of this study was to investigate the antioxidant activity of *Chamaecyparis obtusa* leaf extract, *C. obtusa* leaf extract are well known for a potent antioxidant and anti-inflammatory activity. We used 70% EtOH and D.W. to extract from *Chamaecyparis obtusa* leaf, and we investigate to verify the biological activation effect and investigate the antibacterial effect. In this result, both 70% EtOH and D.W. extracts showed strong antioxidant efficacy. Extracts showed strong antioxidant efficacy equal to ascorbic acid from low concentrations. To identify the anti-inflammatory efficacy, reduce in iNOS, COX-2, and MAPKs (such as phosphorylation of JNK and Erk) were investigated. Also, both 70% EtOH and D.W. extracts showed anti-inflammatory efficacy. Finally, we investigated the efficacy in ethanol and D.W. extracts to identify antibacterial activity on the *Staphylococcus aureus* and *Bacillus*. In anti-bacterial result confirmed that 70% EtOH extract was effective then D.W. extract effect. In this study, we have verified the strong antioxidant and anti-inflammatory effects of *Chamaecyparis obtusa* leaf extract, and furthermore, the D.W. and 70% EtOH extract of *Chamaecyparis obtusa* leaf is excellent for antibacterial action.

Conclusion : These results demonstrated that *C. obtusa* leaf extract can be use as a functional ingredients.

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주요 cannabinoid의 신속 동시분석 방법에 의한 대마 (*Cannabis sativa* L.)
원료의 칸나비노이드 전환특성

류병렬¹⁾, 고은지¹⁾, Md Obyedul Kalam Azad¹⁾, Md Jahirul Islam¹⁾, Md Hafizur Rahman¹⁾,
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**Cannabinoid Conversion Characteristics of Hemp (*Cannabis sativa* L.) Raw Materials
by Rapid Simultaneous Analysis of Major Cannabinoids**

Byeong Ryeol Ryu¹⁾, Eun Ji Go¹⁾, Md Obyedul Kalam Azad¹⁾, Md Jahirul Islam¹⁾, Md Hafizur
Rahman¹⁾, Jung Dae Lim^{1)*} and Young Seok Lim^{1,2)**}

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ABSTRACT

Background: This study was carried out that development of HPLC validation for analysis of main cannabinoids (CBD, CBDA Δ^9 -THC, and Δ^9 -THCA) on inflorescence of hemp (*Cannabis sativa* L.) in a short time. CBD is the main medicinal component of cannabis, and Δ^9 -THC is a psychotropic component was originated from acidic cannabinoids (CBDA and Δ^9 -THCA) through non-enzyme decarboxylation. New analysis method applied, the characteristics of decarboxylation of raw material such as inflorescence were identified by converting acid cannabinoids into neutral cannabinoids that are active in the human body.

Methods and Results: UV spectrum of each of the four common cannabinoids were scanned and the cut-off section of the mobile solvent (MeOH, ACN, Water) was identified without interference. Uniform elution of acidic cannabinoids (CBDA, Δ^9 -THCA) without peak tailing, acids (phosphoric acid, formic acid, trifluoroacetic acid) were tested. The established conditions were validated with system suitability test, linearity, precision, detection limit, and quantitation limit. Inflorescence of hemp was freeze-dried and pulverized by twelve mesh, and decarboxylation process was performed on isolated oven at 90, 105, 120 and 135°C for 60 minutes, was sampled every 5 minutes respectively. Sample was extracted using MeOH and analyzed through newly developed synchronized HPLC method. The best UV spectra of wavelength was appeared at 220 nm and mobile phases was selected water and MeOH containing TFA by solvent gradient system. All cannabinoids were detected in retention time 9 minutes, and the reliability of this HPLC condition was confirmed through additional validation. Decarboxylation index appeared DT₅₀ (when acid cannabinoids are reduced in half; half-life), and it was confirmed that decarboxylation is converted by a constant formula of temperature and time. For acidic cannabinoid was converted to neutral cannabinoid (Δ^9 -THC and CBD) by decarboxylation, Δ^9 -THC was more quickly than CBD in raw material.

Conclusion: We identified decarboxylation process for cannabinoid chemical conversion in raw material level compared previous reports about extract and standard compound. Treatment of post harvest process (temperature and time) in raw materials prevented the loss of CBD in the decarboxylation process of extracts and standard chemical, it is the first reported.

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*** (Acknowledgement) 본 연구는 춘천바이오산업진흥원의 천연소재(대마) 연구개발 및 산업화 사업의 지원에 의해 이루어진 결과로 이에 감사드립니다.

청년과학자
short communication

(Y-1~7)

학술발표회

좌장 백종섭 교수
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국내 대추 품종의 구분을 위한 InDel 마커의 개발

김문교*

충북대학교 특용식물학과

Development of InDel Markers to Distinguish Korean Jujube Cultivars

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ABSTRACT

Background : Jujube (*Ziziphus jujuba*) is rich in nutrients and is economically and ecologically important medicinal plant in Korea. However, since it is very difficult to distinguish jujube cultivars using morphological characters, the development of molecular markers is necessary to protect and distinguish Korean jujube cultivars.

Methods and Results : Genomic DNA for Next generation sequencing (NGS) analysis was extracted using DNeasy Plant Mini Kit from Qiagen, and bulk genomic DNA for PCR analysis was extracted using CTAB method. The extracted DNA was measured using Denovix's model name DS-11+ and the DNA concentration used for PCR was quantified. NGS analysis was performed for six major Korean cultivars, Bokjo, Boeun, Chuseok, Mudeung, Geumseong, and Wolchul. Insertion or deletion (InDel) loci were screened by comparison of the sequence information of the 6 Korean cultivars using CLC Genomics Workbench. The gel used for electrophoresis was made of 3% agarose and stained with DNA using ethidium bromide (EtBr). The Zj-InDel-1 marker can distinguish Bokjo, Boeun, and Chuseok, and the Zj-InDel-2 marker can distinguish Chuseok and Boeun cultivars. As a result of the phylogenetic tree analysis created by the UPGMA method, it was found that 60 genetic resources were divided into a total of 10 groups.

Conclusion : We developed Zj-InDel-1 and Zj-InDel-2 markers that can distinguish Bokjo, Chuseok, and Boeun from the other Korean cultivars, Mudeung, Geumseong, Wolchul, and Cheonsang. The InDel markers developed in this study could be used for the domestic jujube cultivar classification and for the protection of the elite Korean cultivars.

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정향 추출물을 활용한 농산물 항균포장내지 개발

김종혁*

경상대학교 응용생명과학부

Development of Antibacterial Packaging Paper for Agricultural Products using *Syzygium aromaticum* Extract

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ABSTRACT

Background : *Syzygium aromaticum* was selected to show excellent antibacterial activity among 11 medicinal crops, this study was carried out to develop an antimicrobial paper against major putrefactive pathogens (*Botrytis cinerea*, *Alternaria tenuissima*, and *Rhizopus stolonifera*) in strawberry through integrating *S. aromaticum* bud extract and silver nitrate (AgNO_3).

Methods and Results : In order to confirm and select the antimicrobial properties of 11 medicinal crop extracts, the inhibitory zone was investigated for three putrefactive pathogens by agar diffusion method. Among them, *S. aromaticum* was selected because they showed an inhibition zone of 3 mm or more against three putrefactive pathogens. And then, the minimum inhibitory concentration (MIC) was obtained through the poisoned food method, and the minimum inhibitory concentration of *S. aromaticum* extract was $20 \text{ ml} / \ell$. As in the previous experiment, *Rubus coreanus*-silver nanoparticles (R-AgNPs) solution, when measuring the absorbance of the *S. aromaticum*-silver nanoparticles solution (C-AgNPs), the peak value is measured in the 400 nm wavelength band. The antimicrobial coated paper was prepared by immersing commercial paper in each synthetic solution and then drying it. The prepared paper was added to 500 g plastic strawberry packaging, and the reduction in weight and hardness content were measured for 5 days. As a control (non-treatment), untreated paper was used. The weight of each treatment decreased by 8.2, 6.3, 4.8% compared to day 0 in the order of control, R-AgNPs, and C-AgNP and in the case of hardness, 28.6, 26.6, and 5.9% decreased.

Conclusion : Compared with non-treatment paper, antimicrobial paper demonstrated a smaller change in post-harvest strawberry weight and hardness, helping to maintain fruit quality and lengthen the storage period.

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[Y-003]

약용작물 (부산물) 추출물을 활용한 흰가루병 친환경 방제제 개발
권현민*

경상국립대학교 응용생명과학부

Development of Control Agent against Powdery Mildew using Medicinal Crop
Extracts

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Department of Applied Life Science, Gyeongsang National University, Jinju 52828, Korea.

ABSTRACT

Background : This study was carried out to develop a new and environmental-friendly bio-fungicide to control powdery mildew using medicinal crop or its by-product extracts.

Methods and Results : The experimental materials were used to 30 medicinal crops to test the effects of natural for powdery mildew control. Dried plants were extracted by 80% methanol over three times for 3 hours using soxhlets extract. The experiments on selecting natural substances were conducted by strawberry leaves infected powdery mildew into distilled water and inoculating 100 μ l of natural extract into powdery mildew spores for six hours to select the first substance to suppress. And then, the selected natural materials were tested in the greenhouse by spraying single or mixture of 50ml (1000 times diluted) to each plant of strawberry leaves infected with powdery mildew.

Rhus javanica and *Cedrela sinensis* were finally selected out of 30 kinds of medicinal crops to test the effects of single or mixture application with potassium silicate in order to show a similar control effect as disinfectant. As a result of investigating the single-use treatment effect of SiO₂ concentration, 0.5% concentration was the most effective. As a result of processing 0.5% SiO₂ and diluted extract, 0.5% SiO₂ and 1000 times diluted extracts were the best. Furthermore, application twice after 3 - 4 days from the day applied first, the control effect was better.

Conclusion : It was found that the control effect of powdery mildew was more than 75% when processing 0.5% SiO₂ and 1000 times diluted extract. Moreover, the control period was about 30 days, which is an environmental-friendly control suitable for the control of powdery mildew during the strawberry harvest season.

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[Y-004]

더덕의 주요 사포닌 **lancemaside** 기작연구 및 대량생산 연구

박동익*

경상대학교 응용생명과학부

Study on Mass Production And Mechanism of Lancemaside of Major Saponin in *Codonopsis lanceolata*

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Department of Applied Life Science, Gyeongsang National University, Jinju 52828, Korea.

ABSTRACT

Background : The saponin of *Codonopsis lanceolata* root has attracted interest as natural traditional medicines, eaten raw or cooked. Therefore, this study was conducted to find a way to increase the saponin content after harvesting in *C. lanceolata* root.

Methods and results : Experiments were conducted lactobacillus fermentation treatment as a way to increase the content of lancemaside. In the fermentation treatment, The roots of *C. lanceolata* were freeze dried and fermented 30°C for *Bacillus subtilis*, *Saccharomyces cerevisiae*, *Lactobacillus alimentarius*, *Bacillus subtilis*, *Lactiplantibacillus plantarum*, and 22°C for *Leuconostoc mesenteroides*, respectively. The 5 kinds of lactobacillus and yeast was cultured to a concentration 1.0×10^9 cell/ml for fermentation treatment. after that, It was filtered through a 0.2 mm syringe filter and analyzed with LC-MS/MS. As a result, *B. subtilis* fermentation treatment was the highest group to contain the saponin content. And then, prepared the harvested roots of *C. lanceolata* for sprouting about 2 - 3 cm for 25°C in the incubator and being sequentially treated with UV treatment and lactobacillus. In the UV treatment, *C. lanceolata* were treated by UV-C for 23 hours, and then gave a recovery time for 10 days in room temperature with proper moisture content, and the UV treated roots were fermented for *Bacillus subtilis* cultured to a concentration 5.23×10^8 cell/ml 7 days in 30°C and it was diluted 100 times to became the final volume 2.4 l. Then extracted, concentrated and freeze dried samples were diluted 100 times by autoclave. It was filtered through a 0.2 mm syringe filter and analyzed with LC-MS/MS. As a result, The saponin content in *C. lanceolata* was increased by 1.7 - 1.8 times through fermentation with *Bacillus subtilis* after UV-C treatment in harvested root.

Conclusion : The saponin content in *C. lanceolata* was increased by 1.7 - 1.8 times through fermentation with *Bacillus subtilis* after UV-C treatment in harvested root.

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[Y-005]

식량작물 지중점적관개 시스템을 활용한 도라지, 지황의 생육특성 구명
장미하*

경상대학교 응용생명과학부

Evaluation of the Growth Characteristics in *Platycodon grandiflorus* and *Rehmannia glutinosa* using Sub-Irrigation System for Food Crops

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Department of Applied Life Science, Gyeongsang National University, Jinju 52828, Korea.

ABSTRACT

Background : Sub-irrigation system have recently been supplied little by little as a part of the field smart farm. Therefore, this study is being carried out examine to review availability of a sub-irrigation system in the medicinal crops (*Platycodon grandiflorus* and *Rehmannia glutinosa*).

Methods and Results : The sub-irrigation system was buried at a depth of 40cm at 80cm intervals, and will have automatic irrigation and fertigation in the growth early and in the root and rhizome enlargement stage of *Platycodon grandiflorus* and *Rehmannia glutinosa*, respectively.

In growth early, irrigation management will be treated by every 7 days such as the 7 days, 14 days, 21 days, 28 days, and until 35 days after sowing or transplanting, and in the root and rhizome enlargement stage will be automatically irrigated at -10kpa, -20kpa, and -30kpa of soil moisture content with control (non-irrigation). Also, fertigation at this time will be teated at EC 0.5, 1.0, 1.5, and 2.0 dS/m with control (non-treatment), respectively.

Conclusion : Predicting the research results applied with the sub-irrigation system in medicinal crops, It is expected to be able to stably produce high-yields and high-quality in *Platycodon grandiflorus* and *Rehmannia glutinosa* regardless of climate change such as drought.

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[Y-006]

HME-DDS (Hot-Melt Extrusion-Drug Delivery System) 기술을 적용하여 오디의 anthocyanin 함량 및 수용해도 향상

고은지*

강원대학교 바이오헬스융합학과

Improved the Content and Water Solubility of Anthocyanins of Mulberry by applying HME-DDS (Hot-Melt Extrusion-Drug Delivery System) Technology

Eun Ji Go*

Department of Bio-Health Convergence, Graduate School, Kangwon National University, Chuncheon 24341, Korea.

ABSTRACT

Background: Anthocyanins have been confirmed to possess numerous bioactive features that can promote human health. Although mulberry is rich in anthocyanin, the clinical use has been limited due to its instability in aqueous media, low water solubility and the oral bioavailability of anthocyanins. Therefore, the objective of this study was to prepare colloidal dispersed HME-DDS system of Mulberry by hot melt extrusion (HME).

Methods and Results: To maximize the content of anthocyanin in mulberry, different types and amounts of acids were treated. According to previous studies, the extraction yield of active compounds can be enhanced by treating acid solutions. To figure out the optimal concentration for extracting anthocyanin from mulberry, ascorbic acid, citric acid, and succinic acid were treated at concentrations of 0.25M, 0.5M, and 0.75M. After that, the anthocyanin content was analyzed by the measurement of total anthocyanin contents. As a result, it was confirmed that the treatment of 0.75 M of citric acid exhibited the highest anthocyanin content. In order to investigate the effect of HME process on the content of anthocyanin, 0.5M, 0.75M, and 1M of citric acid were subjected to HME. On top of the acids, additional excipients were introduced to design drug delivery system (DDS) for mulberry. With the combination of HME and DDS, an colloidal dispersion system could be prepared. The prepared formulations were characterized in terms of total anthocyanin content, total flavonoid content, total phenol content, and DPPH to compare and analyze the antioxidant effect and anthocyanin content.

Conclusion: After applying HME-DDS technology, the physicochemical properties of formulations have been characterized. The particle size, polydispersity index and zeta potential. Furthermore, fourier transform infrared spectrometer (FT-IR) and X-ray diffraction (XRD) measurement and extrusion to compare the functional group properties of the extruded molding. To observe the morphology of HME-DDS formulations, field emission scanning electron microscope (FE-SEM) and transmission electron microscopy (TEM) images will be captured.

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[Y-007]

HME (Hot-Melt Extrusion) 기술을 이용한 참당귀 지용성 활성성분 가용화
유수지*

강원대학교 바이오헬스융합학과

**Solubilization of Hydrophobic Active Compounds of *Angelica gigas* Nakai using
HME (Hot-Melt Extrusion) Technology**

Su ji Ryu *

Department of Bio-Health Convergence, Kangwon National University, Chuncheon 23431, Korea.

ABSTRACT

Background : The roots of *Angelica gigas* Nakai (AGN), used to treat gynecological diseases such as anemia and menstrual pain, contain decursin (D), decursinol angelate (DA), and decursinol (DOH), a major metabolite. However, since the two index components (D and DA) have low solubility in water, they are extracted using organic solvents such as methanol and ethanol. However, since water is used in ordinary bath medicine, new material of AGN, which increases the water solubility of D and DA, is required. In the study, colloidal AGN was prepared for the increased water solubility through a hot-melt extrusion (HME) process by mixing AGN with an additive, and the water solubility of D and DA was measured by HPLC.

Methods and Results : Dried AGN cut to less than 5 mm was mixed with additives (excipients) to solubilize the hydrophobic active component, and was fabricated through the HME process under heat and pressure. The AGN contents of HME-AGN 1, HME-AGN 2, HME-AGN 3 was 91, 87 and 81, respectively. For the extraction and determination of active compounds, the prepared HME-AGN and AGN powder were dispersed into distilled water (D.W.) and stirred at 70°C for 30 min, followed by ultrasonic extraction at 40°C for 1 h. The extract was filtered before analysis, and D and DA were analyzed using an HPLC system. The water solubility of D in HME-AGN 1, HME-AGN 2 and HME-AGN 3 was increased by about 2.5, 3, and 14 times compared to that of AGN powder. The water solubility of DA in HME-AGN 1, HME-AGN 2, and HME-AGN 3 was increased by about 5, 7, and 41 times. In the case of HME-AGN 3, all the active compounds showed the highest content over the formulations tested.

Conclusion : It was confirmed that the water solubility of the active compounds of AGN prepared by HME technology was improved. Water solubility is known to be highly correlated with the oral bioavailability. Therefore, the oral bioavailability of the active compounds of AGN could be enhanced through the improved water solubility by HME technology.

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학술발표회

-포스터발표-

- | | |
|--------------|-------------------|
| 1. 재배, 생리 | (P01-001~P01-027) |
| 2. 유전, 육종 | (P02-001~P02-013) |
| 3. 생리활성 및 성분 | (P03-001~P03-066) |
| 4. 기원 및 분류 | (P04-001~P04-002) |
| 5. 식물환경 및 기타 | (P05-001~P05-006) |

고온 스트레스에 따른 참당귀의 생육 및 유용성분 특성

정대회*, 김기윤, 박홍우, 정충렬, 전권석

국립산림과학원 산림약용자원연구소

Growth and Useful Component of *Angelica gigas* Nakai under High Temperature Stress

Dae Hui Jeong*, Ki Yoon Kim, Hong Woo Park, Chung Ryul Jung and Kwon Seok Jeon
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Korea.

ABSTRACT

Background : Recently, the pace of global climate change has tremendously increased, causing extreme damage to crop production. Here, we aimed to examine the growth characteristics and useful components of *Angelica gigas* under extreme heat stress, providing fundamental data for its efficient cultivation.

Methods and Results : Plants were exposed to various experimental temperatures (28°C, 34°C, and 40°C), and their growth characteristics and content of useful components were analyzed. At the experimental site, the ambient temperature was 19.38°C, soil temperature was 21.34°C, ambient humidity was 81.31%, soil humidity was 0.18 m³/m³, and solar radiation was 162.05 W/m². Moreover, the soil was sandy-clay-loam (pH 6.65), with 2.66% organic matter, 868.52 mg/kg soil available phosphate, and 0.14% nitrogen. Values of most growth characteristics, including the survival rate, height, and fresh and dry weight, were the highest at 28°C. Although the highest content of useful components was observed at 34°C, there were no significant differences across temperatures.

Conclusion : Growth characteristics varied across temperatures due to detrimental effects of heat stress, such as accelerated tissue aging, reduced photosynthesis, and delay of growth. Similar content of useful components across temperatures may be due to poor accumulation of anabolic products caused by impaired growth at extremely high temperatures.

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[P01-002]

길항미생물과 태양열 소독에 따른 4 - 5년생 인삼의 생육과 뿌리썩음병
경감에 미치는 영향

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Effect of Growth and Root Rot Disease of Four and Five Year-old Ginseng in
Solarization and Antagonistic Microorganism

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ABSTRACT

Background : The two soil-borne fungi both *Cylindrocarpon destructans* and *Fusarium solani* have been caused root rot in many ginseng production areas in continuous and/or replanted farming fields. In these fungi, ginseng root rot caused by *Cylindrocarpon destructans* is the most destructive disease of ginseng. When green manure were put into the soil and covered with transparent vinyl for solarization, root rot pathogens could be controlled to some extent by several factors like an increase in soil temperature, oxygen consumption, and emission of carbon dioxide. Incorporation of antagonistic microorganism helps soil fertility supplying favorable nutrient to ginseng roots resulting in enforcement of diverse disease resistance or tolerance reducing root rot damage.

Methods and Results : The green manure crop, sunflower was planted and incorporated into soils during before July 20 and solarization was performed on July 22 to August 22 in 2016. Solarization was treated with transparent PE vinyl. Baicono No. 1 Gold (as antagonistic microorganism, *Bacillus mojavensis*, active ingredient is above 1.0×10^7 CFU/g) was mixed in constant ratio 35 g versus 1 ℓ with bed. The two treatments were performed as following : solarization and incorporation into soil with sunflower as green manure as first, and antagonistic microorganism incorporation after a series of combination with solarization and then green manure. Survived root rate did not show statistically significant difference in two treatments. Some parameters, root fresh weight, root length, body length, and root diameter exhibited higher values in a series of combined treatment (sunflower, solarization and antagonistic microorganism, sequentially) compared to the single treatment (sunflower and solarization) in four-year old ginseng. These results were similar to those of five-year old ginseng.

Conclusion : The effect of single and combined treatment showed to some extent different results depending on its growth year of root in ginseng.

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[P01-003]

녹비작물 환원과 태양열 및 훈증 소독에 따른 5년생 인삼의 뿌리썩음병 경감 효과

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Control Effect of Root Rot Disease of Five Year-old Ginseng in Green Manure Crops Combined with Solarization with Fumigation

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ABSTRACT

Background : The two soil-borne fungi both *Cylindrocarpon destructans* and *Fusarium solani* have been caused root rot in many ginseng production areas in continuous and/or replanted farming fields. In these fungi, ginseng root rot caused by *Cylindrocarpon destructans* is the most destructive disease of ginseng. When green manure were put into the soil and covered with transparent vinyl for solarization, root rot pathogens could be controlled to some extent by several factors like an increase in soil temperature, oxygen consumption, emission of carbon dioxide, and microbial activities. Furthermore, fumigation with Dazomet GR as insecticide has been applied to keep higher control in root rot density pathogens by covering soil surface with transparent vinyl for 30 days.

Methods and Results : The two green manure crops, maize and sunflower were planted and incorporated into soils during before July 20 and solarization was performed on July 22 to August 22 in 2016. Solarization was treated with transparent PE vinyl and fumigation was also applied after solarization. Fumigation was treated with Dazomet GR. as insecticide for 30 days occurring gas emission in replanted soil fields covering with transparent PE vinyl. Highest survived root rate was observed to be 75.7 and 76.7% in single treatment, fumigation with maize incorporated in field and dual treatment, fumigation following solarization with sunflower incorporated in field, respectively. The lowest root rot disease rate was also exhibited significantly to be 26.7% in dual treatment, fumigation following solarization with maize incorporated in field.

Conclusion : Control value for root rot disease was more effective in dual treatment, fumigation following solarization than in single treatment, solarization without different green manure crops (maize and sunflower).

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[P01-004]

엔도설판 오염 유도 토양에서 바이오차 처리에 따른 4년생 인삼의 생육에 미치는 효과

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Effect of Biochar on Growth of Four Year-old Ginseng in Artificial Endosulfan Contaminated Soil

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ABSTRACT

Background : Endosulfan is a mixture of alpha and beta isomers and would create the principal metabolite, the endosulfan-sulfate, whose half-life ranges from at least 30 days to a maximum 6 or 8 years depending on the mixed ratio and environment. Thus, the retention of endosulfan in soils of ginseng cultivation fields may induce the incompatibility of ginseng owing to the potential translocation of such component during the growing period of ginseng. Application of biochar can enhance crop productivity and also has many pores that provide an ideal microbial habitats including the potential of microbes to degrade pesticide residues in soils. Furthermore endosulfan adsorption by woody biochar exhibits lower uptakes in ginseng roots. In here, when biochar (BC) was applied to the soil, the effect of reducing pesticide residues was confirmed. It is necessary to investigate the effect on the growth of ginseng by soil treatment with BC.

Methods and Results : Neutralized biochar, 0.1, 0.3 and 1.0% was treated in the soil following endosulfan was treated as 1.0 ppm into soil, and finally 2-year old ginseng seedling was transplanted on April 2 to 6, 2018. Changes of growth and underground characteristics as affected by different biochar application under artificial endosulfan contaminated upland soil grown with four-year old ginseng were showed. Root rot index was highest in endosulfan 1.0 ppm treatment, biochar 1.0% treatment showed the lowest root rot index to 1.5 value. In the changes of rusty root rate, there was not showed significant difference, however, in these treatments, biochar 1.0% treatment was the lowest rusty root rate.

Conclusion : Percent survived root was showed higher in all biochar treatments than in endosulfan 1.0ppm treatment. In the change of root production, the highest root yield exhibited in only biochar 1.0% treatment, occurrence of root rot disease rate was revealed that the highest application of biochar 1.0% showed lowest occurrence to 31.2% in four-year old ginseng.

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[P01-005]

2020년 인삼 6년근 수확지의 뿌리썩음병 발생과 병원균 동정

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Root Rot Disease Outbreak and Pathogen Identification of 6 Years Old Ginseng Harvest Fields in 2020

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ABSTRACT

Background : Ginseng is very important cash crop and medicinal herb in Korea. It takes four to six years to produce harvest ginseng root and ginseng is attacked by several pathogens during cultivation.

Methods and Results : We investigated the disease rate caused by ginseng root rot from 6 years old ginseng cultivation fields (28 fields). Ginseng root rot was investigated in three times based on 90 cm × 180 cm, the lesion area was divided into five steps according to the root rot degree. The lesion area is 0% (disease free) = 0, 1 - 30 % = 1, 31 - 60% = 2, 61 - 99% = 3, 100% (missing plant or complete loss) = 4, respectively. The highest disease severity was 20hong01 (2.9) and the lowest one was 20ans02 (0.04). Pathogens were isolated from ginseng lesion collected in these fields and identified the color of fungus. A total 587 strains were isolated from ginseng root rot, identified as brown 91 strains, cream 227 strains, white 48 strains, red 89 strains, and other 132 strains. Of these strains, 141 isolates were performed sequencing for ITS (internal transcribed spacer) region. Sequence results for the ITS region showed that *Ilyonectria radicicola*, the main disease of ginseng root rot was 45 isolates, *Fusarium solani* was 44 isolates, *F. oxysporum* was 45 isolates, and 7 other fungi.

Conclusion : By analyzing the correlation between ginseng root rot pathogen and disease outbreak will be used as a basis for establishing a control strategy during ginseng cultivation.

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기비처리 수준에 따른 2년생 인삼 생육 및 양분이행 특성

문지원*, 장인배, 장인복, 서수정, 김영창

농촌진흥청 인삼과

Growth Characteristics and Nutrient Transfer of 2-year-ginseng according to the Level of Basal Fertilization

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ABSTRACT

Background : This experiment was conducted to analyze changes in the growth and saponin content of ginseng according to the level of fertilization in order to determine the appropriate amount of compost application during the planned site management.

Methods and Results : Compost and rice straw were mixed in the cut soil for 1 year preliminary management. Rice straw treated about 8.6 Ton at the level of 3 Ton/10a. After 1 year of planned site management, seedlings were planted on March 24, and after 2 months of growth in early June, the growth characteristics of the above-ground part were investigated. For the above-ground growth, a total of 6 items were investigated: chlorophyll content (SPAD), stiffness diameter, plant height, leaf length, leaf length, and leaf width. For the growth of the basement, three items were investigated: root weight, root length, and root diameter. As a result of the above-ground analysis in June, the difference was not significant, but statistically, the growth of the 2nd and 3rd treatments was generally good. Plant length, hard length, leaf length, stiffness diameter, and chlorophyll content all showed poor growth in Treatment 1. Treatment 4 was not statistically significant, but was numerically small compared to treatments 2 and 3. As a result of plant analysis in September, the difference was not significant, but the growth of the 2nd and 3rd treatments was statistically good overall. The growth of root length, root diameter, and root weight was the lowest in treatment 4. Treatment 1 had poor growth compared to treatments 2 and 3. As a result of plant analysis in September, calcium, copper, iron, magnesium, manganese, sodium, and zinc are higher in the above-ground content than in the underground, regardless of treatment. Regardless of the treatment of potassium and phosphorus, the content of the underground part is higher than that of the above-ground part. The items showing a significant difference according to the treatment level were phosphorus, and the above-ground content of treatment 4 was significantly higher than that of underground.

Conclusion : From the results of 2-year growth characteristics, it was confirmed that the appropriate level of compost application in the planned site management was 2 - 3ton/10a. As for the results of plant analysis, it seems necessary to analyze the nutrient transition according to the treatment level by additionally conducting monthly change survey. And ginseng aims to harvest 4-6 years old, it is necessary to present an appropriate application amount after continuous monitoring of the growth of old aged muscles. In addition, since it is a cut land, it will be an important management method for the main cloth to prevent physiological disorders caused by high salt accumulation by dividing insufficient nutrients into kibi and additional fertilization.

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[P01-007]

고온처리, 화학처리 이용한 지황의 복합 바이러스제거 처리 비교

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Comparison of Combination Virus Elimination Methods from the *Rehmannia glutinosa* by Thermotherapy, Chemotherapy

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ABSTRACT

Background : *Rehmannia glutinosa* is in the Scrophulariaceae family and is one of the most common and important medicinal herb plants. It is a perennial herbaceous plant and its root is used in medicine. Fresh or dried roots of *Rehmannia* are used mainly for hematologic conditions, sedation, insomnia and diabetes. Unfortunately it is difficult to propagate seeds due to poor seed viability and low propagation rate. Propagation by root tubers caused serious deterioration of the plant as a result of virus infection during vegetative propagation, which resulted in tuber yield reduction. Therefore, this plant is propagated vegetatively, but its vegetative propagation increases the incidence of virus infections in commercial fields, which can induce the production loss critically. So we tried to compare the efficacy of virus elimination from *R. glutinosa* by thermotherapy, chemotherapy *in vitro* plant to find an optimal micropropagation for healthy and virus-free plant production. *Rehmannia* was identified as a host of at least five viruses, including *Rehmannia mosaic virus* (ReMV), *Youcai mosaic virus* (YoMV), *Broad bean wilt virus 2* (BBWV2), *Plantago asiatica mosaic virus* (PIAMV), and *Rehmannia virus 1* (ReV1), the viral incidence surveys have not been performed yet in *rehmannia* fields in Korea.

Methods and Results : In this study, For virus elimination, *In vitro* plants conducted thermotherapy (heat treatment at 37°C for 6 weeks) and chemotherapy (addition into medium with ribavirin 60 mg/ℓ, 80 mg/ℓ). After treatments, RT-PCR tests were used for detection of five viruses including ReMV, YoMV, BBWV2, PIAMV and ReV1.

Conclusion : Efficiency of virus elimination was enhanced up to 42% in ribavirin 80 mg/ℓ than ribavirin 60 mg/ℓ with treatment at 37°C for 6 weeks. however, over the *in vitro* plant weakened. Most samples were verified to have multiple virus infection. From these results, we can suggest that combination treatment of chemotherapy and thermotherapy may be more effective for the elimination of major viruses from *R. glutinosa*.

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[P01-008]

오디 재배양식 및 지역에 따른 균핵병 방제 효과와 농약 잔류 특성

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Pest Control and Analysis of Residual Pesticides of Mulberry Fruit and Leaf against Popcorn Disease by Cultivated Type and Region

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ABSTRACT

Background : As the Positive List System (PLS) is implemented in broad application to all agricultural products, attention to the correct use of pesticides is also needed in the mulberry farmers that produce mulberry leaves and fruit. In this regard, three types of pesticides against mulberry popcorn disease were sprayed twice to three times to the outdoors and greenhouses to prepare safety standards, and the residual pesticide analysis was conducted by collecting mulberry fruits and mulberry leaves.

Methods and Results : Three types of thiophanate-methyl, thiophanate-methyl · triflumizole and fluopyram registered as PLS pesticides for mulberry popcorn disease, were sprayed in the Wanju and in Buan region, and residue pesticide analysis was conducted with HPLC analyzer. As a result, in the case of mulberry fruit, all three types of treated twice were found to be non-detected or below the permissible level, confirming that they were suitable for safe spraying. However, 5.6 mg/kg was detected in the greenhouse treated three times with the thiophanate-methyl, slightly above the MRL (maximum residue limit). In addition, the level of thiophanate-methyl · triflumizole was higher than or similar to the permissible level (0.1 mg/kg) as the thiophanate-methyl was detected in mulberry leaves in the greenhouse, respectively, with 0.2 mg/kg (Gwasang No. 2, spraying twice), and 0.09 mg/kg (Daesim, spraying three times).

Conclusion : The number of spray for the control of mulberry popcorn disease in the greenhouse should be limited to two times or less, especially when mulberry leaves in the greenhouse treated with thiophanate-methyl · triflumizole are used as food materials, careful consideration is required.

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Development of Two Layer T-type Hedge Cultivation Method for “Hwasu” Goji Berry (*Lycium chinense* Miller)

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ABSTRACT

Background : This study was carried out to develop new cultivation methods for ‘Hwasu’ goji berry that is tetradiploid, self-compatibility. ‘Hwasu’ had been developed by backcross of tetradiploid cultivars and colchicine induced mutation of local cultivars. ‘Hwasu’ has some good characteristics including Eriophyidae mite resistance, high betaine content and fresh fruit yield. Also, it’s vegetative growth is much more vigorous than the other cultivars. Therefore it was needed to develop larger canopy scale cultivation methods. Among the other cultivation methods I-type tree cultivation and T-type hedge cultivation methods have been developed and spread more than 80% of local farms. Despite of its diffusion rate in local farms it was needed to develop more harvest efficient and productive cultivation method for ‘Hwasu’ goji berry.

Methods and Results : In this study, tested cultivars was ‘Hwasu’ with four types of old and new cultivation methods. Plot was set by randomized block design with three replicates in three rain shelter greenhouses and the tested trees were three years old. For fertilization we put 3,000 kg/10a of compost for basal and $N : P_2O_5 : K_2O = 40 : 30 : 30$ kg/10a of fertilizer for basal and additional uses. Through the tests we investigated yield and growth characteristics by RDA’s ‘Agricultural Research Investigation Standard’.

According to the test of new cultivation methods, two layer T-type hedge cultivation method showed better canopy characteristics and productivity than I-type tree and T-type hedge cultivation on the number of fruit bearing and the dried fruit yields. Especially, two layer T-type hedge cultivation plots produced about 18% higher yield than that of second high yielding cultivation method, three layer T-type cultivation.

Conclusion : According to this study two layer T-type hedge cultivation method could increase annual yield by 18% compared with three layer T-type cultivation method. As a result of analyzing the economic feasibility, beside initial material and labor cost requirement, the labor force was reduced at the time of harvesting and the annual yield was increased. Therefore, total annual raw income expected to increase about 2,546,000 won/10a by adopting two layer T-type hedge cultivation method.

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LED 청색, 적색 광과장 비율이 고추냉이 생육에 미치는 영향

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Effect of LED Blue and Red Light Wavelength Ratio on the Growth of *Wasabia Japonica* Matsum.

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ABSTRACT

Background : *Wasabia japonica* Matsum. is a perennial, low-temperature, shaded plant of the Cabbage family. It grows wild at the edge of a mountain valley where cool and clear water flows. It is native to Japan, and Korea grows wild on Ulleungdo. The production of *Wasabia japonica* Matsum. rhizomes requires a constant temperature for over 18 months, and the area under these conditions is very limited. Therefore, cultivation of *Wasabia japonica* Matsum. is known to be very tricky. With the recent development of environmental control technology, *Wasabia japonica* Matsum. production technology has been developed by applying smart farm technology. In order to develop the optimal *Wasabia japonica* Matsum. production technology, it is necessary to apply an appropriate artificial light, and in particular, the investigation of the light wavelength is necessary, so this study was conducted.

Methods and Results : The growth of *Wasabia japonica* Matsum. according to the ratio of light wavelength red and blue was compared. For the study, an indoor hydroponic cultivation device was used, and a soaking method was used in the loess ball medium. Wasabi is a species of Dharma, and seedlings grown for 10 weeks were planted. The light wavelength treatment was performed by combining a red LED bar and a blue LED bar, and the blue: red ratio was set at 1:1, 1:1.5, 1:2, and 1:2.5 based on the number of LED modules. As for the nutrient solution, commercial nutrient solution for leafy vegetables was treated at a level of EC 1 to 1.5 dS/m. In order to investigate the degree of growth, it was cultivated for 10 weeks, and the number of leaves, plant height, leaf length, leaf area, and survival rate were examined once per week. As a result of analyzing the growth characteristics according to the light wavelength ratio, the growth was best at 1:1.5 blue-red ratio based on the number of LED modules. When the blue-red ratio based on the number of LED modules was 1: 1.5, the blue-red ratio based on PPF was 1:0.69. The number of LED modules and the PPF value were not proportional.

Conclusion : As a result of analyzing the light wavelength affecting the growth of horseradish, the growth was good at 1 : 0.69 based on the PAR value in the blue-red ratio. This is a different trend from the study of lettuce using artificial light. The result of this study is that in the case of shaded crops, it is judged that the response to the general amount of light or light wavelength appears differently. Therefore, when applying artificial light to shaded crops, consideration of the amount of light and light wavelength is considered necessary.

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[P01-011]

광폭해가림 재배시설의 모델별 미기상과 5년생 인삼의 생육특성

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경기도농업기술원

Micrometeorology for Each Model of Wide-Shading Facility and Growth Characteristics of 5-Year Old Ginseng

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ABSTRACT

Background : This study is designed to select a wide-shading facility model for ginseng, which is suitable for coping with the climate change and for saving labor for culture in Gyeonggi Area on the growth of 5-year old ginseng according to the micrometeorology and photosynthesis for each model.

Methods and Results : Wide-shading facilities were installed per model in 2017, such as the slope-shading facility I (Gyeongsangbuk-do ARES), slope-shading facility II (Gyeonggi-do, ARES), and roof-type shading facility (RDA). The black shading nets were installed for the slope-shading facility I and the blue shading nets were installed for both slope-shading facility II and roof-type facility in mid-April, 2017. As for the slope-shading II, aluminum screens 40% were additionally installed in the high temperature period of summer (from July to August). On Apr. 3rd, 2017, 90 2-year seedlings were transplanted per each treatment area of 1.62m². Micrometeorological device were installed in the middle section of the wide slope-shading facility in order to measure the amount of light, temperature, leakage, thermal image and optical spectrum. The photosynthesis was measured in the middle section of small leaves by using a photosynthesis measuring device (LI-6400, Li-COR) at 9:00 - 10:00 at 200 $\mu\text{mol s}^{-1}\text{m}^{-2}$. During the high temperature period of July and August, the maximum temperature under the roof type wide-shading facility was higher than that under slope-shading facility I or slope-shading facility II. The optical spectrum analysis for each treatment indicated the followings; slope-shading facilities using black shading nets showed similar patterns for natural light but as for slope-shading facilities II and roof-type shading facilities which use blue shading nets, the penetration of yellow, green and red light was lower in the wide band spectrum of blue, green, yellow and red. In the thermal image comparison, the slope-shading facility I, slope-shading facility II and roof type shading facility showed similar temperatures of 42.6 - 43.6°C. As for the growth of the above-ground part of ginseng per broad band type and model, the slope-shading facility I and slope-shading facility II showed good results while as for the photosynthesis, the slope-shading facility II showed to be a little higher. As for the growth of underground part of 5-year old ginseng, the length, diameter and weight of root under the slope-shading facility I and slope-shading facility II were better than those of roof-type shading facility while, as for the weight of ginseng roots, that under the slope-shading II (1.92 kg/1.62m²) was higher by 0.56 kg than that under roof-type shading facility.

Conclusion : It is concluded that considering the climatic environment and growth characteristics, the wide-shading facility model which is suitable for the Gyeonggi-do area is the slope-shading facility II.

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[P01-012]

일천궁 재배포장에서 멀칭 필름의 종류에 따른 포장 온도경감 및 생육증진 효과

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Effect of Reducing Field Temperature and Promoting Growth according to the Type of Mulching Film in Cultivation of *Cnidium officinale* M.

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ABSTRACT

Background : *Cnidium officinale* M. is a perennial plant belonging to the Apiaceae family and is one of the representative medicinal crops in East Asia. Recently, due to the increase in sales of foods and drugs using *Cnidium officinale* M., the cultivation area is increasing significantly, but production instability continues because it is vulnerable to high temperatures in summer. Accordingly, in this test, a comparative cultivation test was performed by conventional films and low-temperature films in order to lower the temperature of the cultivation site.

Methods and Results : Mulching was treated by dividing into a conventional film (black film), 4 types of low-temperature films (S1, S2, S3, S4), and no treatment. The low-temperature film uses a moisture-permeable material and a technology that reduces the temperature by absorbing the heat of vaporization is applied. After film mulching, *Cnidium officinale* M. was planted on April 7, 2020, and the temperature and plant growth of each treatment area were investigated during the high temperature in summer. As a result of the measurement on June 8, the surface temperatures of the non-mulching and black film treatments were 48.7°C and 58.8°C, respectively, and the soil temperatures were 35.9°C and 46.9°C. The surface temperatures of the low temperature films S1, S2, S3, and S4 were 48.8°C, 45.6°C, 47.4°C, and 37.1°C, respectively, and the soil temperatures were 34.8°C, 33.5°C, 35.3°C, and 36.1°C, respectively. The most excellent high temperature reduction effect was the S4 film, which had a surface temperature of 21.7°C (37%) and a soil temperature of 10.8°C (23%) lower than the conventional black film. The growth of *Cnidium officinale* M. was also excellent in low temperature film compared to black film. In the 92-day survey after planting, the length of the black film treatment group was 19.9cm, and the length of the S1, S2, S3, and S4 treatment groups was 25.9, 32.1, 22.5, and 19.6 cm, respectively. There was an average of about 25.0 cm (26%) of growth promotion effect.

Conclusion : As a result of this study, it was confirmed that the low-temperature film with enhanced moisture permeability effectively suppresses the increase in the film surface temperature and soil temperature in summer and helps to promote crop growth. However, as a result of this test, the effect of improving crop growth may be different if the region changes or the climate changes every year as a result of specific climatic conditions. Therefore, in order to use this technology in the field, it is considered that it is necessary to accumulate data and increase applied crops through repeated tests.

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논재배 인삼 개선해가림시설의 미기상 및 생육특성

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The Growth and Micrometeorology Traits of Korean Ginseng (*Panax ginseng* C. A. Meyer) Plants in the Progression Shade Facility

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ABSTRACT

Background : Coventional shade facility is a lack of sunlight necessary for photosynthesis because sunlight is blocked by shade less than 5% except in the morning. There are a problem that ginseng growth is uneven, a difference in growth by the location of the furrow. As the light intensity increases up to 30,000 lux, Ginseng photosynthesis also increases. Since the total light intensity of sunlight is 120,000 to 130,000 lux, 30,000 lux is 20 - 25% (Jung *et al.*, 2010). The optimal light intensity of ginseng growth is 10,000 - 15,000 lux that the optimum light intensity depends on the temperature. When the temperature is lower than about 20°C, the photosynthesis amount is increased above 15,000 lux. When the temperature is around 30°C, it is good within 4,000 lux (Park *et al.*, 1979). In case the temperature of the high temperature is above 30°C as the amount of sunshine increases, the temperature of ginseng leaves increases, Respiration increases On the other hand Photosynthesis rarely occurs.

Methods and Results : We set up 2 kind of facility as progression shade and conventional shade in Ginseng & Medicinal Plant Research Institute, Chungnam Agricultural Research & Extension Services (CNARES). This study examined the difference between coventional shade and progression shade in light intensity and growth of the improvement. Progression shade facility used four (90cm, 120cm, 150cm, 180cm) different length of Sunshade (PE2). We examined cultivation and weather Environment and the characteristics of ginseng plant and roots growth. The result was as follows. The average light transmittance for four-days in the sun shade was 90 cm (21.0%) > 120cm (16.9%) > 150 cm (11.2.%) > control (6.5%). In the case of 90cm 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 $\mu\text{mol CO}_2 \text{ m}^{-2}\text{s}^{-1}$) > 180cm 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.

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 suitable for the short additional cover with two-layerd black polyethylene net.

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[P01-014]

콩 파종·수확기에 따른 수량 및 이소플라본 함량비교

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Comparison of Seed Weight and Isoflavone Contents according to Sowing and Harvesting Period in Soybean

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ABSTRACT

Background : Soybeans are an important source of protein and lipids in Korean diet. In addition to the essential ingredients, isoflavones are attracting attention as vegetable estrogen and contain a variety of ingredients. Isoflavones are effective in osteoporosis and cardiovascular disease, which have a high incidence during menopause. Therefore, this study sought to select when isoflavones were highly cultivated.

Methods and Results : In 2020, the Miryang Southern Crop Department used the Daepung-2 variety. The sowing period was carried out at around three times every 20 days as of June 1st. The harvest time of the first sowing was carried out four times at intervals of 10 days from 120 days after sowing, and the second sowing was carried out four times at intervals of 10 days from 110 days after sowing. The third sowing was carried out in 4 periods every 10 days from 100 days after sowing. For the isoflavone content, the contents of Daidzin, Genistin, and Glycitin in the Glycone and Aglycone groups were analyzed in triplicate.

Conclusion : The seedlings were sown on June 1st and harvested on October 15th were the largest at 356 kg/10a. And the average yields were 268 kg/10a, more than other sowing times. The isoflavone content was highest at 681 µg/g from seeds sown on June 1st and collected on October 5th. In addition, the content of seeds harvested on October 26 after sowing at the same time was slightly higher at 625 µg/g. Seeds sown on July 9 and collected on October 26 were 586 µg/g. Sowing on June 1st and June 19th had the highest content around 120 days after sowing, and sowing on July 9th had the highest content around 110 days after sowing. The difference in isoflavone content is expected to have been caused by moisture, solar radiation, and temperature as stressors of the crops from the flowering period to the full-pod stage.

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Research of Appropriate Seedling Period of Plug-seedling in *Platycodon grandiflorum*.

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ABSTRACT

Background : *Platycodon grandiflorum* is principal medicinal crops and widely used as medicinal purpose or vegetable. It is cultivated by direct sowing or seedling transplanting cultivation. It costs a lot of weed control efforts in direct sowing cultivation and there are root cutting and other disadvantages in common seedling transplanting cultivation. Therefore, this study was carried out to investigate appropriate seedling period of plug-seedling in *Platycodon grandiflorum* for the establishment of stable seedling transplanting cultivation.

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 2018. The seeds were sown on 128 spherical seedling trays from the middle of February 2019 until the end of March 2019, and grown for 30, 40, 50, 60 and 70 days in glasshouse. 70 days after first seedling, seedling growth characteristics such as emergence rate, plant length, stem diameter and other factors were investigated in late April 2019. After transplanting into the field, growth characteristics such as percentage of establishment, root fresh weight, root dry weight and other factors were investigated in the middle of October 2019.

As a result, seedling growth characteristics such as plant length (7.8 cm), stem diameter (1.63 mm), leaf length (3.8 cm), leaf width (2.5 cm), shoot fresh weight per hill (0.53 g) were the highest at 60 days and emergence rate (78.6%) was the highest at 70 days. Field growth characteristics such as blooming period (July 9) was the fastest and root fresh weight per hill (193.5 g), root dry weight per hill (53.6 g) were the highest at 60 days and percentage of establishment (92.5%) was the highest at 50 days.

Conclusion : In the seedling stage, considering plant length, stem diameter, leaf length, leaf width and shoot fresh weight per hill, 60 days seedling was excellent seedling growth characteristics. In the field stage, considering root fresh weight per hill, root dry weight per hill and blooming period, 60 days seedling was excellent field growth characteristics.

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지황 논재배 시 토양 병원성 진균 분포 및 품종별 생육특성 비교

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Comparison of Growth Characteristics by Cultivar and Distribution of Soilborne Fungal Pathogens during Cultivation of *Rehmannia glutinosa* in Paddy Field

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ABSTRACT

Background : Jeongeup-si is main production area of *Rehmannia glutinosa*, but cultivation area of it is stagnant due to the lack of first planted field by injury of continuous cropping. Some farmers are attempting to cultivate it in paddy fields, but there have been many cases of failure because of excess-moisture injury caused by selection of inappropriate sites. Therefore, this study was conducted to contribute to the introduction of paddy-upland rotation system and expansion of cultivation area through comparison growth characteristics of each cultivar and analysis of major pathogenic fungi in the soil when cultivating *Rehmannia glutinosa* in paddy field.

Methods and Results : This experiment was carried out to use 6 varieties (Jihwang 1ho, Gogang, Togang, Dagang, Hwanggang and Daegyeong) in first planted field and replanted field of paddy soil located in Jeongeup-si from late April to late October 2020. According to the growth stage of *Rehmannia glutinosa*, we collected and analyzed soil samples about three genera (*Rhizoctonia* spp., *Fusarium* spp., *Acremonium* spp.) reported as fungal pathogens affecting root rot disease of it. The abundance ratio of the fungal pathogens was low in March and May, increased in August when soil temperature rose, and decreased again in October. The trend of abundance ratio by genus was high in order of *Fusarium* spp., *Acremonium* spp., *Rhizoctonia* spp. and there was much higher in replanted field than first planted field. The emergence rate and mortality rate of each cultivar ranged from 82.8% to 98.5% and 14.5% to 20.5% in first planted field, respectively, and 87.9% to 98.7% and 25.5% to 42.8% in replanted field, respectively. The yield of marketable fresh roots by cultivar was shown as follows. Gogang was the highest at 775.1 kg/10a in first planted field, and Hwanggang was relatively good at 354.3 kg/10a in replanted field.

Conclusion : As a result of analyzing the fungal pathogens in the rhizosphere soil of *Rehmannia glutinosa*, *Fusarium* spp. showed the highest abundance ratio, so it can be presumed as a major factor of root rot disease, but further studies such as isolation identification and pathogenicity test are considered to be necessary. Through comparison of growth characteristics to select suitable cultivar for paddy cultivation of *Rehmannia glutinosa*, it was found that Gogang and Hwanggang were good in first planted field and replanted field, respectively. However, it is thought that an additional test is necessary because yield of *Rehmannia glutinosa* saw a sharp decline due to excess-moisture injury caused by record torrential rain in 2020.

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음성 지역 인삼 재배 후 유망 약용작물 선발

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Selection of Promising Medicinal Crops after Cultivating Ginseng in Eumseong Region

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ABSTRACT

Background : *Panax ginseng* is the crop that is severely damaged by continuous cropping. Therefore, researchers have been conducted to find a physicochemical solution, but there is no clear solution so far. The purpose of this study was to find promising medicinal crops grown on the harvested ginseng field, and to find suitable crops for the climatic environment similar to the Eumseong region.

Methods and Results : This experiment was carried out on 10 kinds of medicinal crops in 6-year-old ginseng cultivation history field (GF) and plowed field (PF) respectively in Eumseong test field. To make the soil chemistry of both fields uniform, as a result of soil chemistry analysis, fertilization was conducted according to the standard of fertilizer prescription for each crop. In addition, three kinds of organic fertilizers, which are widely used in farms, were applied according to treatment groups, then made furrows and sowed seeds. Afterwards, the insecticides and fungicides were sprayed three times each to control pest outbreaks. As a result of experiment, nine kinds of crop including *Peucedanum japonicum*, *Platycodon grandiflorum*, *Rehmannia glutinosa*, *Coix lacryma-job*, and *Cnidium officinale* had high seedling emergence rate more than 90% except for *Codonopsis lanceolata* in the GF. In particular, the fresh leaf weight of the *P. japonicum* was higher in the GF than in the PF when comparing untreated control. In the comparison of organic matter treatments in the GF, It was shown that there was statistically significant different fresh leaf weight in three kinds of organic matter treatment as a 154.8 - 179.3 g/plant when comparing untreated control of 110.9 g/plant.

Conclusion : Based on the above results, we first selected *P. japonicum* as one of the promising crop after cultivating ginseng in Eumseong region, and plan to investigate the proper planting density and amount of organic matter in the near future.

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[P01-018]

청백필름하우스 이용 남부 평야지 인삼 스마트팜 재배 특성

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Characteristics of Korean Ginseng Cultivation using Smart Farm Technology in the Southern Plains Blue-White Film Plastic House

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ABSTRACT

Background : This study was conducted in a plastic house facility using blue-white film developed exclusively for ginseng cultivation. The test area is Gimje, Jeollabuk-do, a southern plain. The facility house is a house with automatic side window opening and closing, soil irrigation, shading, and ventilation functions, and was conducted for basic research on smart farms for ginseng facility cultivation.

Methods and Results : 1-year-old seedlings were planted on March 24, 2020 (n = 81 seedlings/1.8 × 0.9 m²). The side windows were opened when the air temperature was above 23°C, and the soil moisture level was maintained at 18 - 20%, and the shading was maintained when the amount of light(PPFD) inside the blue-white film plastic house was 200 μmol/m²/s or higher. The average air temperature inside the blue-white film plastic house and the conventional shading cultivation method measured from April to September was 24.3°C and 24.4°C, respectively, and there was no significant difference in atmospheric humidity. Soil temperature and humidity were also the same trend. The chemical properties of the soil in the blue-white film plastic house are as follows. pH levels was 7.0, EC levels 0.5 dS/m and OM levels 15 g/kg. The total nitrogen content was 2.1 mg/kg and the available P₂O₅ contents was 412.2 mg/kg. Exchangeable cations K, Ca and Mg contents were 1.8, 8.4 and 3.2 cmol+/kg, respectively. The seedling germination rate was 96.2%. The amount of light intensity, illuminance and solar radiation (survey date: June 5) in the blue-white film plastic house were 116.9 μmol/m²/s, 6,085 lux and 33.7 W/m². This values were 6 - 7% of that of the open field. The plant height was 19.9 cm, stem length was 6.3 cm, leaf length was 7.2 cm and stem diameter was 1.7 mm. The root length was 18.3 cm, the tap root length was 5.6 cm, diameter of taproot was 9.7 mm and the fresh root weight was 4.3 g. The disease incidence (Alternaria blight, Gray mold and Damping-off etc.) rate were 0.3 - 2.4%. The incidence ratio of rusty root ginseng was 5.0% and leaf discoloration rate was 2.1%. There was no occurrence of high temperature damage.

Conclusion : By adding some smart farm facilities to the blue-white film plastic house that helps the use of blue light and lowers the temperature inside the facility, it was confirmed that there is no high temperature damage and less disease incidence when cultivating 2-year ginseng in the southern plains.

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저장온도 및 저장방법이 황정 종근 발아에 미치는 영향

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Effect of Storage Temperature and Storage Method on the Germination of *Polygonatum* spp.

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ABSTRACT

Background : *Polygonatum* spp. protects the stomach and lungs, stops coughing, and soaks purified water. In pharmacological experiments, blood pressure lowering, blood glucose lowering, anti-arteriosclerosis, and hepatic fat depositing prevention effects were found.

The purpose of this study was conducted to find out how to efficiently store *Polygonatum* spp. and to determine the effect of the storage method on the germination of stalk roots.

Methods and Results : In order to find out the efficient storage method of rootstock of *Polygonatum* spp., put it in gunny bag, vinyl bag, and newspaper packaging (cover with newspaper in PVC box) as a packaging method. the storage temperature are room temperature, 0℃, and 10℃ for each treatment (5 kg) was put and stored. The room temperature storage was stored at room temperature, 0℃ and 10℃ were stored in the cold storage. The vinyl packaging has drilled 10 holes to allow air to pass through. The storage period was stored from the end of March to the beginning of July. According to the survey after eight weeks of storage, the weight loss rate was the highest at room temperature of 30.9% at the storage of the gunny bag, and the lowest at 0℃ vinyl bag storage of 1.6%. Among packaging materials, the weight loss rate was higher in the order of gunny bag > newspaper > vinyl bag packaging. During the storage period, the decay rate was also the same as the weight loss rate, and was the highest in room temperature gunny bag storage, and the lowest in vinyl bag storage at 0℃. After 8 weeks of storage, the germination rate was investigated after planting the rootstock in the pot. As a result, the higher the storage temperature, the lower the germination rate, and between packaging materials, the germination rate was higher in the order of vinyl bag > newspaper > gunny bag.

Conclusion : From the above results, it was judged that the effective storage method and germination of rootstock of *Polygonatum* spp. was to store them at 0℃ with vinyl bag packaging.

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청백필름하우스 이용 인삼 재배 후 타 작물 재배특성

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Cultivation Characteristics of Other Crops after Ginseng Cultivation using Blue-White Film Plastic House

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ABSTRACT

Background : Since ginseng is a semi-shaded plants, it is cultivated using artificial shading facilities. In conventional shading cultivation, rainfall leaks, causing many diseases when growing ginseng. To solve this problem, a technology for cultivating a blue-white (B-W) film plastic house exclusively for ginseng, which has the effect of blocking light and rain, has been developed at the Jeonbuk Agricultural Research & Extension Services. This study was conducted to select suitable crops for cultivation after harvesting ginseng grown in the B-W film plastic house.

Methods and Results : The test was carried out in the B-W film plastic house where ginseng was harvested and in the open field (control). The crops used in this test were *Allium victorialis*, *Ligularia fischeri*, *Gastrodia elata* and *Panax ginseng* C.A. Meyer. *A. victorialis* and *L. fischeri* grown in the open field were shaded by 50% during the high temperature period. The average air temperature of open field and the B-W film plastic house measured from April to September was 20.1°C and 20.2°C, respectively. Soil temperatures in August and September tended to be high in the open field (1.4 - 2.2°C in Aug. and 0.5 - 0.9°C in Sep.). In July and August, the precipitation was 622 mm and 676 mm, respectively, which was higher than normal year. The large amount of precipitation is believed to be the cause of the low survival rate and increased disease incidence of *A. victorialis* and *L. fischeri* grown in the open field. The chemical properties of the soil in the open field and B-W film plastic house are as follows. pH levels were 6.1 and 7.1. EC levels were 0.8 dS/m and 1.2 dS/m. The organic matter contents were 29.9 g/kg and 29.2 g/kg, and the available P2O5 contents were 448.8 mg/kg and 471.7 mg/kg. Exchangeable cations K, Ca and Mg contents (cmol+/kg) were 1.4 and 1.0, 10.9 and 10.0, 2.9 and 2.1, respectively. The amount of light intensity (PPFD) of the B-W film plastic house was 8.5 - 10.2% of that of the open field, and the amount of light intensity of the open field shaded (50%) was 31.5 - 50.5%. *A. victorialis* was excellent in growth in the open field shaded, but the survival rate was very low. The growth of *L. fischeri* was excellent in the B-W film plastic house and the survival rate was also high. The production of *L. fischeri* leaves increased by 7.9 times compared to open field cultivation at the B-W film plastic house.

Conclusion : In the first-year trial for selecting suitable crops for the B-W film plastic house, the survival rate of *L. fischeri*, which has less damage from low temperature and precipitation, was high, its growth was excellent, and its leaf productivity was high.

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라이시미터를 이용한 3년근 인삼의 증발산량 평가
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Evaluation of Evapotranspiration of 3-year-old Ginseng using a Lysimeter

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Background : Lysimeters are widely used to measure the movement of nutrients and moisture in the soil. Water management methods are important in ginseng cultivation, but information on water consumption by year and growing season is insufficient. The purpose of this study was to evaluate the actual evapotranspiration of 3-year-old ginseng by growing season using a lysimeter and to investigate the water use pattern.

Methods and Results : The lysimeter used in this study consisted of a pot with an inner diameter of 60 cm wide × 60 cm long, a depth of 50 cm, and a wall thickness of 10 cm, and an electronic load cell (PKF-C600) with a resolution of 1/600,000. As for the pot filled soil, the pot with ginseng transplanted and without transplanted were used for the calculation of the actual evapotranspiration. The lysimeter was installed in the outdoor sunshading facility using green sunshading material. Microclimate data of inside and outside of the sunshading facility were collected using temperature and humidity (HMP115) and solar radiation sensor (CMP6). The change in leaf area of ginseng was measured by collecting image data. The average value of the vapor pressure deficit (VPD) representing the dryness of the atmosphere was higher in the sunshading facility from the late of March to mid-May, and the outside after that. The leaf area index of 3-year-old ginseng was 0.64 - 0.72 from late May to early June, which was the highest during the cultivation period. The evapotranspiration was the highest period with an average of 0.344 mm in mid-April to early July, and the maximum in early June with 0.409 mm. The transpiration was the highest period with an average of 0.168mm from mid-May to late June, and the maximum was 0.216 mm in early June.

Conclusion : From April to June, when ginseng growth begins to grow, the atmosphere is dry and rainfall is low, so irrigation is required. By using a lysimeter to find out the evapotranspiration for each growing season of ginseng, it will be possible to set the irrigation cycle and amount for each growing season.

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채종시기에 따른 천문동 종자 수량 특성

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Characteristics of Seed Yield of *Asparagus cochinchinensis* Merrill. according to the time of seed harvesting

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ABSTRACT

Background : *Asparagus cochinchinensis* Merrill is a climbing habit perennial plant belonging to the genus *Asparagus*, and is a dioecious plant. *Asparagus cochinchinensis* Merrill seeds can only be harvested when it is 7 years old or older. So that, research on the production of *Asparagus cochinchinensis* Merrill seeds is difficult compared to other medicinal crops.

Methods and Results : This study was conducted for two years from 2019 to 2020. Seven-year-old Jeonnam local variety (Hwasun species) was used as the test cultivar. The seed yield test was conducted by dividing into two types of topping and harvest time. Topping degree test was carried out at intervals of 30 cm from 60 cm to 150 cm on the ground surface, and seeds were harvested at maturity. Harvest time test was harvested 5 times at intervals of 20 days from 30 to 110 days after the flowering period. For fertilization, All of the standard fertilization amounts (N-P-K-Compost = 21-17-17-3,000 kg/10a⁻¹) were given as basal application of fertilizer. In both tests, the planting density was 30×25cm, and cultivated by mulching with black plastic film. There was 1 experimental plot, and the seeds were harvested by repeating 3 times. *Asparagus cochinchinensis* Merrill flowering period was 16 June. Topping degree test Seed harvesting was carried out on September 14th. The harvest of the harvest time test was conducted on July 16 (1st), August 4 (2nd), August 25 (3rd), and September 14 (4th), and the 5th harvest was It was impossible due to the death of the above ground part. Yield characteristics according to the degree of topping were the highest at 150 cm, 50.6 g per plant, and 33.8 kg per 10a were harvested. There was no difference in one hundred seed weight according to the degree of topping. Yield characteristics according to the harvest time were the most at 37.5 g per 10a in the fourth harvest (around 90 days after the flowering period), and the one hundred seed weight tended to become heavier as the harvest time was delayed.

Conclusion : From the above results, it was suggested that 150 cm of topping height for the production of excellent *Asparagus cochinchinensis* Merrill seeds would be advantageous, and that the optimal harvesting time would be 90 days after the flowering period.

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인삼 생육에 차광재료가 미치는 영향
최양애*, 류영현, 손형락, 장명환, 정지윤, 허민준
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Effect of Light Shielding Materials on Ginseng Growth

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ABSTRACT

Background : Ginseng, *Panax ginseng* C. A. Meyer is a perennial herb that grows under the shade environment. The amount of light reaching the plant varies with the shading materials to make sunshade. The quantity of sunlight under the blue sheet is about three times higher than black blue net that currently in use. Ginseng plant that grow prefer in cool temperatures and shade, may be damaged when they are exposed to high temperatures and a great deal of sunlight. In fact, the recent summer heat wave has caused damage, including burning of ginseng leaves.

Methods and Results : In this study, three types of shading materials in ginseng cultivation were used to make sunshade facilities to grow ginseng. After transplanting Yeunping rhizomes of the one old seedling in the spring of 2017, environmental and growth indicators were measured where the plants were growing.

In the summer of 2018, the micro environment inside the sunshade facilities was threatening the growing ginseng plants. In July 2018, the highest temperature in the shade of the black blue net was 39℃, when the amount of light was 800 lux under the black blue net, 5,600 lux under the blue sheet, and 1,800 in the silver sheet. In the case of the blue sheet, the weight of roots harvested in July was heavier than that harvested in September, despite grew for more than two months. Especially in the summer of 2018, when there was a heat wave incident, roots harvested in July were heavier than those harvested in September at all the three facilities.

Conclusion : The smaller weights of the roots harvested in September compared to the weights of the roots harvested in July seems to be due heat wave in the summer. In particular, the lowest root weight in the blue sheet may be due to the earliest death of the leaves (data not shown), which may be due to the addition of more intense light stress to high temperature stress.

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[P01-024]

인삼 연작지 훈증처리가 토양미생물상 및 뿌리썩음병원균 밀도에 미치는 영향

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Effect of Fumigation Treatment of Ginseng on the Occurrent of Soil Microbial Community and Root Rot Pathogen Density

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ABSTRACT

Background : Ginseng (*Panax ginseng* C. A. Meyer) is cultivate for many years in one place, the occurrence of root rot place, the occurrence of root rot caused by soil pathogens increases as the elderly grow, and the harvesting rate of 6-year-old ginseng tends to be as low as 70%. Ginseng continuous cultivation disorder is mainly caused by root rot disease, and the disease incidence increases rapidly when continuously cultivated in the soil where ginseng is grown. Ginseng is less prone to root rot in virgin soils, but the disease incidence increases rapidly in succession, causing great damage. Therefore, it is possible to cultivate it again after 10 years or more after the ginseng harvest, and ginseng farms are looking for places where ginseng has not been cultivated. Therefore, this study was conducted to reduce the occurrence of ginseng root rot by treating the soil fumigation agent where ginseng was grown and to examine whether ginseng can be grown.

Methods and Results : As a result of conducting tests to develop soil nutrient management and fumigation treatment technology to alleviate ginseng serial cultivation disorders, the aboveground plant height by type of soil fumigant was high in Dazome granules and methamsodium treatment, and lowest in no treatment. There was a high tendency in sodium treatment. Root rot pathogen density (*C. destructans*) was highest in no treatment and low in methamsodium treatment, and residual pesticides (320 species) were not detected in all treatments of soil fumigant.

Conclusion : In order to alleviate ginseng serial cultivation disorders, a test was conducted to control root rot during soil fumigation. Even when methamsodium was treated, the above-ground and underground growth tended to be excellent and the density of root rot pathogens tended to be low.

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LED 스펙트럼이 새싹 인삼의 형태 생리 및 항산화 능력 변화에 미치는 영향

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Effect of LED Spectra on Morpho-physiological and Antioxidant Capacity Changes in Young Ginseng Seedlings

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ABSTRACT

Background : *Panax ginseng* is a perennial herb, has been used as medicinal purpose for long period of time, and well-known for its pharmacological activities such as anticancer, anti-stress, anti-aging, anti-diabetic, and neuroprotective effects. Ginseng extract is composed of various compounds such as ginsenoside, polysaccharides, flavonoids, peptides, polyacetylene alcohol and fatty acid. Light is the main source of energy for growth and development of plant through photosynthesis. These growth and development process greatly depend on spectral composition, duration, direction, and light intensity. The aim of this study was to analyze the effects of 10 LED light spectrum in a controlled aeroponic system on growth, physiological characteristics, and antioxidant capacity of young ginseng seedlings.

Methods and Results : Seedlings of Korean ginseng have been collected and maintained at the Dept. of Bio-Health convergence, Kangwon National University. One-month aged seedlings were transplanted to an aeroponic system under the following different combination of light spectrum at Intensity ($300 \mu\text{mol m}^{-2}\text{s}^{-1}$): W, R₈B₂, R₇B₂G₁, R₇B₂FR₁, R₆B₂G₁FR₁, R₅B₂W₂FR₁, R₅B₂G₁FR₁UV₁, R₆B₂FR₁UV₁, R₄B₂W₂FR₁UV₁ and R₂B₂G₂W₂FR₁UV₁ along with natural light and cultivated for 20 days. From the results, longer shoot length was recorded from R₇B₂FR₁ spectra and no significant change on root length was observed by LED treatments. Higher plant biomass was recorded from R₅B₂G₁FR₁UV₁. Higher photosynthetic activity was observed in natural light, R₇B₂FR₁ and R₅B₂G₁FR₁UV₁ treatments. Higher Chl a and Chl b were recorded in R₅B₂W₂FR₁, R₅B₂G₁FR₁UV₁, R₄B₂W₂FR₁UV₁ and R₂B₂G₂W₂FR₁UV₁ treatments. Higher carotenoids were recorded in R₅B₂W₂FR₁, R₄B₂W₂FR₁UV₁ and R₂B₂G₂W₂FR₁UV₁ treatments. In case of TPC, TFC and DPPH radical scavenging activity (%), leaf and stem responded well to natural light, R₇B₂G₁ and R₂B₂G₂W₂FR₁UV₁ treatments and root responded well to R₇B₂G₁, R₅B₂G₁FR₁UV₁, and R₆B₂FR₁UV₁ treatments.

Conclusion : We may suggest that variations in ginseng growth and development were observed under the different LED spectral combination. The ginseng seedlings were found well adapted with higher growth, development and antioxidant capacity in R₇B₂G₁, R₅B₂G₁FR₁UV₁, and R₂B₂G₂W₂FR₁UV₁ spectral combination.

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강원 중북부지역에서 차광시설 유형에 따른 1년생 만삼의 생육 및 채종 특성
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Growth and Seeding Characteristics of One-Year *Codonopsis pilosula* by Shading Facility Type in the North-Middle Area, Cheron, Gangwon-do, Korea

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ABSTRACT

Background : This study was carried out to establish the type of shading facilities suitable for stable growth and seed production in order to expand the cultivation area of Pilose bellflower.

Methods and Results : Treatment was 4 types of open field, 55% shading, rain shelter, rain-shelter + 55% shading for each shading method. The chlorophyll content of Pilose bellflower leaves grown in each facility was the highest at 30.8 $\mu\text{mol}/\text{m}^2$ when 55% shading was applied, and was statistically significant. The starting date of flowering by shading facility type was the same as July 5, but the flowering period and the flowering end date showed the earliest trends in the 55% shading treatment, July 27 and August 3. The flowering start date by shading facility type showed the same trend as July 5, but the flowering period and the flowering end date showed the earliest trend as July 27 and August 3, respectively, in 55% shading treatment. The weight of fresh grass and hay per plant was the heaviest at 101.3 g and 21.0 g, when rain-shelter + 55% shading treatment, and were statistically significant. The weight of fresh and dry roots per plant showed the heaviest trend at 36.9 g and 10.9 g, respectively, at 55% shelter treatment, but there was no statistical significance. In the case of 55% shading treatment, the survival rate of ginseng was 68.3%. The yield of dry roots per 10 a was the heaviest at 110.2 kg in 55% shading treatment, and it tended to increase by 29% compared to 85.4 kg in the open field. In the rain shelter and the rain-shelter + 55% shading treatment, the amount of seeding per plant was 3.6 g and 3.7 g, respectively. In addition, the yield of seeds per 10 a was 23.2 kg and 24.2 kg, respectively, in the case of rain shelter and rain-shelter + 55% shading, which tended to increase by 70.6 - 77.9% compared to the open field. However, in the case of 55% shading treatment, the germination force of seeds showed the strongest tendency, and the germination rate was also the highest at 91.0%. In rain shelter and rain-shelter + 55% shading treatment, where the seed yield was high, the germination rates tended to decrease to 76.5% and 72.5%, respectively. The superior seed production amount of Pilose bellflower per 10a was estimated to be 17.8 kg and 17.5 kg in the rain shelter and rain-shelter + 55% shading treatments. In the 55% shading treatment, the superior seed production was 13.8 kg, which was 23.3% higher compared to 11.2 kg in the open field.

Conclusion : From the above results, when the germination rate was considered, a 55% shading facility was considered to be suitable for stable growth and seed production of 1-year-old Pilose bellflower.

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[P01-027]

식물 공장내 인공 LED (Light Emitting Diode) 조사에 의한 감자 괴경 생산

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Production of potato (*Solanum tuberosum* L.) seed tuber under artificial LED light irradiation in plant factory

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ABSTRACT

Background : Plant production in a plant factory is an innovative and smart idea to grow food anytime, anywhere, regardless of the outer environment. However, potato pre-basic seed tuber (PBST) production in a plant factory is a comparatively new initiative. Therefore, the aim of this study was to optimize the artificial LED light spectrum to produce PBST in a plant factory. Two potato varieties such as Golden king (V48) and Chungang (V41) was grown in soil substrate under different combination of artificial LED light combinations (such as red + blue + far-red, red + blue + white, blue + far-red, blue + white, red + far-red, and red + white) maintaining photosynthetic photon flux density (PPFD) of $100 \text{ mol m}^{-2}\text{s}^{-1}$, temperature 23/15°C (day/night), and relative humidity 70%.

Methods and Results : The study revealed that, overall, potato plant growth (viz.; plant height, node number, leaf number, leaf length and width, fresh and dry weight) was enhanced by the red+far red light for both potato varieties. The total seed tuber number per plant was higher in red+blue+white light for V48, and red+far-red for V41. The fresh tuber weight was the highest in the red + blue + far-red light for V48 and red + blue + white for V41. The highest accumulated photosynthetic pigment (total chlorophyll, chlorophyll a, b and carotenoid) was observed in red + blue + white light for both varieties. The total carbohydrate content and total sucrose content were higher in red + blue + far-red and red + far-red light treatment for V48 and V41, respectively.

Conclusion : The current study obtained that potato plant growth and tuber formation are an independent phenomenon, and their response to the artificial light is unique when grown in a plant factory. Red and far-red light spectrum boosted up the growth characteristics; however, red + blue + far-red + white light combination influenced the tuber formation and accumulation of primary metabolites.

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조직배양묘 형태학·해부학적 특성

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Morpho-anatomical Characteristics of *in vitro* Grown Roots in *Panax ginseng* Meyer

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ABSTRACT

Background : Despite the high commercial value of *P. ginseng*, there are few studies on their anatomical structure, specifically root anatomy. In the present study, morpho-anatomical characteristics of *in vitro* grown roots (IGRs) and *ex vitro* grown roots (1-year-old roots) were compared.

Methods and Results : *In vitro* grown roots were obtained by zygotic embryo culture. In the case of 1-year-old roots, plants were harvested in early November from Yunpoong. After storing the plants for 3 months at 4°C to induce breaking dormancy, 1-year-old roots were used as experimental materials. To observe anatomical characteristics, the primary roots were collected to compare the anatomical characteristics of the IGRs and 1-year-old roots by using modified procedures that were previously reported.

Conclusion : *In vitro* grown roots had very different morphological characteristics compared with controls. IGRs had shorter primary roots with several lateral roots, whereas a long taproot was only observed in the 1-year-old roots. It was postulated that these distinct morphologies resulted from differences between *in vitro* and *ex vitro* environmental condition. Periderms of IGRs were thicker and showed better development than that of the 1-yr-old roots. Several air lacunae were present in the secondary phloem in both the IGRs and 1-yr-old roots. Starch grains and polysaccharide deposits were also identified in both the IGRs and 1-yr-old roots. However, more starch grains were observed in the IGRs. Although the anatomical properties of roots regarding differences for *in vitro* and *ex vitro* environments of *P. ginseng* were observed here for the first time, further studies are required for a better understanding of the effects of the *in vitro* culture of *P. ginseng*.

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InDel 마커를 이용한 대한민국 대추 유전자원의 유전형 및 계통수 분석

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Genotype and Phylogenetic Tree Analysis of Jujube Genetic Resources Distributed in Korea using InDel Markers

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Abstract

Background : Jujube (*Ziziphus jujuba*) is a tree of the Rhamnaceae family. It is mainly distributed in subtropical and tropical regions of Asia and America. Jujube has undergone various transformations over a long period of time due to natural evolution and artificial selection, and more than 800 cultivars have been reported. It has potential nutritional benefits, including high nutritional value and antioxidant activity. Recently, the consumption of jujube is increasing. Jujube is propagated vegetatively and it is difficult to identify the cultivars with the naked eye. In order to breed a competitive high-quality jujube, an accurate method to identify jujube cultivars is needed.

Methods and Results : Genomic DNA for next generation sequencing (NGS) analysis was extracted using DNeasy Plant Mini Kit from Qiagen, and genomic DNA for PCR analysis was extracted using CTAB methods. Primers were designed using CLC Genomics Workbench 8 software. Based on the data obtained through NGS analysis, forward and reverse primers were designed on the both sides of the loci including polymorphism. In the case of large sized InDel locus, polymorphism was tested by electrophoresis, and for the small sized InDel locus, polymorphism was analyzed by GeneScan analysis. Electrophoresis was performed at 120 V for 30 minutes and DNA was observed using gel documentation system. Genetic distance was computed by using the Shared allele distance method with PowerMarker software version 3.25.

Conclusion : As a result of the phylogenetic analysis, a total of 20 genotypes were found. Twelve resources were independently identified and the others belonged to 8 groups. Through this study, we could know the genotype of jujube by region in Korea. It is thought that additional markers are needed to distinguish the cultivars more accurately and efficiently.

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[P02-003]

Kompetitive Allele-Specific PCR 마커를 이용한 산양삼과 인삼품종의 유전형 분석

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Genotype Analysis of Ginseng Varieties and Wild-simulated Ginseng Resources using Kompetitive Allele-Specific PCR Markers

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ABSTRACT

Background : *Panax ginseng* is a perennial semi-shadow plant, and botanically, it belongs to genus *Panax* in the Araliaceae family. Recently, wild-simulated ginseng is widely cultivated in Korea. The classification of ginseng seeds used for cultivation of wild-simulated ginseng is not well established. Therefore, it is necessary to confirm the genotype of the cultivated wild-simulated ginseng using molecular markers.

Methods and Results : To test the genetic relationship of the wild-simulated ginseng, a total of 42 genetic resources of *P. ginseng* cultivar and wild-simulated ginseng genetic resources were collected. DNA extraction was performed using the cetyltrimethylammonium bromide (CTAB) method and 20 kompetitive allele specific PCR (KASP) markers were used for genotype analysis. KASP amplifications and allelic discriminations were performed using the Nexar system (LGC Douglas Scientific, Alexandria, USA) in the Seed Industry Promotion Center (Gimje, Korea) of Foundation of Agri. Tech. Commercialization & Transfer in Republic of Korea. An aliquot (0.8 μ l) of 2X Master Mix (LGC Genomics, London, UK), 0.02 μ l of 72X KASP assay mix (LGC Genomics, London, UK), and 5 ng genomic DNA template were mixed in 1.6 μ l KASP reaction mixture in a 384-well Array Tape using Nexar.

Conclusion : As a result of the genotype analysis, the genetic resources used in this experiment did not form clusters in the phylogenetic tree. This propose that the markers used in this study could be used for the genetic analysis for the selection of genotype suitable for cultivation in various wild-simulated ginseng cultivation regions.

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유색마 유전자원 특성평가

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Evaluation of the Characteristics of *D.alata* Genetic Resources

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ABSTRACT

Background : *D.alata*, called water yam, is the most widely distributed worldwide, and the tuber color is purple, yellow, yellowish white, etc. Especially purple yam is valuable as a functional food due to its phenol content and antioxidant ability. This study was conducted to use as a material for the development of new varieties by conducting horticultural traits, growth characteristics evaluation, and component analysis of the introduced *D.alata* genetic resources.

Methods and Results : In March 2018, 16 strains of *D.alata* genetic resources were introduced into tissue culture seedlings in Vietnam and propagated through subculture. In 2019 and 2020, in the rain shelter greenhouse and in the open field, growth surveys such as leaf shape, leaf angle, petiole color and plant weight, leaf area, and leaf width ratio were conducted. Also, the length, thickness, weight, and color of the harvested tubers were investigated. The tubers were washed, lyophilized, and then powdered and analyzed for 20 items, including general ingredients, functional ingredients, vitamins, and minerals. As a result of the growth survey conducted at the peak of growth, the IBR0139 line was the heaviest at 1,658 g/plant, and the leaf area was the largest at the IBR0150 line at 114.5 cm². Leaf width ratio was 1.3 to 1.9, except for IBR0138 and 0140 with triangular heart shape, all were heart ovate. There was a difference in Lab color values, but with the visual evaluation, the 8 strains petiole color was purple, and IBR0143 was green. The tubers can be divided into round and purple line, and long cylindrical yellowish white line. In the strains with purple tuber color, the darker the purple color of the petiole, the darker the tuber color. The total anthocyanin content of IBR0139 was 92.8 mg/100g, and the beta-carotene content of IBR0150 was 648 µg/100g.

Conclusion : Based on the content of functional ingredients, color, and quantity, five lines, such as IBR0137, were selected as materials for the development of new varieties and the diversification of yam processed products is expected to expand consumption and be used as a new income crop for farmers.

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대과다수성 4배체 자가화합성 구기자 신품종 ‘화선’

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A new Gogi Berry Variety with Tetradiploid, Self-compatibility and High Yielding ‘Hwaseon’

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ABSTRACT

Background : Goji berry is a food material that is traditionally has consumed in South Korea for medicinal and edible uses. Breeding and selection of new varieties that have characteristics of high yielding, resistant to pests, especially anthracnose and gall mite, is the most efficient way to increase the productivity of farms and also the most important goal of this research.

Methods and Results : The new goji berry line, CBP14639-56 was selected from the cross between CBP11542-206 and CBP07445-64 to breed the cultivar with self-compatibility and high quality. The parent lines used in crossing were induced into tetraploid by colchicine treatment on bud of diploid varieties. This new cultivar’s preliminary yield capacity test was performed from 2016 to 2017 and the selected line was named “Cheongyang No.34”. Its regional yield capacity evaluations were carried out in Cheongyang, Yesan and Gumsan from 2018 to 2020 and “Cheongyang No.34” was given name as ‘Hwaseon’, and applied to Korea seed & Variety Service as a new Gogi berry variety in 2021.

The specific characteristics were summarized as follows; The shape of tree is semi-open type and the leaf is ovate. The flowers are distinctly larger than the other cultivating varieties. The type of fruit is large in size, round and oblong in shape and bright red in color. The flowering date was approximately June 18 with medium flowering. Branch regeneration vigor after pruning of it is similar to that of the check variety ‘Cheongmeong’. The infection rates on leaves to *Eriophyes macrodonis* Keifer was as strong as 0.8 percent. Anthracnose infection rate on fruits in open field was slightly higher than that of the check variety. The content of betaine in dried-fruits of it was higher than that of ‘Cheongmeong’. The yield of dried-fruit was higher than the check cultivar about 41 percent in open field during from 2018 to 2020.

Conclusion : This variety 'Hwaseon' has the characteristics of self-compatibility, large fruit and high yield capacity and also has excellent resistance to pests, especially gall mite, and is a cultivar suitable for both of rain-shelter green house or field cultivation.

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구기자 신품종 청감 구기자의 수분수 선발

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Selection of Pollenizer of ‘Cheonggam’ New Variety of Goji Berry (*Lycium chinense* Miller)

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ABSTRACT

Background : Goji berry (*Lycium chinense* M. $2n = 24$) is a crop with self-incompatibility in solanales class. It can not be fertilized in the cultivation of single cultivars. Therefore it is necessary to select proper pollinizer. We had bred a new variety ‘Cheonggam’ with high sugar content and less seeds in fresh fruits. This experiment was carried out to select proper pollinizer through researching self-incompatible and Cross-compatibility.

Methods and Results : The self-incompatibility test of ‘Cheonggam’ was investigated fertilization rate and fruit Characteristics by artificial fertilization. Investigation of fertilization rate and fruit characteristics by artificial fertilization was carried out to test cross-compatibility of ‘Cheonggam’ with Cheonggang, Cheongsu, Hogwang, Cheongyang No.36 and Cheonghong. Self-fertilization rate of ‘Cheonggam’ was 15.6%, from this result it is self-incompatibile. In flowering time synchronizing checking, Cheonggang, Cheongsu, Cheongyang No.36 and Cheonghong are extremely earlier than ‘Cheonggam’, and on the other hand ‘Hogwang’ is a little earlier than it.

Cross compatibilities of ‘Cheonggam’, as a maternal parent, with tested varieties base on fertilization rates were turned out as fallows ‘Hogwang’, ‘Cheonggang’, ‘Cheongsu’, ‘Cheonghong’, and ‘Cheongyang No.36’ in order. Whereas, Cross compatibilities of ‘Cheonggam’, as a pollen parent, with tested varieties base on fertilization rates were turned out as fallows ‘Cheonghong’, ‘Hogwang’, ‘Cheonggang’, ‘Cheongyang No.36’, and ‘Cheongsu’ in order.

Through artificial crossing test of Cheonggam and Hogwang goji, it was found that the hybridization affinity of the two varieties was high, the weight of the raw fruit increased, and the sugar content was also increased.

Conclusion : Through artificial selfing test, ‘Cheonggam’ goji berry was identified as self-incompatibility, and as a result of hybridization affinity test, ‘Hogwang’ goji berry was identified as superior in hybridization affinity with ‘Cheonggam’. In addition, when ‘Cheonggam’ goji berry was cultivated with ‘Hogwang’, it was expected that it could increase the fresh fruit weight and sugar content, so it was selected as a proper pollinizer.

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인삼 품종 구분을 위한 SNP 분자표지 개발

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Development of Molecular Marker for Korean Ginseng (*Panax ginseng* C. A. Meyer) Cultivar Identification using Single Nucleotide Polymorphism.

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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 5 ng/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 25,736,085 bp, which indicated genome coverage of 0.86%. After the filtering process, We selected a total of 3,999 SNPs through SNP filtering. 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 6 groups, thus causing differentiation between the inbreds. Ginseng variety classification included Group1 was Seonwon, Seonpung, Koryeo4, Cheongseon, Cheonpung, Group2 was Geumwon, Group3 was Geumsun, Seonun, Geumpung, Cheonryang, Seonhyang, Group4 was Geumgin, Group5 was K1, Koryeo2, Gopung, younpung. A similar classification pattern for Phylogenetic tree was observed from clustering analysis.

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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국내 생산 지황의 굵기별 품질특성 평가
이윤정, 오명원, 이정훈, 정진태, 마경호, 윤영호, 한종원*
농촌진흥청 국립원예특작과학원 인삼특작부 약용작물과

**Evaluation of Quality Characteristics by Rhizome Diameter of *Rehmannia glutinosa*
Cultivated in Korea**

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ABSTRACT

Background : *Rehmannia glutinosa* has been used widely as an herbal medicine in Eastern Asia for more than 2000 years. Dried or steamed rhizomes have been used to regulate the immune response, and still occupy an important place in traditional oriental medicine. Although *Rehmannia glutinosa* have such a high value for use and are an important crop, the quality standards for their products have not been established properly. Therefore, in this study, we tried to conduct a basic study to establish the quality standard of *Rehmannia glutinosa*.

Methods and Results : The rhizome diameter was investigated for the products obtained from major domestic *Rehmannia glutinosa* producing areas (4 areas, 10 farms), and the rhizome diameter was classified into 5 types (< 5 mm, 5 - 10 mm, 10 - 15 mm, 15 - 20 mm, > 20 mm). As a result of measuring the rhizome diameter size distribution, the < 5 mm group was 5%, the 5 - 10 mm group was 33%, the 10-15mm group was 34%, the 15 - 20 mm group was 20%, and the > 20 mm group was 8%, respectively. The dry weight ratio did not show a big difference according to the drying method or rhizome diameter, and it was found to be in the range of 19.4 to 21.7%. The amount of juice also did not show a significant difference according to the rhizome diameter, and it was measured in the range of 53.6 to 55.0%. Catapol, a representative active ingredient in *Rehmannia glutinosa*, showed a difference in content according to the rhizome diameter. In the group whose rhizome diameter was 10 - 15 mm, the highest measurement was 32.1 mg/g, and the highest content was in the order of 15 - 20 mm, > 20 mm, 5 - 10 mm and < 5 mm.

Conclusion : The diameter distribution ratio, dry weight ratio, and juice ratio according to the rhizome diameter of the *Rehmannia glutinosa* did not show a significant difference. However, the catapol content according to the rhizome diameter differs by as much as 1.6 times, so it is necessary to compare the content of additional active ingredients or physiological activity according to the rhizome diameter in the future. In addition, we believe that these results can be used as basic data useful in setting quality standards for *Rehmannia glutinosa*.

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[P02-009]

인삼유래 인지질가수분해효소 *PgpPLAIIIβ*의 세포생장의 극성 및 리그닌 함량 조절 기능에 대한 연구

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Ginseng-derived Phospholipase A, *PgpPLAIIIβ* Alters the Polarity of Cell Growth and Decreases Lignin Content in Arabidopsis and Hybrid Poplar when Overexpressed

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ABSTRACT

Background : Patatin-related phospholipase As (pPLAs) are major lipid acyl hydrolases that plays a role in various biological functions in plant development, suggesting diverse commercial purposes of the economically important medicinal ginseng plant. Herein, we show the functional characterization of a ginseng *pPLAIII* gene for the first time and discuss its potential applications.

Methods and Results : *pPLAIII*s were identified from ginseng expressed sequence tag clones and further confirmed by search against ginseng database and polymerase chain reaction. The *pPLAIII* gene which shows the highest homology with Arabidopsis *pPLAIIIβ* was overexpressed in Arabidopsis and hybrid poplar (*Populus alba* × *Populus glandulosa*) using Agrobacterium. Quantitative reverse transcription polymerase chain reaction was performed to analyze the expression levels of ginseng *pPLAIIIβ* and lignin biosynthesis related genes. Lignin was stained using phloroglucinol-HCl and Mäule method. Quantification of lignin content was performed using acetyl bromide and Klason method. The *PgpPLAIIIβ* transcripts were observed in all organs of 2-year-old and 4-year-old ginseng. Overexpression of *PgpPLAIIIβ* (*PgpPLAIIIβ*-OE) resulted in small and stunted plants in Arabidopsis and hybrid poplar. It shortened the trichomes and decreased trichome number, indicating defects in cell polarity. Lignin content was decreased in the OE lines, especially in middle xylem and the expression levels of genes related to lignin biosynthesis were also significantly decreased.

Conclusion : Taken together, cytohistological and its relevant biochemical analysis as well as transcripts changes suggest that ginseng *pPLAIIIβ* plays a role not only in cell elongation patterns, but also in altering lignin content.

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신감초 (*Glycyrrhiza korshinskyi* Grig.) 유전자원의 작물학적 특성

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Agronomic Characteristics of *Glycyrrhiza korshinskyi* Grig. Resources

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ABSTRACT

Background : Licorice is one of the major herbal medicine material belonging to *Glycyrrhiza* L.. It is used not only as a herbal medicine but also a variety of industrial material including cosmetics and sweetener. Although widely used in Korea, licorice is largely dependent on imports (99%). For a long time, there were attempt to cultivate licorice in Korea. However, there is a difficulty in domestic cultivation due to physiological disorders. Furthermore, it does not meet the standard ingredients recored in the Korea Pharmacopoeia (glycyrrhizin 2.5% and liquiritigenin 0.7%). Therefore, it is required to develop licorice lines suitable for the domestic environment. Thus, in this study, we evaluated the growth and yield characteristics of glycyrrhiza lines.

Methods and Results : Glycyrrhiza lines were transplanted in the experimental field of NIHHS (Eumseong) by cutting. All experiment plots were designed by the randomized block method with 3 independent replicates. The growth and yield characteristics were investigated over two years. The target traits are lodging resistance, high-yielding, and high content. Based on the qualitative evaluation, Glycyrrhiza resources were selected for lodging resistance lines. In 1-year-old licorice, the dry-root yield of MCD-Y-0017-41 was 293.8 g/m², the highest among them. The dry-rhizome weight of MCD-Y-0017-34 was 138.5 g/m² in 1-year-old licorice. In 2-years-old licorice lines, based on growth characteristics of above-ground part, the plant height of MCD-Y-0017-33 was 113.6 cm. MCD-Y-0017-05 was showed the thickness stem diameter (19.0 mm). MCD-Y-0017-16, MCD-Y-0017-26, MCD-Y-0017-30, MCD-Y-0017-41, and MCD-Y-0017-50 had trait of late leaf abscission. As a result of underground part, the root diameter of MCD-Y-0017-30 was investigated as 27.2 mm, which was the tickness other them. Among them, MCD-Y-0017-02 had the highst dry-root yield (936.6 g/m²), whereas MCD-Y-0017-45 had the highst dry-rhizome yield (267.8 g/m²) in 2-years-old. The glycyrrhizin conten was high in MCD-Y-0017-33 in 2-years-old.

Conclusion : Growth and yield characteristics of *Glycyrrhiza* lines were evaluated to develop licorice varieties suitable for domestic environment. Among them, lines such as MCD-Y-0017-02 were selected the high-yielding and high content lines with lodging-resistant trait. These lines will perform the regional test yield in 3 area including Chungbuk Eumseong.

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황해쑥 재배 지역에 따른 생육 및 수량 특성

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Agricultural Characteristics of *Artemisia argyi* on Regional Yield Trial

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ABSTRACT

Background : *Artemisia argyi* H.Lév. & Vaniot is perennial plant belonging to family Compositae and is known as origin plant of herbal medicine *ae-yeob* in KHP (12th). In Korea, genus *Artemisia* plant is widely used for food material and herbal medicine. It is effective for pain relief from old times because it has a warm nature. In addition, hemostasis, dysmenorrhea, indigestion, flu, stomachache, asthma, anti-gastritis, antiulcer activity, and etc. The major effective components of *A. argyi* are eupatilin and jaceosidin. As demand increased due to various usage, it became necessary to develop varieties with superior yield and ingredient content. Therefore, to develop *A. argyi* lines suitable for domestic environment, we evaluated the growth, yield, and quality characteristics of *A. argyi* lines.

Methods and Results : For regional yield trial, total 4 lines of *A. argyi* were planted in the experimental field of NIHHS in two areas, Chungbuk Eumseong and Gangwon Pyeongchang. *A. argyi* lines were multiplied and transplanted by cutting. All experiment plots were designed by the randomized block method with 3 independent replicates. The average seedling rate of all ARTES lines was 43.1%, which is believed to be due to early transplanting in April. Although the seedling rate was low, ARTES1 and ARTES3 had thick stem diameter other lines and the growth of ARTES1 and ARTES3 was remarkable. Furthermore, ARTES3 was markedly high in yield. The effective components, eupatilin and jaceosidin, were high in before flowering stage than after flowering stage, however, there was no significant among lines.

Conclusion : Agricultural traits of *Artemisia argyi* lines were evaluated to develop variety. Based on growth and yield characteristics ARTES3 is evaluated as excellent for growth and yield.

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참당귀 기내재분화에 대한 호르몬 및 배지농도의 효과

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Effects of Plant Growth Regulators (PGRs) and Media-strength on *in vitro* Regeneration of *Angelica gigas* Nakai

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ABSTRACT

Background : *Angelica gigas* Nakai is a traditional medicinal crops in Korea. It belonging to the family Umbelliferae. Auxin, cytokinin and media-strength are the basic composition factors that improved shoot induction, rooting and plant growth in plant tissue culture. Using these factors, we optimized a tissue culture protocol to produce virus-free plant of *A. gigas* Nakai.

Methods and Results : We investigated the number of shoot and root, length of shoot and root, percentage of rooting, and fresh weight. Explants were used after 4-week of culture. In hormone tests, explants were placed on the MS hormone-free medium containing 3% sucrose. At first, five types of cytokinin which BA, Kinetin, TDZ, Zeatin, 2ip were tested. Each cytokinin was tested at three concentrations that 0.5, 1.0, 2.0 mg/ℓ. The most effective cytokinin was 1.0 mg/ℓ kinetin. However, in all treatments, the rooting percentage was lower than the control. Additionally, we tested IBA, IAA, NAA those of the three types of auxin. Each auxin type was tested at three concentrations that 1.0, 2.0, 4.0 mg/ℓ. Among the treatments, 1.0 mg/ℓ NAA and 1.0 mg/ℓ IAA were significantly improved fresh weight and the number of roots compared to control. The media-strength was conducted in three kinds of medium which MS, WPM, B5. Each media-strength is divided into three treatments that 1/2, full and 2×. Explants were placed on the hormone-free medium containing 3% sucrose. As a result, 1/2 MS medium was found to be the most effective compared to others. We achieved that the best *in vitro* plantlets were produced in 1/2 MS medium with 1.0 mg/ℓ kinetin and 1.0 mg/ℓ IAA.

Conclusion : Based on this, it is expected that the regeneration system of *Angelica gigas* Nakai can be established.

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인삼 우수 선발계통의 생육특성

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전라북도농업기술원 약용자원연구소

Growth Characteristics of Excellent Selection Lines of Ginseng

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ABSTRACT

Background : Ginseng (*Panax ginseng* C. A. Meyer) consumption is steadily increasing every year as the level of national income and interest in health increase. However, due to the effects of climate change such as climate warming in recent years, there are many difficulties in stable production of impressions. Therefore, it is urgent to develop disaster-resistant varieties to produce stable ginseng in response to environmental changes.

Methods and Results : The line disclosed in the test material of this study was a line that was cultivated by the pure cultivation method by selecting high-quality individuals from the field of ginseng cultivation farms. The growth characteristics were cultivated, and the growth characteristics of the productive test were divided into above-ground and underground parts. For the growth of the ground part, the stem thickness and length, petiole length, number of leaves, and the number of stems were investigated.

Conclusion : Five lines, including GO4006, were the lines with excellent growth and less disease and physiological disorders. Selected outstanding lines In the evaluation of generational advancement characteristics, the high temperature was three lines, such as GS-J-8, and the moisture resistance, was two lines, including KG 10-43.

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냉해동 처리한 오미자의 침출 특성

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농촌진흥청 국립원예특작과학원 인삼특작부

Extraction Characteristics of *Schisandra chinensis* by Freeze-thawing

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ABSTRACT

Background : Matured *Schisandra chinensis* (*S. chinensis*) has good marketability, but it is difficult to maintain its quality during storage and distribution. Freezing and freeze-thawing treatments can be usefully utilized for quality maintenance and processing of spilling fruit juice. In this study, we investigated whether *S. chinensis* treated with freezing and freeze-thawing was suitable for the manufacture of liquor.

Methods and Results : Each of the freezing and freeze-thawing *S. chinensis* was immersed in 35% ethanol, extracted for 15 days, and used for analysis (color, antioxidant activity major components). In the analysis of the color, antioxidant activity and level of major components, the freezing and the freeze-thawing showed a higher tendency than the control, and the freeze-thawing was the best among them.

Conclusion : The results of this study are that the freeze-thawing treatment of *S. chinensis* improves the color, antioxidant activity and level of major components, and is suitable for making soaked liqueur.

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숙성처리가 숙지황의 품질특성에 미치는 영향

장귀영, 이은숙, 지윤정, 최재훈, 이승은, 김형돈, 강민혜, 한종원, 김금숙, 최수지*
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Effects of Aging Treatment on Quality Characteristics
of *Rehmanniae Radix Preparata*

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ABSTRACT

Background : The manufacturing processes of *Rehmanniae radix preparata* (*R. preparata*) are complex and labor-intensive. The aging treatment can help in the production efficiency of *R. preparata* by increasing the precursor of 5-HMF (5-hydroxymethyl-2-furfuraldehyde, quality indicator of *R. preparata*). Therefore, this study was performed to compare quality characteristics of *R. preparata* according to the aging treatment.

Methods and Results : *R. preparata* was prepared in the traditional method (drying-soaking-steaming) with different *Takjus* (sterilized and non-sterilized *Takjus*) and the new method applying aging treatment without soaking process (steaming-drying after aging), respectively. These samples were used to analysis of appearances and 5-HMF content. When treated 3 cycles, the changes of appearance and color was faster in sample prepared by aging treatment than samples with traditional method. In 5-HMF content, 5-HMF content was increased in all samples with increasing processing cycles, and higher in samples applying aging treatment (2.24 mg/g) than samples by traditional method (0.34 - 0.41 mg/g). In traditional method with different *Takjus*, samples with non-sterilized *Takju* were higher than sterilized *Takju*. The optimal aging period was 8 days in terms of 5-HMF content.

Conclusion : These results indicated that aging treatment can positively affect the production efficiency of *R. preparata* by increasing 5-HMF content and changes of appearance, and optimal aging periods was 8 days.

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DSS로 유도된 궤양성 대장염에 대한 산돌배추출물의 염증 개선효과

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Ameliorative Effects of Wild Pear Extracts (*Pyrus ussuriensis* Maxim.) on Bowel Inflammation in Dextran Sulfate Sodium-induced Colitis Mice

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ABSTRACT

Background : *Pyrus ussuriensis* Maxim. belongs to the genus *Pyrus* has been used as traditional herbal medicine with the effects of fever, cough, asthma and constipation for centuries. Recently, the wild pear (WP) has drawn increase attention for research of anti-inflammation and strong antioxidant activities. This study evaluated the protective effect of WP extracts on dextran sulfate sodium (DSS)-induced colitis mice.

Methods and Results : 8-week-old male C57BL/6N mice were induced acute colitis by administration of 2.5% DSS for 5 days, after treatment with WP water extract (WPA) and WP ethanol extract (WPE), and WP fermented extract (WPF) for 21 days and then sacrificed 5 days later. Animals were divided into 5 groups (n = 8): Control, DSS, DSS + WPA, DSS + WPE, DSS + WPF. DSS-treated mice developed symptoms accompanied by severe bloody diarrhea and weight loss. The disease activity index (DAI) in DSS group was more severe than WP-treated groups. Colon length in DSS group was significantly reduced by 13% compared to the control group. WPF-treated group showed an increase colon length. The levels of pro-inflammatory cytokines including IL-1 β , IL-6, and TNF- α were significantly reduced in the WP-treated groups. Moreover, colonic mucosal cytokine, myeloperoxidase (MPO) activity was significantly reduced by WP extract treatment.

Conclusion : These results that WP displayed the alleviative effects on inflammatory bowel disease model may be a useful therapeutic approach to ulcerative colitis.

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산겨릅 추출물로 코팅한 커피 원두의 숙취해소능 연구

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Hangover Relieving Effect of Coated Roasting Coffee Beans with Extracts

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ABSTRACT

Background : Coffee is one of the favorite foods of all ages excluding children. In order to develop a hangover-relieving beverage by combining coffee with functional extracts such as *acer tegmentosum* extract which is known to protect against hepatic disorders, lipid droplet accumulation and CYP2E1, which play an important role in alcohol metabolism, were analyzed.

Methods and Results : The eight extracts for *in vitro* study of hangover relieving effect were consisted of *acer tegmentosum* extract (ATE), two kinds of green bean extracts and five kinds of coffee bean extracts. First of all, cytotoxicity of eight extracts was assessed by WST1 assay. AML12 cell line was not decreased to below 80% of survival rates with eight extracts. To compare lipid droplets accumulation induced by alcohol, AML12 cells were observed by Oil-Red-O staining and lipid content was measured. A + A group was shown reduced lipid accumulation by concentration dependent (EtOH treat: 0.66 ± 0.01 , A + A 50: 0.56 ± 0.00 , A+A 200: 0.49 ± 0.03 , A + A 800: 0.44 ± 0.03). To additional, CYP2E1 expression level was significantly reduced by treated 800 $\mu\text{g/ml}$ of extract coated coffee beans (ACB; $262.43 \pm 22.67 \text{ pg/ml}$, A + A: $255.85 \pm 30.79 \text{ pg/ml}$, A + G: $259.97 \pm 31.43 \text{ pg/ml}$, R + A: $258.26 \pm 2.32 \text{ pg/ml}$) in comparison with EtOH treat group ($343.81 \pm 0.92 \text{ pg/ml}$). These results may be concluded that coffee beans and coated extracts coffee beans were found to reduced hangovers by drinking.

Conclusion : From the above results, we may suggest that both coffee beans and extract of *acer tegmentosum* can help improve alcohol hydrorelieve hangovers, but it is need further study about synergy of combine to coffee beans and extracts by supplementing the manufacturing process of extract coating coffee beans.

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석류종자추출물에 의한 체지방 감소 효과

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Effect of Pomegranate Seed Extract on Adipogenesis in 3T3-L1 Adipocytes

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ABSTRACT

Background : The pomegranate (*Punica granatum*) belongs to the family puniceae, which can help prevent various disease risk factors, including high blood pressure, high cholesterol oxidative stress, hyperglycemia, and inflammatory activities. Particularly, recent studies have demonstrated that the pomegranate seed extract (PSE) has many biologically active components that help in controlling diet-induced obesity and insulin resistance. However, its impact on adipocyte differentiation and adipogenesis remains unclear. Therefore, we investigated whether PSE treatment affects the differentiation of 3T3-L1 preadipocytes to adipose cells and lipid accumulation.

Methods and Results : The cell viability was analyzed using 3-[4,5-dimethylthiazol-2-yl]-2,5-diphenyl tetrazolium bromide (MTT) assay. Adipogenesis of 3T3-L1 adipocytes was analyzed after induction in the induction medium containing the PSE. Treatment with PSE significantly decreased lipid accumulation by Oil Red O staining in a dose-dependent manner. Moreover, PSE increased the content of free glycerol in 3T3-L1 adipocytes. To understand the anti-adipogenic effects of PSE, the changes in the expression of several adipogenic transcription factors, including sterol regulatory element-binding protein (SREBP)-1C, cytidine-cytidine-adenosine-adenosine-thymidine (CCAAT)/enhancer-binding protein (C/EBP) α , and peroxisome proliferator-activated receptor (PPAR) γ were investigated using quantitative reverse transcription PCR (RT-qPCR). Treatment with PSE dramatically suppressed the mRNA expression of SREBP-1C, C/EBP α , and PPAR γ compared with control in a dose-dependent manner.

Conclusion : These results indicated that PSE treatment inhibits adipocyte differentiation and lipid accumulation in 3T3-L1 adipocytes, and it may have applications as a potential source for an anti-obesity functional food agent.

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알로에로부터 분리된 성분의 SARS-3CL protease 저해 활성

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국립원예특작과학원 약용작물과

Inhibitory Activity of Isolated Components from *Aloe vera* on SARS-3CL Protease

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Youn Ho Moon and Yoon Jeong Lee

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ABSTRACT

Background : *Aloe barbadensis* (Miller), or *Aloe Vera*, in the Xanthorrhoeaceae family, is native to South Africa. Recently, this is grown in all continents of Europe, Asia, America and Africa. *A. vera* has been used as a cosmetics, health drinks, beverages, and medicines for during 3,000 years. This leaves contain main components that are vitamins, polysaccharides, phenolic compounds and organics. The phytochemicals in the gel of this plant is known to have anthraquinone and C-glucosylanthrone derivatives such as aloin A, Aloin B, and aloin-emodin. They have been found to have antibacterial, antioxidant, and antiviral activities. However, there has been no report of the inhibitory activity of components in *A. vera* on SARS-3CL protease.

Methods and Results : Methanol extract of the leaves of *A. vera* was chromatographed by silica gel, C-18, sephadex LH-20 column chromatographies to obtain four compounds 1-4. These compounds were identified to aloin A (1), aloin B (2), 7-O-methylaloesin A (3), and feralolide (4) by analyzing NMR and LC-Mass spectra. To evaluate the inhibitory effect of the four compounds 1-4 toward SARS-3CL protease *in vitro*, the amount of substrate DABCYL-KTSAVLQSGFRK ME-EDANS hydrolyzed by this enzyme was detected in the presence or absence of inhibitors (1-4) using a fluorescence (excitation 360 nm/emission 520 nm). As the results, they showed in dose dependent inhibitory activity with IC₅₀ values of 25.7, 97.2, 41.6, and 16.7 μ M, respectively. Emodin and aloin-emodin were used as positive control.

Conclusion : Aloin A (1), aloin B (2), 7-O-methylaloesin A (3), and feralolide (4) were isolated from the leaves of *A. vera*. Of them, feralolide (4) was confirmed to block the catalytic reaction of SARS-3CL protease about ten micromole concentration.

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오미자 수집종의 연차간 성분변화 및 성분 상호간의 관계
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**Changes and Correlation of Lignan Contents among *Schisandra chinensis* (Turcz.)
Baillon Germplasms for 3 Years**

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ABSTRACT

Background : *Schisandra chinensis*(turcz.) baillon, called(known as) Omija in Korea, contains lignan compounds that pharmacologically are important. Despite of the increases of cultivation area and use in food industry, little has been studied regarding differences and changes of lignan contents among *Schisandra chinensis* germplasms. This study was conducted to compare yearly changes of major lignan compounds, providing informative data of dibenzocyclooctadiene lignan compounds.

Methods and Results : The 96 germplasms of *Schisandra chinensis* were collected in Korea peninsula. The relationship between the lignan compound and agricultural trait of 96 *schisandra chinensis* and the annual change of the lignan compound were investigated by HPLC. The content of major compound, schizandrin, was not changed significantly for three years but those of gomisin A and gomisin N changed apparently. Schizandrin and gomisin N showed a positive correlation with the correlation coefficients of 0.17 and 0.13, respectively, in 2017 and 2018, and the number increased to 0.33 in 2019. It showed a positive correlation. Schizandrin A had a high correlation with schizandenol at 0.55, and schizandrin C and Schizandenol had a high correlation with gomisin N at 0.56 and 0.52, showing a high positive correlation.

Conclusion : It will be used as a key selection index when selecting high-quality *Schisandra chinensis* based on the correlation of each component and the change in components.

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단삼과 녹각영지버섯의 포제 전 (前) 후 (後) 주요성분 변화

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농촌진흥청 인삼특작부

Components Variation on Processing of *Salvia miltiorrhiza* and Antler-shaped *Ganoderma lucidum*

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ABSTRACT

Background : The processing of medicinal plants is very important on oriental medicine. We investigated that the chemical constituents of *S. miltiorrhiza* and Antler-shaped *G. lucidum* are changed by the processing conditions, which are a heating temperature and time.

Methods and Results : The *S. miltiorrhiza* and Antler-shaped *G. lucidum* were processed by a heating temperature and time. The conditions of processing are distinguished by a heating temperature, 120 - 240°C, and time 10 - 20 min. The prepared samples were extracted by a reflux extraction method, 70% EtOH, boiling temperature 85°C, 2 h, 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 50 min, 0.8 mL/min). UV detection was conducted at 243 and 280 nm. The 7 components of *S. miltiorrhiza*, which are rosmarinic acid, salvianolic acid A, B, dihydrotanshinone I, cryptotanshinone, tanshinone I, IIA, and 5 components of *G. lucidum*, which are ganoderic acid A, D, H, ganodermanontriol, ergosterol, were analyzed. As a results, contents of rosmarinic acid (33.0 mg/g), salvianolic acid A (8.4 mg/g), B (212.0 mg/g), dihydrotanshinone I (1.1 mg/g), tanshinone I (7.5 mg/g) were increased at DR20150 - DR20180, but were decreased at DR10210 - DR10240. The contents of tanshinone IIA and cryptotanshinone were decreased by a heating temperature and time. In the results of *G. lucidum*, ganoderic acid A & H (54.5 mg/g), ganodermanontriol (24.9 mg/g) and ergosterol (64.6 mg/g) were increased at NR10120 - NR20120, but were decreased by a heating temperature and time. The ganoderic acid D (5.8 mg/g) at NR10210 was increased gradually by a heating temperature and time. Above the results, the chemical constituents might have by a heating temperature and time, respectively. Therefore, a processing of *S. miltiorrhiza* and Antler-shaped *G. lucidum* might have useful as a utilization of the various functional materials.

Conclusion : From the above results, we may suggest that processing of *S. miltiorrhiza* and Antler-shaped *G. lucidum* might have useful as a utilization of the various functional materials.

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[P03-009]

수수 종자의 항산화 활성, 총 페놀 및 플라보노이드 함량 분석

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Antioxidant Activity, Total Phenol and Total Flavonoid Compound Analysis of *Sorghum bicolor* (L.) Seeds.

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ABSTRACT

Background : Sorghum (*Sorghum bicolor*) is a cereal crop originated from north-eastern Africa, and is ranked among the top five cereal crops in the world. It has been used as food, feed, fodder, and bioethanol. Depending on its variety, it contains various levels of phenolic compounds such as phenolic acids, flavonoids and tannins. Also, it is important for its rich polyphenol contents, relative to other cereals such as wheat, rice, and millet. In this study, we investigated antioxidant activity, total phenol and total flavonoid contents in sorghum grains and the result can be used to select high-quality seeds among accessions.

Methods and Results : The 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 48h and the extracts were concentrated at 45°C. To determine antioxidant activity, we measured the DPPH radical scavenging ability. K167197 (RC: $770.89 \pm 42.80 \mu\text{g} / \text{mL}$) showed the lowest DPPH radical scavenging activity. On the other hand K208142 (RC: $23.26 \pm 1.28 \mu\text{g} / \text{mL}$) indicated the highest DPPH radical scavenging activity. The highest total phenolic content was shown in the accession from K208142 ($287.58 \pm 8.41 \text{ mg GAE} / \text{g}$) and the highest total flavonoid content was confirmed in K201234 ($72.96 \pm 2.82 \text{ mg QE} / \text{g}$). On the other hand the lowest total phenolic content was illustrated in accession from K167116 ($7.90 \pm 0.27 \text{ mg GAE} / \text{g}$) and K269323 ($2.34 \pm 0.07 \text{ mg QE} / \text{g}$) represented the lowest total flavonoid content.

Conclusion : The accessions from K208142, K208142, K201234 reported the highest value in DPPH radical scavenging ability, total phenolic content and total flavonoid content, respectively.

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항산화 활성에 따른 수수 수집종의 미백 및 항주름 효과

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Whitening and Anti-wrinkle Effects of *Sorghum bicolor* (L.) Accessions by Different Antioxidant Activities.

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ABSTRACT

Background : Sorghum is a drought tolerant C4 grass used for the production of grain, sugar, and biomass. Sorghum has been grown in tropical and subtropical regions. In some Asian and African countries such as India and Nigeria, sorghum is one of the important crops used to make foods. Especially in a few under-developed and semiarid regions, sorghum is the major source of energy and nutrition for humans. It can reduce the risk of chronic diseases and cancer thanks to its antioxidant substances. In this study, 4 sorghum accessions which have high antioxidant activities and 4 accessions with low antioxidant activities were selected. Then we carried out whitening and anti-wrinkle experiments in order to identify the differences between those accessions that have high and low antioxidant activities.

Methods and Results : The 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 48h and the extracts were concentrated at 45°C. We selected 4 accessions (K208142, K227720, 155383, K136185) with high antioxidant activities whose RC₅₀ ranged from 23.26 ± 1.28 - 40.50 ± 1.89 µg / ml and 4 (K167034, K167197, K129520, K129519) with low antioxidant activities whose RC₅₀ were in range of 404.96 ± 18.85 - 1653.32 ± 68.44 µg / ml. To determine whitening and anti-wrinkle effects, we use tyrosinase inhibition assay and elastase inhibition assay. As a result, all of high antioxidant accessions (K208142, K227720, 155383, K136185) showed higher inhibition rates than lower ones (K167034, K167197, K129520, K129519) both in tyrosinase and elastase experiments.

Conclusion : According to these results, we can get information that sorghum accessions with high antioxidant activity has better effect in both whitening and anti-wrinkle inhibition rates than those with lower antioxidant activity.

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마의 색소물질 함량과 색도 간의 상관관계 분석

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Correlation Analysis Between Pigment Content and Chromaticity in Yam

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ABSTRACT

Background : Chinese yam is grown in Korea and divided into long, short and round shape. Yam is used as medicinal crops and food. Recently, the health functional characteristics of plant pigments have been highlighted, and interest in yam with pigments has been increasing. In this study, we analyzed the anthocyanin, beta-carotene, and flavonoid content of yam sources held by the Institute of Biological Resources of the Gyeongsangbuk-do Agricultural Research Institute and analyzed the correlation with L, a, and b-value.

Methods and Results : The analytical samples were used by freeze-drying and grinding of the flesh site. The chromaticity measurement was made using a Spectrophotometer CM5 (Konica Minolta) and expressed in the Hunter color scheme L-, a-, and b-value. The anthocyanin content was measured by extraction made samples (10 g) were extracted with 50 mL ethanol for 12 h. The liquid extract was separated by centrifugation at 3000 rpm for 30 min. Flavonoid contents of yam was determined spectrophotometrically.

Conclusion : From the above results, the correlation coefficients for anthocyanin and L-value were -0.83, a-value was 0.82, and b-value was -0.58. The coefficients of beta-carotene and L-value were -0.45, a-value was 0.41, and b-value was 0.56. The correlation coefficients of flavonoids and L-values were -0.48, a-value was 0.42, and b-value was 0.56. Anthocyanin was highly correlated with a-value, which expresses redness. Beta-carotene and flavonoids are positively correlated with b-value, which indicates an amber degree, but did not have a high coefficient.

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한속단 추출물의 펜토바르비탈-유도 수면 증진 효과

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Extract of *Phlomis umbrosa* Turcz. Augments

Pentobarbital-Induced Sleep Behaviors in Mice

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ABSTRACT

Background : Sleep is necessary in order to maintain mammalian homeostasis, healthy physical and mental states. Thus, lack of sleep can result in reduced work efficiency and quality of daily life. This study was performed to investigate the sleep-promoting effect of the water extract of *Phlomis umbrosa* Turcz. on pentobarbital-induced sleep behaviors in mice.

Methods and Results : All experiments were carried out between 1:00 and 5:00 pm. The mice were not fed for 24 h prior to the experiment. The water extract of *P. umbrosa* (200 - 400 mg/kg) and diazepam (2 mg/kg) were orally administered to mice. After 45 min of administration of extract and diazepam, pentobarbital (45 mg/kg) was injected (i.p.) to induce sleep. Mice that did not sleep 15 min after the injection were excluded from the experiment. The *P. umbrosa* extract decreased sleep latency at a dose of 400 mg/kg ($P < 0.05$) and increased sleep duration at doses of 200 - 400 mg/kg ($P < 0.05$) in pentobarbital-treated mice. The time to recovery from sleep was decreased by the *P. umbrosa* extract ($P < 0.05$), but was not affected by diazepam. To understand the beneficial activity of *P. umbrosa* extract for sleep behaviors, we measured the level of brain GABA in the cerebral cortex and melatonin in the blood. In case of the brain GABA level, there was no significant difference between the control and the *P. umbrosa* extract groups. However, the blood melatonin level significantly increased in both diazepam and the *P. umbrosa* extract groups ($P < 0.05$).

Conclusion : From the above results, we may suggest that *Phlomis umbrosa* Turcz. can enhance sleep behaviors and may be used as dietary complements for insomnia treatment.

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[P03-013]

네트워크 약리학을 활용한 제 2형 당뇨병 완화를 위한 켈레꽃 상황버섯의
성분과 약리학적 기전 규명

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Identification of Chemical Compounds and Pharmacological Mechanisms of *Phellinus linteus* (Grown on *Rosa multiflora*) for Alleviation of Type 2 Diabetes Mellitus through Network Pharmacology

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ABSTRACT

Background : *Phellinus linteus* (mushroom) grown on *Rosa multiflora* (PL@RM), exposed beneficial effect and safety on Type 2 diabetes mellitus (T2DM) from Korean folk remedies. However, its active chemical constituents and mechanism(s) against T2DM have not been confirmed. Hence, we deciphered the active compounds and mechanism(s) of PL@RM against T2DM through network pharmacology.

Methods and Results : GC - MS of PL@RM manifested 54 compounds and drug-likeness properties of these compounds were confirmed by Lipinski's rule. The compound (40) related genes were composed of Similarity Ensemble Approach (SEA) and SwissTargetPrediction (STP). The overlapping genes (61) between the two databases were identified. Besides, the T2DM related genes (4,736) were extracted from DisGeNet and OMIM database. In parallel, a Venn diagram was constructed between the overlapping genes (61) and T2DM related genes (4,736), and finally, 48 genes were picked. The interactive networks between compounds and overlapping genes were plotted and visualized by RStudio. In addition, KEGG Pathway enrichment analysis was evaluated by String. String analysis showed that the mechanisms of PL@RM against T2DM were related to 16 pathways, where inhibition of gluconeogenesis by inactivating metabolic pathways was noted as the hub pathway of PL@RM against T2DM. Besides, bubble chart indicated that activation of the AMPK signaling pathway might enhance the insulin receptor (IR) phosphorylation, which is regarded the key signaling pathway of PL@RM against T2DM. Furthermore, the autodock vina revealed the promising binding affinity energy of the epicholesterol (the most drug-likeness compound) on HMGCR (hub gene).

Conclusion : Overall, this work hints at the therapeutic evidence of PL@RM on T2DM, and this data expound the main chemical compounds and mechanisms of PL@RM against T2DM.

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[P03-014]

당뇨 완화를 위한 찰수수 성분의 네트워크 약리학 분석

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Network Pharmacology of Compounds from *Sorghum bicolor* with Target Proteins related to Diabetes Mellitus

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ABSTRACT

Background : *Sorghum bicolor* (SB) is rich in protective phytoconstituents with health benefits and regarded as a promising source of natural anti-diabetic substance. However, its comprehensive bioactive compound(s) and mechanism(s) against type-2 diabetes mellitus (T2DM) have not been exposed. Hence, we implemented network pharmacology to identify its key compounds and mechanism(s) against T2DM.

Methods and Results : Compounds in SB were explored through GC-MS and screened by Lipinski's rule. Genes associated with the selected compounds or T2DM were extracted from public databases, and the overlapping genes between SB-compound related genes and T2DM target genes were identified using Venn diagram. Then, the networking between selected compounds and overlapping genes was constructed, visualized, and analyzed by RStudio. Finally, affinity between compounds and genes was evaluated via molecular docking. GC-MS analysis of SB detected a total of 20 compounds which were accepted by the Lipinski's rule. A total number of 16 compounds-related genes and T2DM-related genes (4,763) were identified, and 81 overlapping genes between them were selected. Gene set enrichment analysis exhibited that the mechanisms of SB against T2DM were associated with 12 signaling pathways, and the key mechanism might be to control blood glucose level by activating PPAR signaling pathway. Furthermore, the highest affinities were noted between four main compounds and six genes (FABP3-Propyleneglyco monoleate, FABP4-25-Oxo-27-norcholesterol, NR1H3-Campesterol, PPARG-β-sitosterol, PPARG-β-sitosterol, and PPARG-β-sitosterol)

Conclusion : Our study overall suggests that the four key compounds detected in SB might ameliorate T2DM severity by activating the PPAR signaling pathway.

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[P03-015]

케나프 잎의 네트워크 약리학 연구: 비만 억제 주요 신호 전달 경로

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Network Pharmacology Study on *Hibiscus Cannabinus* L. Leaves: The Effectiveness of a Hub Signaling Pathway in Suppressing Obesity

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ABSTRACT

Background : *Hibiscus cannabinus* L. leaves (HCLLs) are considered as a favorable source of natural antiobesity substance. However, its actual bioactive compound(s) and mechanism(s) against obesity have not been confirmed. Hence, network pharmacology was conducted to identify its key compounds and mechanism(s) against obesity.

Methods and Results : Compounds in HCLLs identified through GC-MS analysis and screened by Lipinski's rule. Genes related to the selected compounds and obesity were obtained from public databases, and the overlapping genes between HCLLs compound-related genes and obesity target genes were selected using a Venn diagram. The networking between selected compounds and overlapping genes was then constructed, visualized, and analyzed by RStudio. Finally, the binding affinity between compounds and genes was evaluated via molecular docking (MD). A total of 30 compounds in HCLLs were detected via GC-MS, and Lipinski's rule accepted all compounds. The compounds-related genes (570 genes) and obesity-targeted genes (3,028 genes) were identified, and between them, 64 overlapping genes were selected. Gene Set Enrichment Analysis (GSEA) displayed that mechanisms of HCLLs against obesity were associated with 13 signaling pathways on 22 compounds in HCLLs. Superficially, AKT1, Vitamin E, and RAS signaling pathway were noted as a hub gene, an uppermost bioactive compound, and a hub signaling pathway, respectively. However, the binding affinity of ligands and proteins on the RAS signaling pathway was very low; instead, the PPAR signalling pathway was evaluated with potent efficacy against obesity through MD. On PPAR signaling pathway, α -Amyrin had been found as the most significant compound for the amelioration of obesity. The α -Amyrin manifested the strongest binding affinity on six target proteins associated with PPAR signaling pathway.

Conclusion : Our study suggests that an auxiliary (PPAR) signaling pathway of HCLLs might intervene efficiently against obesity over the hub (RAS) signaling pathway.

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***Holigarna caustica* 잎 메탄올 추출물의 항통증과 항염 활성**

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**Anti-nociceptive and Anti-inflammatory Activities of the Methanol Extract of
Holigarna caustica Leaves**

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ABSTRACT

Background : *Holigarna longifolia* (Roxb.) is commonly used in the traditional medicine to treat a variety of painful conditions like eye irritation, inflammation, arthritis, skin diseases, cuts, and wounds. The present study was undertaken to investigate the antinociceptive and anti-inflammatory activities of methanol extract of *H. longifolia* leaves with its possible mechanism of action.

Methods and Results : Fresh leaves of *H. longifolia* were collected, dried, and extracted with methanol (MEHL). And then the MEHL was subjected to antinociceptive activity test using chemical-induced (acetic acid and formalin test) and heat-induced (hot plate and tail immersion test) pain models. Additionally, the possible mechanism behinds the antinociceptive activity was verified both centrally and peripherally. On the other hand, carrageenan-induced paw edema test was used to determine the anti-inflammatory potential of the extract. Exploratory and motor behavior test were evaluated by the open-field test. Various bioactive compounds responsible for antinociceptive and anti-inflammatory activities were ascertained using GC-MS analysis. The MEHL showed strong, significant and dose-dependent antinociceptive activity in all chemical-induced and heat-induced pain models at all experimental doses. The association of opioid receptors in the antinociceptive effects was confirmed by using naltrexone. MEHL also showed the involvements of cGMP pathway for antinociceptive activity. In addition, dose-dependent inhibition of edema was produced in the carrageenan-induced inflammation. MEHL were not connected with changes in the locomotor activity or motor responses of mice. In the GC-MS analysis, 40 compounds were identified among which thirty bioactive compounds were found with potent antinociceptive and anti-inflammatory properties.

Conclusion : Our current study revealed that MEHL possesses strong central and peripheral antinociceptive activity as well as anti-inflammatory activity. It may also be concluded that opioids receptors and cGMP pathway are involved in the analgesic mechanism of MEHL. This study rationalizes the ethnomedicinal use of *H. longifolia* leaves in various painful conditions.

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[P03-017]

***Syzygium fruticosum* 종자의 생리활성 물질과 약리학적 활성 탐색에 관한 연구**

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Exploration of Bioactive Profile and Prospective Pharmacological Activities of *Syzygium fruticosum* Seed

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ABSTRACT

Background : *Syzygium fruticosum* (SF), a valuable Bangladeshi fruit, is considered an alternative therapeutic agent. Mainly, seeds are used as nutritional phytotherapy to ease physical and mental status by preventing chronic diseases. Here, we scrutinized *S. fruticosum* seed's fundamental importance in traditional medicine by following an integrated approach combining *in vivo*, *in vitro*, and *in silico* studies.

Methods and Results : The SF was fractionated with different solvents, and the ethyl acetate fraction of SF (EaF-SF) was further studied. Mice treated with EaF-SF (200 and 400 mg/kg) manifested anxiolysis evidenced by higher exploration in elevated plus maze and hole board test. Similarly, a dose-dependent drop of immobility time in force swimming test ensured significant anti-depressant activity. Besides, higher dose treatment exposed reduced exploratory behaviour resembling decreased movement and prolonged sleeping latency with a quick onset of sleep during the open field and thiopental induced sleeping tests, respectively. In parallel, EaF-SF significantly ($P < 0.001$) and dose-dependently suppressed acetic acid and formalin-induced pain in mice. Also, a noteworthy anti-inflammatory activity and a substantial ($P < 0.01$) clot lysis activity (thrombolytic) was observed. GC-MS analysis resulted in 49 bioactive compounds. Among them, 12 bioactive compounds with Lipinski's rule and safety confirmation showed strong binding affinity (molecular docking) against the receptors of each model used.

Conclusion : To conclude, the *S. fruticosum* seed is a prospective source of health-promoting effects that can be an excellent candidate for preventing degenerative diseases.

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산국의 기억력 개선 효과

박셋별, 장귀영, 이윤지, 최재훈, 지윤정, 강민혜, 이정훈, 김형돈, 최수지, 이승은*

농촌진흥청 국립원예특작과학원 인삼특작부

Memory Improving Activity of *Dendranthema boreale* (Makino) Ling ex Kitam. in Scopolamine-treated Rats

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ABSTRACT

Background : Mechanism related with inflammation is one of the cause of Alzheimer's disease (AD), a major form of dementia. *Dendranthema boreale* (Makino) Ling ex Kitam. (DB), a plant of Asteraceae, was selected among several plant materials from *in vitro* assay. In the study, DB extract was evaluated on its potential as memory enhancing property through *in vivo* assay.

Methods and Results : DB extracts prepared with the mixed solvent of ethanol and water was tested the inhibition activity on nitric oxide (NO) production, tumor necrosis factor- α (TNF- α) level and the effect on cell viability in lipopolysaccharide (LPS)-treated BV2 murine microglia cells. As *in vivo* experiment, rats were administered with the diets including DB extract (0.07% and 0.14%) and induced memory dysfunction with scopolamine (1 mg/kg/day, intraperitoneally) injection for 21 day. Learning- and memory-improving potential of rats were observed via the behavior test in Y-maze and passive avoidance test (PAT). Biomarkers related with cognition were analyzed in the hippocampal tissue and the serum.

DB flower extract inhibited more effectively on TNF- α releasing of LPS-treated BV2 microglia cells than DB leaf extract. Ethanol extract of DB flower prepared at room temperature showed the most potent inhibitory activity on nitric oxide (NO) release of BV2 cells among the extracts prepared with the different extract conditions. From *in vivo* experiment, rat groups fed with DB flower extract showed higher spontaneous alteration in Y-maze test and latency to escape in PAT than negative control (NC) group. Choline transferase activities (ChAT) in hippocampus of rats administered with DB extract were higher than that of NC group rats. And acetylcholinesterase (AChE) activity of DB extract high diet (DBH) group slightly increased. Expression of brain-derived neurotrophic factor (BDNF) and extracellular signal-regulated kinase (ERK) in DB groups showed significantly higher values than those of NC group.

Conclusion : From above results, it is suggested that DB flower might be useful as a memory enhancing material for functional food and pharmaceuticals.

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[P03-019]

침향의 베타-아밀로이드와 타우-단백질의 플라크 억제 기능에 의한 치매 예방 가능성

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Agarwood Reduces the Risk of a Potential Dementia by Inhibiting Plaque Formation of Beta-amyloid and Tau-protein

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ABSTRACT

Background : Agarwood has been widely used in many different areas including oriental medicines, aroma therapy, cosmetics, health supplement products and etc. There are more than 20 *Aquilaria* species which were officially registered as Agarwoods. Most commonly used among them are *Aquilaria malaccensis*, *Aquilaria crassna* and *Aquilaria sinensis*. Agarwoods are massively growing in Southeast Asian countries. For Agarwoods used as medicinal purposes, they are well known for their effects on anticancer, diabetes and respiratory diseases. However, their effects on dementia related diseases have been limitedly reported regarding Alzheimer's and Parkinson's. The objective of our study was to see the inhibition effects of Agarwood on plaque formation of beta-amyloid and tau-protein which are, to date, the most significant factors associated with the dementia.

Methods and Results : For treatment in the experiment, *Aquilaria crassna* was extracted by 70% EtOH and was orally administered daily to ICR mice for 6 weeks. The mice used in our research were divided into 2 different groups; (1) High-fat diet control and (2) High-fat diet. with Agarwood extracts. The western blot analysis was made for the expression of beta-amyloid and tau-protein as markers for dementia associated diseases. We have found the group (2) has less expressed beta-amyloid and tau-protein compared to the group (1). As was reported in other study, obesity, causes the increased expression of beta-amyloid and tau-protein, which leads to potential cause of dementia. The group (2) treated with Agarwood showed less expression of beta-amyloid and tau-protein than the control group.

Conclusion : From the result of our study, Agarwood could be a potential remedy and preventative medicine for dementia related diseases. Agarwood also needs to be fractioned to screen and test major single compounds for the effectiveness of the dementia associated diseases.

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희귀 진세노사이드 Compound K의 *in vitro* 전립선 항암효과

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Anti-cancer Effect of a Rare Ginsenoside Compound K on Prostate Cancer *in vitro*

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ABSTRACT

Background : According to WHO cancer report, 1 in 6 death is due to cancer. Cancer patients were 18.1million in 2018 and the number of death by cancers is expected to be almost double in 2040. Prostate cancer is the 2nd carcinoma for men. Ginseng has long been widely used as an oriental medical plant in Korea and China. The main compound of ginseng has a very little or none of compound K (C-K) which is in general produced by bio-transformation by some enzymes. C-K effects have been extensively studied and were found to have strong anticancer effects, which was thoroughly proven via *in vitro* tests. C-K also is known for reducing oxidative stress, anti-inflammation reaction, anti-obesity and myelosuppression. C-K induces the programmed cell death through mitochondria-dependent pathway. It also causes a repression of glucose metabolism function. C-K well controls the cell cycle pathways by controlling CD1 and CDK4 proteins in G1 cell cycle stage. C-K also limits the cell proliferation and metastasis by inhibiting those proteins associated with apoptosis. In our study, we have tested C-K effect on human prostate cancer using DU-145 cell lines *in vitro*. Apoptosis and necrosis by C-K were examined and qPCR was performed to see the expression of genes associated with apoptosis in DU-145 cancer cells.

Methods and Results : DU-145 cells were cultured with 10% FBS and 3% antibiotics at 5% CO₂ incubator at 37°C. For treatment of C-K, C-K was mixed with DMSO to concentrations ranging from 0 to 100 µM. When the cell confluence became 70%, we treated C-K to the cells for 48 hrs and measured cell viabilities using the CCK8 assay kit. the result showed that IC₅₀ of DU145 was 48.09 mM. we also made apoptosis/necrosis assay using apoptosis/necrosis assay kit (ab176749). Only apoptotic cell death was found and no necrosis was detected with C-K treatment. qPCR analyses were performed to see the expression of genes associated with apoptotic events.

Conclusion : A rare ginsenoside compound K was highly effective for its anticancer effect on Du 145 and could be a highly curable remedy as a natural medicinal treatment in future drug industry.

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pH 및 균질화 처리별 백삼 추출물의 물리화학적 특성

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Physiccochemical Characteristics of White Ginseng Extract according to pH and Homogenization Treatment

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ABSTRACT

Background : Until now, ginseng has been concentrated only on the ginsenoside and acidic polysaccharide, respectively, to see the active ingredient and functional effect. Therefore, when extracting white or red ginseng, most of them were hot water extraction or alcohol extraction. The purpose of this study was to increase the extraction efficiency of ginsenosides, polysaccharides, and proteins by varying the pH using a buffer and going through a homogenization process.

Methods and Results : White ginseng (WG) powder was extracted with a citric acid-phosphate buffer of pH 3.0, 3.5, 4.0, 4.5, 5.0, and water as a control with 20 times by stirring (550 rpm) at 80°C for 5 hours. And homogenization was 5,000, 7,500, 10,000, 12,500 and 15,000 rpm, extraction time was 5, 10, 15, 20 and 25 minutes. The extract of WG was measured for color, absorbance and the content of ginsenosides, acidic polysaccharide and protein. WG extract by pH 4.0 and 12,500 rpm, 15min treatment, the L, a, and b values of the WG extract were 56.76, 4.54, and 37.81, and the transmittance (660 nm) was 36.53%, showing the highest degree of suspension. At pH 3.0, the content of total ginsenoside was the lowest at 18.05 mg/g (WGP), and when extracted with water only, it was 20.06 mg/g (WGP), and when homogenized at pH 4.5, it was the highest at 21.94 mg/g (WGP), which was 1.10 times higher than that extracted with water only. Acidic polysaccharide content of the extract was 17.66% when treated for 25 minutes at pH 4.0, 12,500 rpm, which was approximately 1.17 times higher than 15.02% of the treatment with water only without homogenization. Protein content of the extract was 19.85% when treated at pH 4.0, 12,500 rpm for 20 minutes, which was 1.19 and 1.42 times higher than 16.70% of the treatment without homogenization and 14.01% of the treatment with water only, respectively.

Conclusion : From the above results, when WG was extracted, the pH was adjusted from 4.0 to 4.5 and treated at 10,000 - 12,500 rpm for 15 minutes, WG extract was found to increase the extraction efficiency of acidic polysaccharide and protein as well as total ginsenosides. Therefore, it can be seen that the quality of the extract can be improved by adjusting the pH using a citric acid-phosphate buffer when extracting WG.

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[P03-022]

열처리 조건에 따른 원감 감초의 항염 활성 및 주요 성분 변화

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Changes in Anti-inflammatory Activities and Major Components of Wongam with Heat Treatment Conditions

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ABSTRACT

Background : Licorice is important resource as a sweetener for traditional medicines. Recently, RDA developed a new cultivar of Licorice ‘Wongam’. This study was performed to determine the changes in anti-inflammatory activities and major components of Wongam with heat treatment conditions.

Methods and Results : Wongam roots were treated at 120 and 130°C for 1 hr and extracted with 70% ethanol using ultra-sonicator at room temperature. These extracts were used to determine total phenolic content (TPC), major components content (liquiritin, liquiritigenin, iso-liquiritigenin, and glycyrrhizic acid) and anti-inflammatory properties. Total phenolic content and browning index were increased with increasing temperature. In major components, liquiritin and isoliquiritigenin contents increased, however liquiritigenin and glycyrrhizic acid contents slightly decreased with increasing temperature. And heat-treated extracts inhibited nitrite and inflammatory cytokines in LPS-induced macrophage cells slightly better than non-treated one.

Conclusion : The results of this study showed that the total phenolic content, major components such as liquiritin and isoliquiritigenin, and anti-inflammatory properties of Wongam extract were increased by heat treatment. Therefore, heat treatment is can be applied to improving functional qualities and developing utilization of Wongam.

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지황 굵기별 항산화 성분 및 항산화 활성
이윤정, 오명원, 이정훈, 정진테, 마경호, 윤영호, 한종원*
농촌진흥청 국립원예특작과학원 인삼특작부 약용작물과

**Antioxidant Components and Antioxidant Activity by Rhizome Diameter of
*Rehmannia glutinosa***

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ABSTRACT

Background : *Rehmannia glutinosa* belongs to the perennial herb of *Rehmannia* in Scrophulariaceae. The pharmacological foundation of *Rehmannia glutinosa* is chemical components contained in its rhizomes. *Rehmannia glutinosa* has been used as an traditional medicine, and is important resource for natural medicines and functional foods. However, no studies have been conducted to compare functional ingredients and activities according to the rhizome diameter of Korean *Rehmannia glutinosa*. Therefore, through this study, we compared and evaluated the antioxidant content and activity according to the rhizome diameter of *Rehmannia glutinosa*.

Methods and Results : This study was conducted to investigate the antioxidant component and antioxidant activity of five types(< 5 mm, 5 - 10 mm, 10 - 15 mm, 15 - 20 mm, > 20 mm) classified according to rhizome diameter of *Rehmannia glutinosa*. As a result of measuring the antioxidant component and antioxidant activity according to rhizome diameter, there was a significant difference according to the rhizome diameter. Polyphenols, ABTS radical scavenging activity, DPPH radical scavenging activity, and reducing power were measured as high in the order of 5-10mm, < 5 mm, 10 - 15 mm, > 20 mm, and 15 - 20 mm, and the flavonoid content also showed a similar trend. In addition, the 5-10mm type, which is the most excellent in antioxidants, was found to have an antioxidant content and activity that is about twice as high as that of 15 - 20 mm.

Conclusion : These results confirmed that *Rehmannia glutinosa* is a medicinal plant material with a strong function due to its excellent antioxidant content and antioxidant activity. In particular, the 5 - 10 mm size type is expected to be usefully utilized in the development of new functional materials for *Rehmannia glutinosa*. We intend to provide these results as useful basic data for improving the utilization and usability of *Rehmannia glutinosa* resources.

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헴프씨드의 **Phenolic amides**에 대한 평가와 멜라닌 생성 억제 효능

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Characterization of Phenolic Amides from Hemp Seed and Their Melanogenesis Inhibitory Activity

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ABSTRACT

Background : Hyperpigmentation resulting from the overactivation of tyrosinase leads to darker spots or patches on the human skin. Although these phenomena are harmless, there is still great demand for melanogenesis inhibitors to prevent hyperpigmentation by inhibiting the tyrosinase, a rate-limiting enzyme in melanogenesis. Hemp seed has been used in traditional medicine for thousands of years. Furthermore, the hemp seed has potential applications in the cosmetic industry because of strong antioxidant and anti-aging effects. Recently, effects of hemp seed extract on melanin synthesis in melanocytes have elucidated. However, melanogenesis inhibitory activity of chemical compositions from hemp seed extract has not yet been reported. In this study, we characterized the effects of phenolic amides from the hemp seed extract on the inhibition of melanin biosynthesis.

Methods and Results : Hemp seed extract and its ethyl acetate (EtOAc) fraction have the highest potential for inhibition of melanogenesis in melanoma cells. The LC-MS/MS analysis of hemp seed EtOAc fraction showed 28 compounds including hydroxycinnamic acids, phenolic amides and lignanamides. Three phenolic amides (N-trans-Caffeoyltyramine, N-trans-Feruloyltyramine, N-trans-Coumaroyltyramine) had inhibitory effect on α -MSH-induced melanogenesis.

Conclusion : In conclusion, phenolic amides from hempseed improve the efficacy of melanogenesis inhibition, suggesting a potential functional role as a cosmetic whitening agent.

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취 추출물이 여성 갱년기 증상에 미치는 영향

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(재)홍천메디칼허브연구소

Effect of Kudzu Extract on Improved Female Menopausal Symptoms

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ABSTRACT

Background : The tendency to use medicina herbs to manage menopausal symptoms has increased in recent years. This study was conducted to evaluate the effect of *Pueraria lobata* extract (KE) on improving female menopausal symptoms. The purpose of this study was to confirm whether *Pueraria lobata* extract (KE) has the effect of improving the symptoms of women's menopause through osteoblasts and phlegm follicles.

Methods and Results : *Pueraria lobata* extract (KE) significantly increased ALP activity, collagen synthesis, mineral deposition and osteocalcin production in MC3T3-E1 cells. The mineral deposition increased by the induction of osteoblast differentiation increased in a concentration-dependent manner compared to the osteoblast differentiation control group. Osteocalcin production was significantly increased in the group treated with KE (200 $\mu\text{g}/\text{m}\ell$). In addition, compared to the osteoclast differentiation control (0 $\mu\text{g}/\text{m}\ell$), the TRAP activity significantly decreased with increasing KE treatment concentration (200 $\mu\text{g}/\text{m}\ell$). In the case of the osteoclast differentiation control group, the actin ring was the clearest and the cells were concentrated, but as the concentration of KE increased, the actin ring significantly decreased. In other words, it can be said that KE treatment inhibits differentiation to a stage where bone resorption was possible.

Conclusion : The above results indicate that KE was effective in improving women's menopause symptoms including osteoporosis. Also that suggested the possibility of developed that as a functional material for improved women's menopause symptoms.

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까실쑥부쟁이의 부위별 추출물의 항산화 활성

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Antioxidant Activities of Extracts from Different Parts of Rough-surface Aster (*Aster ageratoides* var. *ageratoides*)

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ABSTRACT

Background : As economic growth has brought higher standards of living, leading to the increase in the aged population and the westernization of eating habits has lowered the incidence of infectious diseases, but on the other hand such a change seems to be increasing the prevalence of chronic degenerative diseases such as cancer, heart troubles, hypertension, and diabetes. As a result, there is an increasing public interest in cancer or other chronic degenerative diseases and a growing number of medical studies have begun to focus on such diseases. Recently, those studies are being considered more important in the conduct of research into and development of Korean medicinal plants, especially with significant attention given to physiological activation. In the present study, we investigated the antioxidant activities in the flower, leaf and stem of Rough-surface aster (*Aster ageratoides* var. *ageratoides*) in order to detect biologically active substances and develop novel functional resources.

Methods and Results : Rough-surface aster (*Aster ageratoides* var. *ageratoides*) were collected in Sancheong, Gyeongnam. Separated into leaves, stems, and flowers, 95% ethanol was used to extract and filter them for 48 hours with an extraction stirrer. Eight types were analyzed using extracts. As a result of analysis, the total phenol content in flowers was 25.53 mg GAE/g SW, which was about 2 times as high as that of leaves and stems, and the total flavonoid content was the highest in leaves at 2.11 mg CE/g SW. As a result of the DPPH, ABTS, and FRAP assays, flowers showed higher activity than leaves and stems at 1.21 mg AAE/g SW, 7.21 mg TE/g SW, and 7.45 mg TE/g SW, respectively. The total sugar content was as high as 25.53 mg GE/g SW in flowers. The content of reducing sugar was as high as 30.91 mg QE/g SW in leaves, but there was no significant difference from 29.33 mg QE/g SW in flowers. The soluble protein content was 27.77 mg BSA/g SW in flowers, 1.4 to 1.6 times higher than that of leaves and stems. Among flowers, leaves, and stems, it was confirmed that flowers have high antioxidant activity.

Conclusion : Collectively, these results suggest that the ethanol extracts of Rough-surface aster (*Aster ageratoides* var. *ageratoides*) have potential antioxidant effects, and can be used in food, cosmetics, and the pharmaceutical industries.

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면역형광법 (IF)을 이용한 침향의 *In vitro* 항유방암 효능

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**Anticancer Effect of Agarwood (*Aquilaria crassna*) on Human Breast Cancer *in vitro*
using Immunofluorescence (IF) assay**

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ABSTRACT

Background : According to the statistics on cancer registration of the Central Cancer Registry in 2018, the number of new cancers had been increased every year since 2015. In particular, breast cancer accounts for about 10% of the total cancer incidences. Breast cancer is a representative cancer for women, for which anti-cancer treatment is prolonged due to its high metastasis and recurrence rate. Breast cancer and other cancer treatments have side effects such as drug resistance and toxicity to normal cells. To minimize these side effects, researches on plant-derived anticancer drugs have been actively conducted recently. Agarwood has been a traditional medicinal drug for anticancer effects mainly in Asian countries and also for psychological sedation. Breast cancer causes a high degree of organ diseases due to metastasis and recurrence which initially accompanies surgical operation and chemotherapy. The objective of this study was to investigate the anticancer effects of agarwood (*Aquilaria crassna*) on breast cancer *in vitro*,

Methods and Results : Agarwood (*Aquilaria crassna*) was pulverized and extracted using 70% Ethanol and 70% Methanol, respectively, and after each extraction, alcohols were evaporated. From evaluation of the antioxidant power (DPPH) of the extracts for each solvent, the EDA value (%) was 64.65 for ethanol extract and 62.45 for methanol extract, showing no significant difference ($p = 0.05$). For the cell culture, the MDA-MB-231 cells were cultured in RPMI1640 medium with 10% FBS, 1% Antibiotics at 38°C and 5% CO₂ incubation conditions. They were cultured for 48 hours before treatment. Both treatments to the cell were 10 µl/ml. After 48 h culture, the cells were fixed with 4% formalin and IF analysis was performed for PCNA, VEGF, Caspase-3, and BCL2. The analysis results showed significantly higher expression of PCNA and VEGF in the control group compared to the agarwood (*Aquilaria crassna*) extracts-treated group. The expression of Apoptosis-inducing caspase-3 in the treated group compared to the untreated group was significantly higher. The expressions of the cell survival signal proteins and the angiogenesis-associated proteins were lower in the Agarwood treated group as expected.

Conclusion : Agarwood (*Aquilaria crassna*) possibly inhibits growth and metastasis of breast cancer and could be developed as a plant-based natural drug for the future drug industries.

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조릿대 추출물의 항산화 및 신경보호 활성

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Antioxidant and neuroprotective activities of *Sasa borealis* extracts

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ABSTRACT

Background : The *Sasa borealis* (SB), a species of bamboo, is a medicinal plant. It is known that SB has diverse biological activities like anti-diabetic, anti-obesity, anti-inflammatory, etc. This study was performed to investigate the antioxidant and neuroprotective activities of SB.

Methods and Results : *Sasa borealis* (SB) aerial parts were extracted using distilled water and 70% ethanol respectively, producing SB water extract (SBW) and SB 70% ethanol extract (SBE). Antioxidant components, such as total phenolic contents (TPC) and total flavonoid contents (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. While TPC of SBE was higher than SBW, TFC of SBW was higher than SBE. In ABTS⁺ and DPPH radical scavenging assay, SBE showed higher scavenging activity than SBW. And all SB extracts (SBW, SBE) significantly reduced the H₂O₂-induced ROS production in neuronal cells.

Conclusion : *Sasa borealis* (SB) water and ethanol extracts have good antioxidant activities and ameliorated the H₂O₂-induced ROS production in neuronal cells. This result indicates that SB extracts can be promising candidates for further researches designed to treat and manage neurological disorders.

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약용작물의 조직배양 조건 확립 및 대사물질 분석

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Establishment of the Tissue Culture Condition and Metabolic Analysis of Medicinal Crop

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ABSTRACT

Background : Medicinal crops are used for the production of ‘well-being’ industry in a wide range of fields such as cosmetic, food and medicine. Safflower (*Carthamus tinctorius*) is one of the medicinal crop belonging to the *Asteraceae* family. Historically, the plant’s seed and flower have been used for medicinal purposes. Hence, by identifying optimal condition for safflower anther culture to facilitate the quick and early finding of safflower germplasms. Furthermore, we used liquid chromatography-mass spectrometry (LC-MS) to analyze the metabolites in safflower leaves.

Methods and Results : We attempted to regenerate plants from safflower germplasms using anther and leaf tissue culture. For tissue culture conditions, various plant growth hormones such as BAP (6-Benzyl aminopurine), TDZ (Thidiazuron), NAA (Naphthaleneacetic acid) and IBA (Indole-3-butylic acid) were investigated. Finally, we obtained the results of shoot induction and plant regeneration using TDZ, NAA through anther culture. However, green callus induction was effective in the same condition, but no shoot induction was observed. Additionally, we utilized LC-MS to compare the metabolic profiles of safflower leaves from parent and regenerated plants. As a consequence, 29 standard metabolites were identified. There was no significant difference in the type of metabolites, although there was a difference in content between the parent plant and regenerated plants. Noticeable, quercetin is a major compounds in the known metabolites that belongs to the flavonoids family and exhibits significant antioxidant activity.

Conclusion : From this results, we propose that safflower leaves should be used as a functional material in health food and medicine. Additionally, we anticipate assisting in the early fixation of germplasms through anther culture for future plant breeding and functional metabolic studies of safflower.

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대홍복숭아의 유효성분 분석 및 품질특성 연구

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Analysis of Active Compounds and Quality Characteristics in Daehong, Local Peach

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ABSTRACT

Background : Daehong, one designation of peach (*Prunus persica*), is cultivated widely in the area of Hongcheon. The research on Daehong is insufficient yet. At first step, we evaluated the component ratio of the active compounds in Daehong. Therefore, the bioactive materials, organic acids, sugar components, total polyphenols, and physicochemical properties were identified according to the maturation period of Daehong.

Methods and Results : The physicochemical changes according to the weight, firmness, outer color, titratable acidity, pH and total soluble solids between ripe and unripe peaches during maturation period were analyzed. We estimated the values of titratable acidity (ripe: 0.33-0.37%, unripe: 0.28 - 0.36%), total soluble solids (ripe: 8.3 - 8.9, unripe: 7.1 - 10.4), pH (ripe: 3.964 - 4.045, unripe: 3.9232 - 4.1777), weight (ripe: 340 - 360 g, unripe: 284 - 340 g), firmness (ripe: 8.4776 - 10.3954, unripe: 2.437 - 14.981), the red direction, a (ripe: 25.63 - 29.32, unripe: 14.07 - 31.63), the brightness of the sample, L (ripe: 43.04 - 52.85, unripe: 45.25 - 63.45), the blue direction, b (ripe: 11.84 - 13.50, unripe: 9.66 - 17.86) of outer color, respectively. And then, the bioactive ingredients and organic acids in them were performed using UPLC analysis. The main components of bioactive compounds in the ripe peaches were analyzed as amygdalin (91.92 - 97.08 mg/100g), chlorogenic acid (14.53 - 25.96 mg/100g) and catechin (9.32 - 11.54 mg/100g) and, in the unripe were analyzed as amygdalin (76.88 - 123.54 mg/100g), chlorogenic acid (16.37 - 31.00 mg/100g) and catechin (8.34 - 11.63 mg/100g). The main organic acid content in the ripe peaches were component with L-malic acid (29.14 - 32.95 mg/g), L-lactic acid (5.72 - 6.77 mg/g), citric acid (5.71 - 5.82 mg/g), and fumaric acid (8.99 - 12.56 mg/g). The organic acid content of unripe were component with L-malic acid (26.80 - 30.09 mg/g), L-lactic acid (4.55 - 6.61 mg/g), citric acid (2.09 - 4.11 mg/g) and fumaric acid (5.05 - 7.06 mg/g). In the main sugar contents, there were no different between in the ripe and unripe. The contents of total polyphenol were 327.16 - 406.70 mg/100g in the ripe peaches and 296.83 - 353.45 mg/100g in the unripe.

Conclusion : For study of quality characteristics in Daehong peaches, analysis of bioactive compounds, organic acids, sugars, total polyphenol and physicochemical property in peaches were performed. It is considered that these results can be used as the useful information and the technical standard for confirming the quality characteristics of Daehong Peach.

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송화 및 연잎을 이용한 약주의 품질특성 분석

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Quality Characteristics of Pine Pollen and Lotus Leaves-based *Yak-Ju*

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ABSTRACT

Background : *Yak-Ju*, one of the traditional fermented liquors in Korea, is allowed to ferment with a specialized yeast, NURUK and rice. In a traditional asian medicine, Both, lotus leaves and pine pollen, are used together to treat fever, diarrhoea and stomach and so on. Their compositions and effects in the fermented liquor were unknown.

Methods and Results : In this study, we investigated which ingredients constitute their compositions during the fermentation process of *Yak-Ju* containing them. Each contents of the active compounds in *Yak-Ju* (organic acid content, polyphenol content, volatile organic compound) were differently analyzed for all treatments. 1. Organic acid : The organic acid content in lotus leaves and Pine Pollen were 0.35 - 2.54 and 0.03 - 10.8 mg/g, respectively. A total of 4 organic acid components were detected in Pine Pollen and lotus leaves-based *Yak-Ju*. Furthermore, organic acids in the *Yak-Ju* were detected such as oxalic, lactic, succinic and kojic acids, among which the latic acid showed the highest amount (10.59 ± 0.22 - 11.74 ± 0.26 mg/ml). 2. Total polyphenol : The polyphenol content ranged from 1.34 to 1.78 mg/ml was not significantly different depending on fermentation process. 3. Volatile organic compound : The volatile organic compounds of *Yak-Ju* were extracted using solid-phase microextraction (SPME) methods and then analyzed by gas chromatograph-mass spectrometer. The lotus leaves indicated the highest 2-Octene (70.80%, alkenes) amount among the volatile organic compound. Five components were identified including alkene, aldehyde, naphthalene. In the case of Pine Pollen, terpene contents described as α -Pinene (22.99%) > Limonene (20.60%). In the case of *Yak-Ju*, ethanol was the highest % area (*Yeonyeobju* 89.34%, *Songhwaju* 72.12%).

Conclusion : The main active compounds (organic acid, polyphenol, volatile organic compound) decreased through the fermentation process. We provide the useful information that *Yak-Ju* containing might protect our health from heavy drinking and alcoholic injury.

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토양매립 및 봉지재배에 따른 잎새버섯 열수추출물의 품질특성 비교
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Comparison of Quality Characteristics of Hot Water Extract of Maitake (*Grifola frondosa*) Mushrooms according to Outdoor Cultivation and Bag Cultivation

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ABSTRACT

Background : This study researched analysis of the various constituents and comparison of biological activities of Maitake mushrooms (Gangwon-do Agricultural Technology Institute developed variety “Taemi”)cultivated in two methods (outdoor cultivation, bag cultivation).

Methods and Results : Crude protein, crude ash, and crude fiber were high in the bag cultivation and carbohydrate was significantly high in the outdoor cultivation. K, Cu and P were higher in bag cultivation than in the outdoor cultivation. There was no significant difference in DPPH radical scavenging ability and total polyphenol contents according to the cultivation method of Maitake mushroom. ABTS radical scavenging activity IC50 was lower in bag cultivation than in the outdoor cultivation. The anti-inflammatory activity was significantly inhibited in bag cultivation (85.71%), and outdoor cultivation (84.87%) compared to the LPS treatment group.

Conclusion : Maitake Mushroom bag cultivation is suitable as a new cultivation method as it has excellent physiological activity as well as outdoor cultivation that is harvested once a year.

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고창 서해안 서식 칠면초의 이화학 평가
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Phytochemical Constituents in West-coastal *Suaeda japonica* Makino

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ABSTRACT

Background : *Suaeda japonica* Makino belonging to the family Chenopodiaceae and a salt-tolerant plant, have been increased economic interests as a high-value materials. Phytochemicals were evaluated by colormetric and chromatographic methods and compared to results from different extraction ratio and times, repectively. Functional materials of *Suaeda japonica* Makino were obtained from Gochang-gun, Jeollabuk-do.

Methods and Results : *Suaeda japonica* Makino from Gochang-gun, Jeollabuk-do, was collected on July, 2020. Aboveground parts of *Suaeda japonica* Makino were sonicated in deionized water and ethanol on the mixed ratio, respectively. Phenolic components from each extract were evaluated by colormetric procedures and compared. Total polyphenols, flavonoids and anthocyanins from functional materials were compared and optimized for processing procedures. Phytochemicals such as syringic acid (1), apigenin (2), isorhamnetin (3), kaempferol (4), 4-hydroxybenzoic acid (5), quercetin (6), luteolin (7) and scopoletin (8) were identified and quantitated by high pressure chromatographay method. Alcohol suspensions of powdered *Suaeda japonica* Makino showed higher 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity than H₂O suspensions. The identified compounds were quantitated and compared to other halophytes. The results indicated that syringic acid in alcohol extracts of *Suaeda japonica* Makino aboveground parts was found to be higher than others.

Conclusion : As the these results, we may suggest that *Suaeda japonica* Makino have useful components as a safe material for functional food and bio-cosmetics.

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누리대 잎과 줄기의 생리활성 비교

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Comparative Study of Bioactivity of Leaves and Stems of *Pleurospermum camtschaticum* Hoffm.

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ABSTRACT

Background : *Pleurospermum camtschaticum* Hoffm. has been widely used as an edible plant in Korea. *P. camtschaticum* Hoffm. has been distributed in South Korea, Japan, Sibeira and peninsula of Kamchatka. In traditional remedies, *P. camtschaticum* Hoffm. was known for helping the pregnant women to make breast milk, promoting digestion and lowering the level of cholesterol. The purpose of this study is to investigate and compare the bioactivities of leaves and stems of *P. camtschaticum* Hoffm.

Methods and Results : Dried leaves and stems of *P. camtschaticum* Hoffm. were purchased from Beyondmaya (Gangwon-do, Korea). Leaves and stems of *P. camtschaticum* Hoffm. were extracted in Methanol. 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity, reducing power assay were used to measure antioxidant activities. To measure antioxidant-related compounds such as phenol and flavonoid, total phenolic contents (TPC) and total flavonoid contents (TFC) was used and presented as mg GAE/g and mg QE/g, which meant 1 g of *P. camtschaticum* Hoffm. contained phenol and flavonoid compared to the calibration curve of Gallic acid and Quercetin. Tyrosinase, elastase and α -glucosidase inhibition activities were measured by using colorimetric. 3,4-dihydroxy-L-phenylalanine (L-DOPA), N-succinyl-(L-alanyl)-D-glutamate, para-nitrophenyl- α -D-glucopyranoside were used as a substrate. The cell viability was evaluated by 3-(4,5-dimethyl-2-thiazolyl)-2,5-diphenyl-2H-tetrazolium bromide (MTT) assay based on mitochondrial respiration by determining reduction of MTT. The creation of nitric oxide (NO) in lipopolysaccharide-induced RAW264.7 cells was also investigated. In tyrosinase, elastase inhibition activities, both of them had no effect compared to standards such as kojic acid. But in α -glucosidase inhibition activity, leaves had a similar effect compared to acarbose. In cell viability, RAW264.7 cells survived at least 85% at all concentrations in leaves and stems. Therefore, *P. camtschaticum* Hoffm. had no toxicity to RAW264.7 cells. In NO generation, leaves and stems had a similar effect as the concentration increased, the generation of NO decreased.

Conclusion : The results of these experiments showed that the bioactivities of leaves were far greater than stems. However, in NO generation, stems showed similar effects compared to leaves. These results indicated that both leaves and stems had a potential to be used as a natural source of pharmaceutical products and food for health.

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Wilma 부위별 메탄올 추출물의 생리활성 비교

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Comparison of Biological Activities of Methanol Extracts from Different Parts of *Cupressus macrocarpa* 'Wilma'

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ABSTRACT

Background : *Cupressus macrocarpa* 'Wilma' has been distributed in North and South America, Europe, Australia, New Zealand and Asia. *C. macrocarpa* has unique scent and has been also used as horticulture therapy. In this study, we used *C. macrocarpa* leaf, stem, root. This study was performed to compare the abilities of different parts of *C. macrocarpa* for the antioxidant activities, tyrosinase, elastase, α -glucosidase inhibition activities.

Methods and Results : *C. macrocarpa* leaf, stem, root were extracted using methanol in room temperature and repeated three times. 1,1-Diphenyl-2-picrylhydrazyl (DPPH) and reducing power assay were used to measure antioxidant activities. Total phenolic contents (TPC) and total flavonoid contents (TFC) were performed using gallic acid and quercetin as a positive control. Tyrosinase inhibition activity was measured at 490nm and kojic acid was used as a positive control. Elastase inhibition activity was measured at 415 nm. α -glucosidase inhibition activity was measured at 405nm and quercetin was used as a positive control. In anti-oxidant activities, *C. macrocarpa* root extract was found higher than other parts. Unlike previous results, the leaf extract showed the best tyrosinase inhibition activity. All parts of *C. macrocarpa* extracts showed similar inhibitory activity of elastase in 1 mg/mL. In α -glucosidase inhibition activity, all parts showed higher inhibition rates than the quercetin and leaf showed the best activity.

Conclusion : The antioxidant activities were the best in the roots extract, but the leaf extract was better in the enzyme inhibition activities. The results of these experiments showed that all parts of *C. macrocarpa* could be used as natural sources of bioactive substances.

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옻 추출물 첨가 사료 폐기의 생육 평가

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The Growth Evaluation of Catfish Fed with *Rhus verniciflua* Stokes Extract Feed

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ABSTRACT

Background : *Rhus verniciflua* Stokes belongs to the Anacardiaceae originated in China. In Korea, *Rhus verniciflua* Stokes grows mainly in Gangwon-do Province. Traditionally, *Rhus verniciflua* Stokes has been used for the treatment of diseases related to kidney, stomach, liver, arthritis and menstrual irregularity. *Silurus asotus* (catfish) is a major species of domestic freshwater aquaculture with an annual domestic production of 4,700 tons. It is mainly used as food ingredients because it is rich in nutrients such as protein, vitamins, minerals and *et al.* The aim of this study is to identify the growth difference and biological activity between catfish fed with different feeds.

Methods and Results : Catfishes used in this study were obtained from Geumah Susan in Chilgok-gun, Gyeongsangbuk-do. Province one was fed with feed mixed with *Ruhs verniciflua* stokes extract (RF) and the other one was with normal feed (NF). The total production of catfishes was increased by 140% for RF catfishes compared to NF catfishes. To identify the level of antioxidant activities, 1,1-diphenyl-2-picrylhydrazyl free radical scavenging activity (DPPH), total phenolic contents (TPC), total flavonoid contents (TFC) and reducing power assay were conducted. RF catfish showed the highest antioxidant effects. Amino acid was a main component crude fat and the total amino acid contents were analyzed. RF catfishes had higher lever of glycine, proline, arginine, serine, alanine and histidine. Also, the total fatty acid contents were carried out. RF catfishes had significantly higher level of fatty acid contents compared to NF catfishes, especially in contents of palmitic acid, oleic acid, linolenic acid and henicosanoic acid. The total contents of mineral K, Na, Fe, Ca, Mg, P, Se, V, An in both catfishes were implemented. And all the rest of, RF catfishes contained less Na, which could increase blood pressure.

Conclusion : From these experimental results, it can be seen that RF catfishes have a lot of positive effects on various biological activities, therefore, the potential utility values of catfish fed with *Ruhs verniciflua* stokes extract feed and *Ruhs verniciflua* stokes extract feed are expected to be great. In addition, further researches are needed in connection with this study.

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진안 홍삼과 길경의 지표물질 분석과 항암효과

이예은, 이다은, 김하빈, 박충범, 황승미*

(재)진안홍삼연구소

**Analysis of Major Compounds and Anticancer Effect of Jinan Red Ginseng
and *Platycodonis radix* Extracts**

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ABSTRACT

Background : The prevalence and mortality rate of chronic obstructive pulmonary disease are on the rise due to exposure to risk factors such as smoking and air pollution and the aging of the population. Red Ginseng (RG) is a natural product with anti-inflammatory and anti-carcinogenic effects. Platycodonisradix (PR), the root of *Platycodonisgrandiflorum* (Jacq.) A. DC., has been used to treat respiratory disease including cough, excessive phlegm, and sore throat for a long history. Combined with Platycodonisradix to enhance the anticancer effect in lung cancer cell lines.

Methods and Results : To investigate the effects on lung cancer cell growth, we treated A549 cells, a lung cancer cell line, with each sample at various concentrations (0.0039 - 4.0000 mg/ml) for 24 h and cell viability were estimated by the MTT assay. PR, RG and mixture of them inhibited the growth of A549 cells in a concentration-dependent manner. It was confirmed that the anticancer effect of the mixture was higher than that of the RG single.

Conclusion : These results confirmed that the anticancer effect of the mixture (RG : PR = 3 : 7) was higher than that of the RG single.

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뽕잎, 아로니아 추출물의 항비만 효과

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Anti-obesity Effect of Extracts

of *Morus alba* L. and *Aronia Melanocarpa* (Michx.) Elliott

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ABSTRACT

Background : The study evaluated the anti-obesity effects of cultivated materials in Jeollabuk-do and Jinan and in order to compare the anti-obesity efficacy of single material and composite material.

Methods and Results : The samples of *Morus alba* L. (MA) and *Aronia melanocarpa* (Michx.) Elliott (AR) were extracted 80% ethanol (80% EtOH) twice and freeze-dried powder. The powders were mixed after melt in distilled water. The ability of MA and AR 80% EtOH to inhibit differentiation was measured using a Oil red O staining after treated MDI (IBMX, Dexamethasone, Insulin) in 3T3-L1 cells. MA 80% EtOH was treated concentration of 100, 250, 500 µg/ml. AR 80% EtOH was treated concentration of 100, 500, 1000 µg/ml. The mRNA expression of C57BL/6J liver and epididymis fat related to anti-obesity were measured by real-time PCR. protein expression of C57BL/6J liver related to anti-obesity were measured by western blot. The extraction yield of MA 80% EtOH was 19.1% and AR 80% EtOH was 46.2%. In the case of a composite material rather than a single material, especially when the proportion of AR 80% EtOH was high, it showed differentiation inhibition ability. The real time PCR analysis result showed significant decrease of expression of sterol regulatory-element binding proteins (SREBPs) cluster of differentiation 36 (CD36) mRNA. In particular, it showed a significant decrease in composite materials. But the western blot result was confirmed only increase in AR 80% EtOH treated group.

Conclusion : It was analyzed that the anti-obesity effect was superior when the composite material was treated than the single material. But protein expression results were confirmed only effect AR 80% EtOH extracts. Therefore we intend to confirm different protein expression in order to effect of MA 80% EtOH and composite materials. From now on, It is sought to promote diversification of cultivable crops in Jinan or Jeollabuk-do by development of functional materials like this study. materials.

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황기 새싹의 시기별 Tryptophan 함량 변화
양창열, 장귀영, 최수지, 지윤정, 강민혜, 김형돈, 이승은, 최재훈*
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Variation in Tryptophan Content in Hwanggi (*Astragalus membranaceus*) Sprouts

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ABSTRACT

Background : This 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 : Sprouts from medicinal crops are food ingredients designated by the Ministry of Food and Drug Safety. Among them, the seed price was reasonable and the highest yield Hwanggi was selected. After 20 hours of soaking the Hwanggi seeds, they were placed in a well-drained bed and soaked twice a day. It grew Hwanggi sprouts for 15 days indoors, where it remained at 23 degrees Celsius. Hwanggi seeds and Hwanggi sprouts grown for 5, 10 and 15 days were extracted. They were frozen and dried, followed by reflux extraction at 85°C for two hours with 70% ethanol solvent, three times. The extracted solution was decompressurized and freeze dried. HPLC analyzes the content of tryptophan in Hwanggi seeds and Hwanggi sprout extracts. During seed cultivation up to 15 days, tryptophan content increased significantly and dramatically. Hwanggi sprouts grown on the 15 days contained 4.57 times more tryptophan than Hwanggi seeds. Hwanggi seeds and Hwanggi sprout extracts were treated to nerve cells SH-SY5Y and incubated 24 hours a day. Hwanggi seeds and Hwanggi sprout extracts did not show neurotoxicity to nerve cells. Rather, the number of neurons increases as the concentration of each periodical extract increases, confirming that the Hwanggi seed and Hwanggi sprout extract help the growth of neurons.

Conclusion : Hwanggi sprouts grown on the 15 days contained 4.57 times more tryptophan than Hwanggi seeds. Furthermore, we confirm that the Hwanggi seed and Hwanggi sprout extract help the growth of neurons. 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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국내 귀리 품종별 켈러스 추출물의 아베난쓰라마이드 함량 분석

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Quantification of Avenanthramides Content in Callus from Korean Native Oat Cultivars

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ABSTRACT

Background : Oats contain unique, a group of amides, soluble phenolic compounds named Avenanthramides (Avn), which are not present in other cereal grains. Avn is known to have anti-inflammatory, antioxidant, anti-itch and anti-cancer functions. In particular, Avn C is known to be effective in preventing and treating Alzheimer's dementia. Nevertheless, Avn is difficult to use commercially as one can only be obtained in small amount from oat. Our study aims to mass-produce Avn using oat callus.

Methods and Results : Oat callus was induced using seeds of three Korean native oat cultivars (Daeyang, Sunyang, and Suyang). In callus induction by 2,4- Dichlorophenoxyacetic acid (2,4-D), the use of 2 ppm and 5 ppm resulted in an average of 62% and 68% induction rates respectively, which was significantly higher than when 1 ppm and 10 ppm conditions were used. Avns (Avn A, Avn B, and Avn C) content was quantified using HPLC. Comparative samples were also prepared from 2-day-germinated seeds, 7-day-old leaves, and 14-day-old leaves. Avn C was detected only in calli and 2-day-germinated seeds. Total amount of Avns was highest in 2-day-germinated seeds.

Conclusion : Taken together, the callus cells derived from oat seeds contains Avn C. The most efficient conditions for callus induction of the three Korean oats were 2 ppm and 5 ppm 2,4-D. Thus, these results can be utilized for mass production of Avn C, which is in the spotlight as a treatment for dementia of the Alzheimer type.

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버섯균사로 발효한 한약재 첨가 곡물의 유용성분

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Useful Components of Fermented Grains Mixed Herbal Medicine Extracts with Mushroom Mycelials

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ABSTRACT

Background : Mushrooms contains protein, amino acids, enzymes, fats, iron, fiber, vitamins and minerals, and are known to contain beta-glucan and ergosterol as functional ingredients. There are also reports of ergothioneine from mushrooms was powerful antioxidant. We were development for various processed products and materialize using mushrooms used for food and medicinal purposes, herbal medicine was fermented with mushroom mycelials.

Methods and Results : In order to select the material for fermentation of raw herbs, powders of *Chaenomeles sinensis* fruit and *Rubus coreanus* fruit were mixed with grains to cultivate *Auricularia auricula-judae*, *Ganoderma lucidum*, *Lentinula edodes*, *Phellinus linteus*, *Schizophyllum commune*, respectively. The highest beta-glucan content was observed in *L. edodes* mycelium (34.28% in *C. sinensis* fruit, 27.64% in *R. coreanus* fruit) among the beta-glucan content of mushroom mycelium cultured in a medium composed of various herbal medicine. The content of ergothioneine were high in the orders of *L. edodes* mycelium (8.58 mg%), *G. lucidum* mycelium (2.37 mg%), and *P. linteus* mycelium (1.47 mg%) among the *C. sinensis* fruit fermentation mushroom mycelials. As the results of ergothioneine analysis, the content of ergothioneine was followed by *S. commune* mycelium (11.03 mg%), *L. edodes* mycelium (7.23 mg%), *G. lucidum* mycelium (4.38 mg%), and *P. linteus* mycelium(2.90 mg%). The major amino acids of fermented herbs by mushroom mycelial were determined glutamic acid, arginine, aspartic acid, leucine.

Conclusion : Therefore, we may suggest that herbs fermentation by *L. edodes* mycelial was more efficacy for industrially utilized such as the functional ingredients and reduce product cost of media than other mushrooms.

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블랙트리플과 서머트리플의 아미노산과 핵산물질 비교

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Comparison of Amino Acid and Nucleotides Components of Black Truffles (*Tuber melanosporum*) and Summer Truffles (*Tuber aestivum*)

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ABSTRACT

Background : Truffles are highly appreciated due to their characteristic sulphuric aroma and their unique taste. Also truffles had amount of carbohydrate, proteins, vitamins and minerals. They are used mainly uncooked in French and Italian cuisine, particularly black truffle (*Tuber melanosporum*) commonly. Black truffle (*T. melanosporum*) is considered the finest because of its complex aroma, and it is also the rarest and the most expensive among the truffle species. Summer truffle (*Tuber aestivum*) is the most frequent found truffle species of Middle Europe. It is less aromatic than black truffle, but moderately priced and has a good aroma quality. Nowadays, volatile flavor components and aroma active compounds between truffle strains were reported. But, research of food useful components in black and summer truffle were not enough for food and medicinal uses. Therefore, in this study the contents of amino acids and nucleotides were compared black truffle (*T. melanosporum*) and summer truffle (*T. aestivum*).

Methods and Results : In this study, amino acid contents and nucleotides were compared of black truffle (*T. melanosporum*) and summer truffle (*T. aestivum*). The analysis results are as followings. The total amino acids content of summer truffle was 9704.31 mg% and black truffle was 7278.04 mg%. The free amino acids content of summer truffle was 3833.08 mg% and black truffle was 1256.75 mg%. As the analysis of nucleotides, one nucleotides were detected by HPLC was the most strongest taste compound 5'-guanosine monophosphate. The 5'-guanosine monophosphate content of summer truffle was 6.12 mg% and black truffle was 1.64 mg%.

Conclusion : As the results of chemical analysis were showed the summer truffle (*T. aestivum*) more higher than black truffle (*T. melanosporum*).

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약용식물 혼합추출물의 항염증효과 및 소화효소 활성

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Digestive Enzyme Activity, and Anti-inflammatory Effect of Plant Mixture Extracts

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ABSTRACT

Background : With aging, muscle loss, inflammation, and indigestion may occur in the body, which may lead to social problems such as an increase in medical expenses and financial support. Thus, this study samples plant mixture extracts developed using various plants and performed various biological activities assay and analysis to determine the efficacy of the plant mixture extracts, and to develop food materials for muscle loss.

Methods and Results : We investigated the anti-inflammatory effects of plant mixture extracts by protease, α -amylase, lipase activity assays, MTT assay, NO assay, inflammatory cytokine assay, β -hexosaminidase and histamine assays. The extract treatment shows digestive enzymatic activities-like actions including protease, α -amylase, and lipase. The mixture extracts suppressed the production of NO, inflammatory cytokines such as IL-1 β , TNF- α and PGE2, and IL-4. The extracts complex inhibited degranulation of RBL-2H3 cells by antigen stimulation.

Conclusion : These results show that the mixture extracts may have beneficial effects for improvement of immune activity and nutrient absorption.

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UV-B 손상이 유도된 Hairless mouse에서의 홍삼 염생식물 등 복합 추출물의 보호 효과

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Protective Effects of Halophyte and Red Ginseng Extract against UVB-induced Damage in Hairless Mice Skin

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ABSTRACT

Background : Excessive exposure to UV-B decomposes collagen and elastin in the skin and causes photoaging such as wrinkles, spots, and freckles. In the current study, the protective effects of halophyte, red ginseng and *Morus bombycis* against ultraviolet (UV)-induced skin damage were investigated.

Methods and Results : Halophyte, Red ginseng and *Morus bombycis* complex extract (HRE) was prepared and its effect on UV-B irradiated hairless mouse skin was studied through ELISA, Western blot, immunofluorescence, and histological staining. HRE inhibited UVB-induced skin swelling and collagen degradation in mouse skin. This effect was likely due to HRE inhibiting the Matrix metalloproteinases (MMPs).

Conclusion : By protecting the skin from UVB-induced skin damage, HRE has the potential to be used in the treatment and prevention of UV-induced skin damage and photoaging.

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한삼 에탄올추출 조건 최적화 및 항산화 활성

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Optimization of Extraction Conditions for Ethanol Extracts of *Humulusjaponicas* and Antioxidant Activity

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ABSTRACT

Background : *Humulusjaponicus* is a perennial herb native to East Asian countries including China and Korea. It has anti-inflammatory, anti-oxidant, anti-bacterial and anti-mycobacterium effects

Methods and Results : In this study, the antioxidant capacity, polyphenol and flavonoid content of *H. japonicus* were investigated *in vitro* and the inhibitory effect of hydrogen peroxide-induced oxidative stress in PC12 cells was investigated. The results demonstrated that the polyphenol, flavonoid content and antioxidant activity of *H. japonicus* extract (HJE) increased with higher ethanol concentration in the solvent. In PC12 cells treated with hydrogen peroxide, HJE upregulated endogenous antioxidant defense systems such as SOD, catalase, OGG1 and HO-1. In addition, HJE inhibited the akt and NF- κ B signaling pathways and increased the expression of SIRT1.

Conclusion : HJE can increase the activity of antioxidant enzymes through the activation of SIRT1, and it is thought that it can suppress inflammation related to oxidative stress through inhibition of akt and NF- κ B signaling pathways.

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미세아교세포에서 한삼 에탄올추출물의 항염증효과

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Anti-inflammatory Effect of *Humulus japonicus* Extract in Microglia Cell

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ABSTRACT

Background : Microglia are prolific protective cells of the brain that are activated in response to inflammation and oxidative stress, thereby causing various neurological diseases. *Humulus japonicus* is a perennial herb native to East Asia such as Korea and China, and has been used in traditional Korean medicine for lung diseases and skin diseases for its anti-inflammatory and antioxidant effects.

Methods and Results : In this study, ELISA and Western blot were used to investigate the anti-inflammatory effect of *Humulus japonicus* extract (HJE). As a result, HJE inhibited the expression of nitric oxide (NO), iNOS, COX2, iNOS, IL-1beta, IL-6 and TNF-alpha in LPS-stimulated microglia cells. The effect seen were probably due to the downregulation of the activation of MAPKs, STAT3, AKT and NF-κB/p65 in HJE microglia cells.

Conclusion : By providing a mechanism of anti-inflammatory action in the neurons of HJE, these findings ultimately suggest a potential use of HJ for the treatment/prevention of neurodegenerative diseases caused by inflammatory disease.

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[P03-047]

매실나무 가지 에탄올 추출물의 혈관이완 효능 및 작용기전에 대한 연구

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Vasorelaxant Activity and Action Mechanism of *Prunus mume* (Siebold) Siebold & Zucc. Branch on Rat Aortic Ring

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ABSTRACT

Background : The purpose of this study was to investigate the vasorelaxant activity and action mechanism of the ethanol extract of *Prunus mume* (Siebold) Siebold & Zucc. branch (PMB).

Methods and Results : PMB (2 - 30 $\mu\text{g}/\text{mL}$) activity on endothelium-intact and endothelium-denuded aortic rings pre-contracted by PE (1 μM) was determined. PMB caused concentration-dependent vasorelaxation on endothelium-intact but did not cause vasorelaxation on endothelium-denuded aortic rings. Pre-incubation with NG-nitro-L-arginine methyl ester (L-NAME), indomethacin, L-NAME + indomethacin, 1H-[1,2,4]oxadiazolo[4,3-a]quinoxalin-1-one (ODQ), methylene blue (MB), atropine, tetraethylammonium chloride (TEA), glibenclamide, 4-aminopyridine (4-AP), and barium chloride(BaCl_2) significantly reduced the EC_{50} values. All inhibitors used in the mechanism study significantly inhibited vascular relaxation

Conclusion : PMB caused endothelium-dependent vasorelaxation in rat aortic rings. The vasorelaxant activity of PMB were related to (1) NO-cGMP pathway, (2) PGI_2 pathway, (3) muscarinic receptor pathway, and (4) potassium channels such as K_V channel, K_{ATP} channel, and K_{IR} channel. Our study explains that PMB may be another approach to hypertension treatment to reduce the burden of cardiovascular disease.

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[P03-048]

구절초, 페퍼민트, 감초로부터 얻은 식물 복합추출물이 테스토스테론에 의해 유도된 탈모에 모유두세포와 C57BL/6에 미치는 영향

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Effect of Plant Complex Extracts Obtained from *Chrysanthemum zawadskii*, *Mentha piperita* and *Glycyrrhiza glabra* L. on Hair Loss Induced by Testosterone in Human Dermal Papilla Cells and C57BL/6 Mice

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ABSTRACT

Background : Hair loss is a global problem for men and women of all ages. Treatments using drugs to prevent hair loss have side effects when used for a long time. The purpose of this study was to investigate the *in vitro* and *in vivo* effects of complex extracts from *Chrysanthemum zawadskii*, *Mentha piperita* and *Glycyrrhiza glabra* (CMG) on hair growth.

Methods and Results : We evaluated the DPPH radical scavenging activity, NO, SOD, GSH, 5-AR, AR assay to determine the hair growth effects. Human hair follicle dermal papilla cells (HFDPCs) and five-week-old male C57BL/6 mice were used. The mice were divided into the four groups: Normal control, Control, 200 mg/kg CMG, and 0.5 mg/kg minoxidil. Each group was orally administrated, once a day, for 14 days. We analyzed hair growth and histological changes. The results revealed that CMG showed the nitric oxide inhibitory effect in LPS-stimulated RAW264.7 macrophages as well as DPPH radical scavenging activity. To investigate cytotoxicity effect of CMG in testosterone-treated HaCaT cells, we conducted cell viability assay. CMG treatment increased cell viability in a dose dependent manner. Moreover, CMG treatment recovered cell morphology and antioxidant system such as SOD activity and GSH content in testosterone-treated HFDPCs. Furthermore, CMG treatment decreased the 5 α -reductase activity and total androgen receptor activity in testosterone-treated HFDPCs. Our *in vivo* results that CMG treatment showed the increase of hair follicles and hair growth.

Conclusion : These results suggest that the CMG promotes hair growth by regulating the activation of antioxidant system and inhibition of 5 α -reductase and total androgen receptor activity.

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[P03-049]

헴프 수피 추출물의 복합 작용 기전에 의한 인지기능 개선 효과

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Bark Extract of *Cannabis sativa* L. Improved Cognitive Dysfunction through Multimodal Mechanism of Action

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ABSTRACT

Background : Alzheimer's disease (AD) is an age-related neurodegenerative disease and is the most common cause of various neurological dysfunction. Although a number of medications have been applied to treatment of AD, but there are no treatments that cure AD or improve the pathophysiological processes in the brain. Recently, development of drugs based on multimodal mechanism of action has emerged as alternative strategy for the treatment of AD. *Cannabis sativa* L. has been used in many countries for the treatment of several disease due to its beneficial effects including neuropathic pain and chronic inflammation, however, its effect against cognitive dysfunction has not yet been elucidated. In this study, we evaluated biological activity of extracts from root, stem, bark, leaf and seed of *Cannabis sativa* L. against cognitive dysfunction.

Methods and Results : We investigated the inhibitory effect of extracts from root, stem, bark, leaf and seed of *Cannabis sativa* L. against two cholinesterases such as AChE and BuChE. Five extract showed concentration-dependent inhibition of AChE and BuChE activities in the concentration range between 0.01 and 1 mg/ml. In particular, the bark extract showed highest inhibition rate on AChE and BuChE activity compared to other extracts. We evaluated anti-amnesic effect of the bark extract on scopolamine-induced memory impairment in mice using Morris water maze test. Scopolamine induced the 2.5-fold increase of escape latency, and the oral administration of 100 mg/kg bark extract completely reversed ($p < 0.001$). We found that treatment of bark extract increased neurotransmitter acetylcholine level in mouse brain by suppressing acetylcholinesterase activity. Further, we also founded that the bark extract increased BDNF(Brain-Derived Neurotrophic Factor) expression and CREB(cAMP response element-binding protein) phosphorylation in the mouse brain using western blot.

Conclusion : Our results demonstrated that hemp bark extract improved cognitive dysfunction by multimodal mechanism of action including the decrease of acetylcholinesterase activity, increase of acetylcholine level, BDNF expression, and CREB phosphorylation. Thus, this study will be helpful for drug development to treat AD based on multimodal mechanism of action.

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구릿대의 지표성분 동시 분석법 검증
나현선, 최보람, 윤다혜, 이대영, 김금숙, 한경숙*
농촌진흥청 국립원예특작과학원 인삼특작부

Analytical Method Validation to Distinguish *Angelicae dahuricae* Radix

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ABSTRACT

Background : *Angelicae dahuricae* Radix (Umbelliferae) is a perennial herb distributed in Korea, China and Japan. The dried roots of *A. dahuricae* Radix have been used in oriental medicine as a remedy for headache and toothache. Also, pharmacological studies have been reported such as antibacterial, hepatoprotection and anti inflammatory. In Korea, *A. dahurica* Benth et Hooker fil. and *A. dahurica* Benth et Hooker fil. var. *formosana* Shan et Yuan are classified as *A. dahuricae* Radix, and used as a herbal medicine. And 3 components including oxypeucedanin, imperatorin and isoimperatorin are listed on the Korean Pharmacopoeia (KP) as content standards of *A. dahuricae* Radix. This study was conducted to establish a method validation to differentiate two kinds of *A. dahuricae* Radix.

Methods and Results : Six compounds including oxypeucedanin, imperatorin, isoimperatorin, byakangelicol, phellopterin and oxypeucedanin hydrate were analyzed by Waters Ultra-performance liquid chromatography (UPLC) and PDA. The separation conditions were performed using an ACQUITY UPLC HSS C18 column (2.1 × 100 mm, 1.8 μm). The mobile phases consisted of solvent A [Water] and solvent B [Acetonitrile] and the elution was carried out under a gradient condition at a flow rate of 0.24 mL/min. The detection wavelength was UV 254 nm. The analytical method was validated by measuring the linearity, intra-day/inter-day precision and accuracy, limit of detection (LOD) and limit of quantification (LOQ) of six components. The analytical method of the six compounds showed high linearity with 0.999, LOD was 0.44 - 1.22 μg/mL, and LOQ was 0.84-2.51 μg/mL.

Conclusion : In this study, six compounds that distinguish between *A. dahurica* Benth et Hooker fil. and *A. dahurica* Benth et Hooker fil. var. *formosana* Shan et Yuan were identified. Also, and UPLC method was established and validated for these components. The result indicates that the analytical method was well validated. Thus, these results suggested that established analytical methods could be used as a good method to differentiate two kinds of *A. dahuricae* Radix.

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참당귀의 대사체 기반 원산지판별

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Metabolomics Based Origin Discrimination of *Angelica gigas*

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ABSTRACT

Background : As the Nagoya Protocol came into force, it became important to develop methods to identify the origin of the cultivation and production of medicinal crops. The compounds contained in the medicinal crops change as the cultivation and production environment changes. And their medicinal efficacy also changes. Therefore it is necessary to objectively discriminate the origin through metabolic analysis.

Methods and Results : Korean and Chinese *Angelica gigas* were analyzed using nuclear magnetic resonance (NMR) spectroscopy based metabolomics. The overall metabolites of Korean and Chinese were compared using multivariate statistical analyses. Significantly changed metabolites were filtered using biomarker analysis. In the results, Korean and Chinese *A. gigas* were separated clearly in the score plot of orthogonal partial least squares discriminant analysis (OPLS-DA). OPLS model was validated using a permutation test, the root mean square error of estimation (RMSEE), and the root mean square error of prediction (RMSEP). The permutation test was performed to check whether there was an overfit, and the intercept value of R^2 was 0.69, which was lower than the original data value, and the intercept value of Q^2 was -0.384, which was less than 0.05, indicating that there was no overfit in the statistical model. RMSEE, which represents the prediction error of the training model, showed a low value of 0.1663 and RMSEP representing the prediction error of the test set, showed a low value of 0.1526. In the biomarker analysis of quantified metabolites, the contents of sn-glycero-3-phosphocholine, histidine, glutamine, fumarate, tryptophan, arginine, and isoleucine in Korean *A. gigas* were higher than Chinese *A. gigas* with $p < 0.05$ and fold change > 1.5 . On the other hand, the contents of fructose, glucose, uridine, and choline in Chinese *A. gigas* were higher than Korean *A. gigas*.

Conclusion : Korean and Chinese *A. gigas* were discriminated using NMR-based metabolomics, and statistically significant discrimination results were shown. In addition, metabolites that influence the discrimination were also selected and these are proposed as biomarkers for the determination of origins.

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[P03-052]

산황나무 잎 추출물의 항알레르기 효과 및 기전 연구

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국립산림과학원 산림약용자원연구소

Anti-allergic Effects and Mechanisms of *Rhamnus crenata* Siebold & Zucc Leaf Extract in RBL-2H3 Cells

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ABSTRACT

Background : *Rhamnus crenata* Siebold & Zucc. (RC), which belongs to Rhamnaceae, is distributed Aisa in China, Japan, and Korea. There have been no studies on the mechanisms of RC for anti-allergic activity. In this study, we investigated whether RC leaf extract (RC-L) suppresses IgE-mediated allergic responses in RBL-2H3 mast cells.

Methods and Results : A mechanistic study of its inhibitory effect was performed by using β -hexosaminidase release assay, reverse transcription polymerase chain reaction (RT-PCR) and western blotting analysis. In β -hexosaminidase release assay, RC-L significantly induced the inhibition of degranulation in IgE-antigen-stimulated RBL-2H3 cells. RC-L suppressed the mRNA expression of tumor necrosis factor- α (TNF- α), interleukin-2 (IL-2), IL-3 and IL-4 in IgE-antigen-stimulated RBL-2H3 cells. Furthermore, RC-L impeded the activations of mitogen-activated protein (MAP) kinase such as ERK1/2 and JNK, but P-p38 increased. RC-L also decreased the phosphorylation of Lyn and Syk in IgE-antigen-stimulated RBL-2H3 cells.

Conclusion : This study demonstrated for the first time that RC-L has anti-allergic effects through inhibiting the Lyn and Syk signaling pathway in mast cells. Therefore, our data indicate that RC-L is potential anti-allergic materials that could be applied for the treatment of allergic diseases.

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[P03-053]

Maslinic acid의 메티실린 내성 황색포도상구균에 대한 항균 활성 평가

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The Evaluation of Anti-bacterial Activity of Maslinic Acid against Methicillin-resistant *Staphylococcus aureus*

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ABSTRACT

Background : Methicillin-resistant *Staphylococcus aureus* (MRSA) is an important cause of nosocomial infections, and considered as a significant public health problem worldwide. Maslinic acid (MA) is a pentacyclic triterpene known as oleananes. It has been reported that various plant resources including *Ancistrocarpus denispinosus*, *Pistacia lentiscus*, *Akebia grifoliata*, *Rubus parvifolius*, and *Vitex trifolia* contain this compound. Several therapeutic effects of MA has been reported such as anti-tumoral, anti-diabetic, anti-oxidant, anti-inflammatory, anti-parasitic, and anti-viral activities. However, the anti-bacterial effects of MA have not been investigated yet. In this investigation, we evaluated the anti-bacterial effect MA against MRSA.

Methods and Results : Firstly, we determined the minimal inhibitory concentration of MA against MRSA and methicillin sensitive *Staphylococcus aureus* (MSSA), and MA showed anti-bacterial activity with minimum inhibitory concentration (MIC) values of 15.6 and 31.6 µg/ml, respectively. Ampicillin, oxacillin, and ethidium bromide (EtBr) which were used as negative control showed MIC values with 500, 250, and 62.5 µg/ml against the MRSA, respectively. However, the activities of ampicillin and oxacillin against MSSA were significantly more effective exhibiting MIC values with 0.4 and 0.2 µg/ml, individually. In addition, the combinatorial effects of MA combined with ampicillin, oxacillin, and EtBr were determined by a checkerboard dilution test. The treatment with MA resulted in a 2-fold reduction in the MIC values of ampicillin, oxacillin, and EtBr, showing fractional inhibitory concentration index (FICI) range from 0.51 to 0.75, indicating that MA in combination with the three antibiotics had a partial synergy effect against MRSA.

Conclusion : MA showed anti-MRSA activity with a MIC value of 15.6 µg/ml, and treatment with MA reduced the MIC values of ampicillin, oxacillin, and EtBr by 2-fold, indicating partial synergistic effect against MRSA. Further investigation of molecular mechanism of MA and additional experiments using other bacterial strains are needed for using MA as anti-MRSA agent for medicinal purposes, and it will increase the potential availability of MA for treatment MRSA-induced infections.

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[P03-054]

약용 작물 발효 추출물의 프리바이오틱스로 이용 가능성 평가

김관우, 이기환, 윤다혜, 이대영, 한경숙, 김금숙, 이영섭*

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The Evaluation of the Potential Availability of Medicinal Crops Fermented Extract as Prebiotics

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ABSTRACT

Background : Prebiotics are food components metabolized by probiotics which are beneficial microorganisms in intestines and are defined as a material that selectively ferments and helps the health of the host by changing the formation and activity of probiotics. In this investigation, we evaluated whether various medicinal crop fermented extracts which were applied to probiotic bacteria have potential availability as prebiotics.

Methods and Results : The ethanol extract of eight medicinal crop (*Eleutherococcus sessiliflorus* (fruit), *Polygonum multiflorum*, processed *P. multiflorum*, *Atractylodes japonica*, *Perilla frutescens*, *Cudrania tricuspidata*, black ginseng, and *Curcuma longa*) were dissolved in 0.1% peptone water to make 31.25 mg/ml, and inoculated with three probiotic strains including *Lactobacillus plantarum*, *Streptococcus thermophilus*, and *Lactobacillus helveticus*) at a concentration of 1×10^7 colony-forming unit (CFU)/ml. Then, they were fermented for 72 h in 37°C, 5% CO₂ incubator conditions. To measure the number of live bacteria, the part of extracts were diluted with 0.1% peptone water and incubated in De Man, Rogosa, and Sharpe (MRS) agar medium for 24 h. The rest of the extract was centrifuged at 3,000 rpm for 5 min, filtered with filter paper, and pH values were measured. The extracts of *E. sessiliflorus*, *A. japonica*, *P. frutescens*, and black ginseng increased the number of *L. plantarum*; *E. sessiliflorus* and *A. japonica* increased the number of *S. thermophilus*; and the number of *L. helveticus* increased by the fermentation with *E. sessiliflorus* and processed *P. multiflorum*. Except for black ginseng, the pH values of extracts which increased the number of *L. plantarum* did not significantly change after fermentation compared to before fermentation.

Conclusion : The ethanolic extract of *E. sessiliflorus*, processed *P. multiflorum*, *A. japonica*, *P. frutescens*, and black ginseng have shown the potential availability as prebiotics by promoting growth of probiotic beneficial bacteria including *L. plantarum*, *S. thermophilus*, or *L. helveticus*. It is necessary to establish fermentation conditions such as various concentrations, pH value, and temperatures to increase the availability of medicinal crops as prebiotics. In addition, if the fermentation process is standardized and applied properly, it is suggested that the development of prebiotic materials using medicinal crops would be worth.

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염 스트레스 조건 하의 인삼에 대한 Putrescine 처리에 따른 생화학적 복구 능력 평가

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Exogenous Putrescine Attenuates the Negative Impact of Salinity Stress by Modulating Physio-biochemical Traits and Enhancing Ginsenosides in Young Ginseng Plants

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ABSTRACT

Background : *Panax ginseng* is a perennial herb, has been used as medicinal purpose for long period of time, and well-known for its pharmacological activities such as anticancer, anti-aging, anti-diabetic, and neuroprotective effects. Polyamines can regulate physiological processes by adjusting osmosis, regulate compatible solutes, detoxify the cell by scavenging reactive oxygen species and modulate antioxidant enzyme activity. The aim of this study was to analyze the potential beneficial roles of exogeneous putrescine on growth, physiological characteristics, antioxidant capacity and ginsenosides accumulation of young ginseng.

Methods and Results : Seedlings of Korean ginseng have been collected and maintained at the Dept. of Bio-Health convergence, Kangwon National University. One-month aged seedlings were transplanted to a modified nutrient solution (EC 4.0, pH 6.0) and adjusted for 7 days. After that, Seedlings were transferred to a new nutrient solution and imposed five treatments as follows: 1. Control; 2. Salinity (150 mmol NaCl); 3. Salinity + 0.3 mmol putrescine; 4. Salinity + 0.6 mmol putrescine; 5. Salinity + 0.9 mmol putrescine. Putrescine was applied to both sides of the leaves of treated plants with 1% Tween-20 (v/v) for one time. From the results, Salinity expressively reduced the plant growth and increased the reactive oxygen species (ROS). Salinity also reduced the accumulation of most ginsenosides in ginseng seedlings (except Rb₁, Rb₂, Re, Rd, and Rg₃). Besides, plant treated by 0.6 mM Put was most effective in improving GR, SL, SFW, RFW, and RDW in salinity treatment. Photosynthetic pigments and fluorescence parameters were also improved by 0.6 mM exogeneous Put treatment. Put helped to reduce the toxicity by increasing osmolytes, and modulating the ROS chemicals and antioxidant enzymatic activities. Put increased all types ginsenosides accumulation in leaf, stem and root of ginsengs seedlings.

Conclusion : Exogeneous application of putrescine improves the growth and physio-biochemical properties of ginseng seedling under salinity stress. Putrescine also helps to accumulate ginsenosides in leaf, stem and root of ginseng plants. Putrescine at a medium dose (0.6 mM) was found to be most effective in ginseng plants under salinity stress.

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융합압출을 통한 자색 감자 (*Solanum tuberosum* L. cv Bora valley)의
안토시아닌 안정성 증대

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Protracting Thermal Stability of Anthocyanins in Extrudate Purple Potato (*Solanum tuberosum* L. cv Bora valley) Prepared by Hot-melt Extrusion

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ABSTRACT

Background : Purple potato (*Solanum tuberosum* L. var. bora valley) is a purple-skinned, medium-late maturing potato cultivar. It contains a high amount of anthocyanin, which could be useful in the development of food products. To protect anthocyanin from oxidation with bio-macromolecule complexes and encapsulation by polymeric emulsifiers, self-association, and co-pigmentation, various methods have been used. Hot-melt extrusion (HME) is currently used widely in the ready-to-eat food and feed industries. Changing the HME conditions would result in a wide range of desired final product characteristics. The HME is a continuous process of high efficiency, nutrient retention/enhancement, and the functional quality of many foodstuff. Because of the amorphous chemical compounds' structure, HME extrudate foods have a high digestibility and bioavailability. Due of the high instability, anthocyanin's thermal stability can be extended by using a protective encapsulating barrier.

Methods and Results : Therefore, biopolymer mediated formulations (BEF) of purple potato (PP) were developed to extent the anthocyanin stability. The BEF of PP (BEFP) were prepared with whey protein concentrate (WPC), lecithin (LCT) and ascorbic acid (AA). The BEFP formulation was composed of PP+WPC (F2), PP+WPC+AA (F3), PP+LCT (F4), PP+LCT +AA (F5). The physical crosslinking of biopolymer and PP was confirmed by FT-IR. The biopolymer coating over the PP molecules in BEFP was investigated using scanning electron microscopy. The highest water solubility and least nano size particle was achieved in F5. The brightness of the BEFP was remained higher in F5. The anthocyanins were persistent in F5. Likewise, F5 also had greater total phenolics, including antioxidant capacity. Inhibitory antibacterial activity was also greater in the F5 formulation. The F5 formulation is found to be the best for preserving anthocyanin stability during processing.

Conclusion : When anthocyanin is formulated with the right polymers, it will have a longer thermal stability. While formulated with lecithin and ascorbic acid, anthocyanin from purple potatoes is successfully prolonged during thermal processing. This discovery would broaden the scope of anthocyanin-rich foods, especially bora valley potatoes, in the processed food industry

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포제 조건에 따른 참당귀 뿌리 추출물의 총 페놀 함량과 항산화 활성 변화
최수지*, 이병주, 신유수, 최재훈, 장귀영, 지윤정, 이승은, 김형돈, 강민혜, 김금숙
농촌진흥청 국립원예특작과학원 인삼특작부

**The Changes in Total Phenolic Content and Antioxidant Activities of Extracts from
Angelica gigas Nakai Roots with Roasting Process**

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ABSTRACT

Background : *Angelica gigas* Nakai (AGN), a species of the family Apiaceae, is used roots as a traditional medicinal material in Korea. It has been known that it is known to be effective for the production and circulation of blood in the body. So, in order to get rid of bruises, blood clots, and cancer, patients are prescribed herbal medicine containing AGN. It has a large amount of decursin, which is known for its anti-aging and antioxidant properties, but few reports have been made of the antioxidant activities of the processed AGN. In this study, we would like to compare the antioxidant activities which can prevent cancer and vascular disease according to the processing conditions of AGN.

Methods and Results : AGN used in this study was harvested from Pyeongchang-gun, Gangwon-do, Korea in the October 2019. Intermediately after transportation, It was washed, dried and sequentially roasted in roasting machine. We obtained differentiated ingredients by roasting dried AGN under various conditions such as heating temperature (120 - 240°C) and time (10 - 20 min). Each was immersed in 70% ethanol (EtOH) water and boiled 3 times for 2 hours at 85°C by reflux extraction method. Thereafter, samples for comparing the total phenol content and antioxidant activity were obtained through vacuum evaporation and freeze drying. Then we measured total phenolic content, DPPH and ABTS radical scavenging ability with all samples including an untreated group. As a result of measuring total phenol content, most of the roasted AGN 70% ethanol extracts were increased compared to the control. Inter alia, roasted AGN at 180°C for 10 min had the highest phenolic content (2.64 ± 0.00) compared to all other extracts. Roasted AGN at 180°C for 20 min had the highest activity in radical scavenging activity on DPPH (316.73 ± 10.10) and ABTS (136.88 ± 5.57) assay. And considering that the yield was also the highest under roasted condition at 180°C for 20 min, it seems that extraction is well performed by appropriate heat treatment. Regarding the antioxidant activity, the ability of each extract to inhibit reactive oxygen species was also measured. Meaningful results were obtained with AGN extract under all conditions, whether processed or not, but it is expected to be insignificant when compared to Vit C.

Conclusion : In summary, these results show that the 70% ethanol extract of roasted AGN is worth considering as a natural antioxidant. In addition, we would like to expand the scope of using AGN, which has a fairly limited scope of use, based on the results of upcoming follow-up studies.

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Sorbaria kirilowii ethanol extract의 UVB에 의해 손상된 세포에서의 광노화 억제 효과

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Anti-photoaging Activities of *Sorbaria kirilowii* Ethanol Extract in UVB-damaged Cells

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ABSTRACT

Background : *Sorbaria kirilowii* (Regel) Maxim, a plant found in China, Korea, Japan, and east of Europe, is a common herb used for traditional medicinal purposes. However, its ability to prevent photoaging has not been studied.

Methods and Results : In this study, we investigated the anti-photoaging functions of an ethanol extract (Sk-EE) of *S. kirilowii* (Regel) Maxim using human keratinocytes exposed to UVB. First, we analyzed the cytotoxicity of Sk-EE. Then, we determine the expression of genes related to inflammation, collagen degradation, and moisture retention. We also explored the anti-photoaging mechanism of Sk-EE by determining correlated signaling pathways and target molecules using reporter gene assays and immunoblotting analyses. Sk-EE treatment of cells increased hyaluronic acid synthase (HAS), filaggrin (FLG), and collagen type I alpha 1 (COL1A1) expression. Sk-EE dose-dependently inhibited the UVB-induced expression of matrix metalloproteinases (MMPs) 1, 2, 9 and cyclooxygenase (COX)-2 by blocking the activator protein (AP)-1 signaling pathway, in particular the phosphorylation of c-Jun N-terminal kinase (JNK), p38, and extracellular response kinase (ERK). In addition, c-Fos and c-Jun were targeted by Sk-EE.

Conclusion : Our results indicate that Sk-EE has anti-inflammatory and skin-protective properties, and could be a candidate to treat signs of photoaging.

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한국 홍삼의 항염증 효과 및 오토파지 활성화 효과

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Korean Red Ginseng Exerts Anti-inflammatory and Autophagy-promoting Activities in Aged Mice

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ABSTRACT

Background : Korean red ginseng (KRG) is a traditional herb that has several beneficial properties including anti-aging, anti-inflammatory, and autophagy regulatory effects. However, the mechanisms of these effects are not well understood. In this report, the underlying mechanisms of anti-inflammatory and autophagy-promoting effects were investigated in aged mice treated with KRG-water extract (WE) over a long period.

Methods and Results : The mechanisms of anti-inflammatory and autophagy-promoting activities of KRG-WE were evaluated in kidney, lung, liver, stomach, and colon of aged mice using semi-quantitative reverse transcription polymerase chain reaction (RT-PCR), quantitative RT-PCR (qRT-PCR), and western blot analysis. KRG-WE significantly suppressed the mRNA expression levels of inflammation-related genes such as interleukin (IL)-1 β , IL-8, tumor necrosis factor (TNF)- α , monocyte chemoattractant protein-1 (MCP-1), and IL-6 in kidney, lung, liver, stomach, and colon of the aged mice. Furthermore, KRG-WE downregulated the expression of transcription factors and their protein levels associated with inflammation in lung and kidney of aged mice. KRG-WE also increased the expression of autophagy-related genes and their protein levels in colon, liver, and stomach.

Conclusion : The results suggest that KRG can suppress inflammatory responses and recover autophagy activity in aged mice.

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Src, Syk, IRAK1의 조절을 통한 *Sauropus brevipes* ethanol extract의 *in vivo* 및 *in vitro*에서의 염증반응 억제 효과

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***Sauropus Brevipes* Ethanol Extract Negatively Regulates Inflammatory Responses *in vivo* and *in vitro* by Targeting Src, Syk and IRAK1**

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ABSTRACT

Background : *Sauropus brevipes* Müll. Arg. (Phyllanthaceae) has been used as an effective ingredient in a decoction for the treatment of diarrhoea. However, there was no report on its modulatory role in inflammation.

Methods and Results : The aerial part of *S. brevipes* was extracted with 95% ethanol to produce Sb-EE. RAW264.7 cells pre-treated with Sb-EE were stimulated by lipopolysaccharide (LPS), and Griess assay and PCR were performed. High-performance liquid chromatography (HPLC) analysis, luciferase assay, Western blotting and kinase assay were employed. C57BL/6 mice (10 mice/group) were orally administered with Sb-EE (200 mg/kg) once a day for five days, and peritonitis was induced by an intraperitoneal injection of LPS (10 mg/kg). ICR mice (four mice/group) were orally administered with Sb-EE (20 or 200 mg/kg) or ranitidine (positive control) twice a day for two days, and EtOH/HCl was orally injected to induce gastritis. Sb-EE suppressed nitric oxide (NO) release (IC₅₀ = 34 µg/ml) without cytotoxicity and contained flavonoids (quercetin, luteolin and kaempferol). Sb-EE (200 µg/ml) reduced the mRNA expression of inducible NO synthase (iNOS). Sb-EE blocked the activities of Syk and Src, while inhibiting interleukin-1 receptor associated kinases (IRAK1) by 68%. Similarly, orally administered Sb-EE (200 mg/kg) suppressed NO production by 78% and phosphorylation of Src and Syk in peritonitis mice. Sb-EE also decreased inflammatory lesions in gastritis mice.

Conclusion : This study demonstrates the inhibitory effect of Sb-EE on the inflammatory response, suggesting that Sb-EE can be developed as a potential anti-inflammatory agent.

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***Sorbaria kirilowii* ethanol extract의 Src/NF-κB를 타겟으로 한 *in vitro*, *in vivo* 항염증 효능**

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***Sorbaria kirilowii* Ethanol Extract Exerts Anti-Inflammatory Effects *In vitro* and *In vivo* by Targeting Src/Nuclear Factor (NF)-κB**

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ABSTRACT

Background : Inflammation is a complex protective response of body tissues to harmful stimuli. Acute inflammation can progress to chronic inflammation, which can lead to severe disease. Therefore, this research focuses on the development of anti-inflammatory drugs, and natural extracts have been explored as potential agents. No study has yet examined the inflammation-associated pharmacological activity of *Potentilla glabra* Var. *mandshurica* (Maxim.) Hand.-Mazz ethanol extract (Pg-EE).

Methods and Results : To examine the mechanisms by which Pg-EE exerts anti-inflammatory effects, we studied its activities in lipopolysaccharide (LPS)-treated murine macrophage RAW264.7 cells and an HCl/EtOH-induced gastritis model. LPS-triggered nitric oxide (NO) release and mRNA levels of inducible nitric oxide synthase (iNOS), tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6), and interleukin-1 beta (IL-1β) in RAW264.7 cells were suppressed by Pg-EE in a dose-dependent manner. Using a luciferase assay and western blot assay, we found that the NF-κB pathway was inhibited by Pg-EE, particularly by the decreased level of phosphorylated proteins of nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB) subunits (p65 and p50), inhibitor of kappa B α (IκBα), p85, and Src. Using an overexpression strategy, cellular thermal shift assay, and immunoprecipitation analysis, we determined that the anti-inflammatory effect of Pg-EE was mediated by the inhibition of Src. Pg-EE further showed anti-inflammatory effects *in vivo* in the HCl/EtOH-induced gastritis mouse model.

Conclusion : Pg-EE exerts anti-inflammatory activities by targeting Src in the NF-κB pathway, and these results suggest that Pg-EE could be used as an anti-inflammatory herbal medicine.

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Tunisian *Olea europaea* L. leaf extract의 Freund's complete adjuvant-유도 류마티스 관절염 및 lipopolysaccharide 유도 염증의 억제 효과

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Tunisian *Olea europaea* L. Leaf Extract Suppresses Freund's Complete Adjuvant-induced Rheumatoid Arthritis and Lipopolysaccharide-induced Inflammatory Responses

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ABSTRACT

Background : *Olea europaea* L. (olive) is traditionally used as a folk remedy and functional food in Europe and Mediterranean countries to treat inflammatory diseases. *O. europaea* contains phenolic compounds and have been reported to prevent cartilage degradation. However, the function and mechanism of *O. europaea* in rheumatoid arthritis are not known.

Methods and Results : In this study, we aimed to examine anti-inflammatory and anti-arthritic effects of Tunisian *O. europaea* L. leaf ethanol extract (Oe-EE). In this study, we aimed to examine anti-inflammatory and anti-arthritic effects of Tunisian *O. europaea* L. leaf ethanol extract (Oe-EE). The Oe-EE clearly reduced the production of the lipopolysaccharide-mediated inflammatory mediators, nitric oxide (NO) and prostaglandin E2 (PGE2), in RAW264.7 cells. The results of HPLC showed that Oe-EE contained many active compounds such as oleuropein and flavonoids. In AIA-treated rats, swelling of paws, pain, and cartilage degeneration were alleviated by oral Oe-EE administration. Correlating with *in vitro* data, PGE2 production was significantly reduced in paw samples. Furthermore, the molecular mechanism of Oe-EE was dissected, and Oe-EE regulated the gene expression of interleukin (IL)-6, inducible NO synthase (iNOS), and MMPs and inflammatory signaling activation.

Conclusion : Consequently, Oe-EE possesses anti-inflammatory and anti-rheumatic effects and is a potential effective treatment for rheumatoid arthritis.

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[P03-063]

***Saururus chinensis* (Lour.) Baill의 AP-1 신호전달과정 중 TAK1 조절을 통한
항염증 효능**

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**TAK1 in the AP-1 Pathway is a Critical Target of *Saururus chinensis* (Lour.) Baill
in its Anti-inflammatory Action**

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ABSTRACT

Background : *Saururus chinensis* (Lour.) Baill (Saururaceae), also known as Asian lizard's tail, is a plant commonly found in East Asia. Its leaves have been used in traditional medicine to treat many diseases such as edema, pneumonia, hypertension, leprosy, jaundice, gonorrhea, and rheumatoid arthritis. Based on its traditional efficacies, the anti-inflammatory effects of this plant and its molecular mechanism were evaluated with ethanol extract of *Saururus chinensis* leaves (Sc-EE).

Methods and Results : The production of pro-inflammatory mediators and cytokines was evaluated through Griess reagent and semi-quantitative reverse transcription-polymerase chain reaction. Further, relevant proteins including c-Jun, c-Fos, p38, JNK, ERK, MEK1/2, MKK3/6, MKK4/7, and TAK1 were detected through immunoblotting. Sc-EE diminished production of nitric oxide (NO), decreased expression levels of cyclooxygenase (COX)-2, interleukin (IL)-6, inducible NO synthase (iNOS), and IL-1 β in LPS-stimulated RAW264.7 cells and remarkably attenuated activator protein 1 (AP-1)-mediated luciferase activities. This extract prominently downregulated the phosphorylation of TAK1, upregulated thermal stability of this protein, and reduced AP-1-mediated luciferase activity in LPS-treated RAW264.7 cells and TAK1-overexpressed HEK293T cells.

Conclusion : These results suggest that anti-inflammatory activity of *Saururus chinensis* could be mediated by suppression of TAK1/AP-1 pathway.

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***Potentilla glabra* var. *Mandshurica* (Maxim.) Hand.-Mazz. ethanol extract의**

Src/NF- κ B 조절을 통한 항염증 효과

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Src/NF- κ B-Targeted Anti-Inflammatory Effects of *Potentilla glabra* var. *Mandshurica* (Maxim.) Hand.-Mazz. Ethanol Extract

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ABSTRACT

Background : This research focuses on the development of anti-inflammatory drugs, and natural extracts have been explored as potential agents. No study has yet examined the inflammation-associated pharmacological activity of *Potentilla glabra* Var. *mandshurica* (Maxim.) Hand.-Mazz ethanol extract (Pg-EE).

Methods and Results : To examine the mechanisms by which Pg-EE exerts anti-inflammatory effects, we studied its activities in lipopolysaccharide (LPS)-treated murine macrophage RAW264.7 cells and an HCl/EtOH-induced gastritis model. LPS-triggered nitric oxide (NO) release and mRNA levels of inducible nitric oxide synthase (iNOS), tumor necrosis factor- α (TNF- α), interleukin-6 (IL-6), and interleukin-1 beta (IL-1 β) in RAW264.7 cells were suppressed by Pg-EE in a dose-dependent manner. Using a luciferase assay and western blot assay, we found that the NF- κ B pathway was inhibited by Pg-EE, particularly by the decreased level of phosphorylated proteins of nuclear factor kappa-light-chain-enhancer of activated B cells (NF- κ B) subunits (p65 and p50), inhibitor of kappa B alpha (IkB α), p85, and Src. Using an overexpression strategy, cellular thermal shift assay, and immunoprecipitation analysis, we determined that the anti-inflammatory effect of Pg-EE was mediated by the inhibition of Src. Pg-EE further showed anti-inflammatory effects *in vivo* in the HCl/EtOH-induced gastritis mouse model.

Conclusion : In conclusion, Pg-EE exerts anti-inflammatory activities by targeting Src in the NF- κ B pathway, and these results suggest that Pg-EE could be used as an anti-inflammatory herbal medicine.

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[P03-065]

***Olea europaea*의 TAK 매개 MAP Kinase 활성 조절을 통한 염증 억제효과**

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***Olea europaea* Suppresses Inflammation by Targeting TAK1-Mediated MAP Kinase Activation**

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ABSTRACT

Background : Possessing a variety of medicinal functions, *Olea europaea* L. is widely cultivated across the world. However, the anti-inflammatory mechanism of *Olea europaea* is not yet fully elucidated.

Methods and Results : In this study, how the methanol extract of the leaves of *Olea europaea* (Oe-ME) can suppress *in vitro* inflammatory responses was examined in terms of the identification of the target protein. RAW264.7 and HEK293T cells were used to study macrophage-mediated inflammatory responses and to validate the target protein using PCR, immunoblotting, nuclear fraction, overexpression, and cellular thermal shift assay (CETSA) under fixed conditions. Oe-ME treatment inhibited the mRNA expression levels of cyclooxygenase (COX)-2, matrix metalloproteinase (MMP)-9, and intercellular adhesion molecule-1 (ICAM-1) in activated RAW264.7 cells. Oe-ME diminished the activation of activator protein (AP)-1 and the phosphorylation of its upstream signaling cascades, including extracellular signal regulated kinase (ERK), mitogen-activated protein kinase kinase 1/2 (MEK1/2), c-Jun N-terminal kinase (JNK), mitogen-activated protein kinase kinase 3/6 (MKK3/6), p38, MKK7, and transforming growth factor- β -activated kinase 1 (TAK1), in stimulated-RAW264.7 cells. Overexpression and CETSA were carried out to verify that TAK1 is the target of Oe-ME.

Conclusion : Our results suggest that the anti-inflammatory effect of Oe-ME could be attributed to its control of posttranslational modification and transcription of TAK1.

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***Euodia pasteuriana* 메탄올 추출물의 AP-1 pathway에서의 TAK1 조절을 통한
항염증 효과**

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***Euodia pasteuriana* Methanol Extract Exerts Anti-Inflammatory Effects by Targeting
TAK1 in the AP-1 Signaling Pathway**

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ABSTRACT

Background : *Euodia pasteuriana* A. Chev. ex Guillaumin, also known as *Melicope accedens* (Blume) T.G. Hartley, is a herbal medicinal plant native to Vietnam. Although *Euodia pasteuriana* is used as a traditional medicine to treat a variety of inflammatory diseases, the pharmacological mechanisms related to this plant are unclear.

Methods and Results : This study aimed to investigate the anti-inflammatory effects of a methanol extract of *Euodia pasteuriana* leaves (Ep-ME) on the production of inflammatory mediators, the mRNA expression of proinflammatory genes, and inflammatory signaling activities in macrophage cell lines. The results showed that Ep-ME strongly suppressed the release of nitric oxide (NO) in RAW264.7 cells induced with lipopolysaccharide (LPS), pam3CysSerLys4 (Pam3CSK), and polyinosinic-polycytidylic acid (poly I:C) without cytotoxicity. A reverse transcription-polymerase chain reaction further confirmed that Ep-ME suppressed the expression of interleukin 6 (IL-6), matrix metalloproteinase-1 (MMP1), matrix metalloproteinase-2 (MMP2), matrix metalloproteinase-3 (MMP3), tumor necrosis factor- α (TNF- α), and matrix metalloproteinase-9 (MMP9) at the transcriptional level and reduced the luciferase activities of activator protein 1 (AP-1) reporter promoters. In addition, immunoblotting analyses of the whole lysate and nuclear fraction, as well as overexpression assays demonstrated that Ep-ME decreased the translocation of c-Jun and suppressed the activation of transforming growth factor beta-activated kinase 1 (TAK1) in the AP-1 signaling pathways.

Conclusion : These results imply that Ep-ME could be developed as an anti-inflammatory agent that targets TAK1 in the AP-1 signaling pathway.

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더덕과 소경불알의 형태학적 특성 비교
구성철*, 허목, 박우태, 김장훈, 문윤희, 이윤정, 허윤찬
국립원예특작과학원 약용작물과

Comparison of Morphological Characteristics between *Codonopsis lanceolata* and *Codonopsis Ussuriensis*

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Background : *Codonopsis* is a perennial plant belonging to the family Campanulaceae, distributed in East Asia and India, including Korea. There are four species of *Codonopsis* in Korea: *C. lanceolata*, *C. pilosula*, *C. usuriensis*, and *C. minima*. This study was carried out to compare morphological characteristics of *C. usuriensis* with *C. lanceolata*.

Methods and Results : Morphological comparisons between *C. lanceolata*, and *C. usuriensis* were conducted on leaves, flowers, and roots. The leaf and flower size of *C. usuriensis* was smaller than *C. lanceolata*. The leaves of *C. usuriensis* had hairs, but not in *C. lanceolata*. Both species had bell-shaped flowers, 5 stamens, 5 calyxes, 5 corollas, pentagonal ovary, and pistils divided into 3 branches. Although two species had brownish purple spots on the inside of the corolla, the brown color of *C. usuriensis* was lighter than that of *C. lanceolata*. Especially the root shape of *C. usuriensis* was round and was different from *C. usuriensis* with long-stretched club shape.

Conclusion : This study showed morphological differences of *C. usuriensis* from *C. lanceolata* in leaf, flower and root, suggesting that *C. usuriensis* species has different morphological characteristics from *C. lanceolata* species for cultivation.

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생약표준품 확립을 위한 품질 검증 연구
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**Preparation of Medicinal Plant Materials Reference Standard
and Quality Verification**

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ABSTRACT

Background : For the quality control of herbal medicines and herbal medicine preparations, the manufacture and management of standard product and standard herbal medicines are essential. Since 2001, it has continuously secured and supplied standard products to the pharmaceutical industry or testing and inspection institutions for items that have been awarded in the public order, such as the 「Korean Pharmacopoeia」 and 「Korean Herbal Pharmacopoeia」. In the past 10 years, the MFDS has invested a lot of effort and budget to secure standard products, and the quantity of standard products has been increasing little by little each year.

Methods and Results : As for the items subject to establishment of standard herbal products, if there is insufficient inventory or stability problems among the items listed in the fair, items subject to registration, and existing items, the item and quantity in demand are selected. In the manufacture of standard herbal medicines, raw materials that have been identified as the target substance through information such as origins. Medicinal plants are collected and selected through identification and content tests. Derive features of the appearance by origin and submit fingerprints through TLC and HPLC. Index component standards are manufactured and established by methods such as separation, purification, and synthesis, and structural confirmation tests and impurity purity tests using NMR, angle of rotation and Mass are conducted as quality verification methods. The purity of the standard product is determined by the area percentage method, etc., and the conformity of the standard product is secured by statistical processing. Reliability is secured through interlaboratory cross-evaluation of the manufactured index components. For each standard product whose reliability has been secured as a result of quality verification tests and statistical processing, prepare a storage method, etc., and distribute it by specifying the packaging unit in brown vials in a constant temperature and humidity room, sealing, labeling, and distributing.

Conclusion : The supply of reference standard to contribute to the improvement of quality control of herbal medicine, and contribute the management and supply of standard products at home and abroad.

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[P05-001]

13년근 산양삼 재배지 토양특성과 토양 미생물군집 간의 상관관계 분석

김기윤, 김현준, 정대희, 허정훈, 엄유리, 전권석*

국립산림과학원 산림약용자원연구소

The Correlation Analysis Between Soil Properties and Soil Bacterial Community in Cultivation Sites of 13-years-old Wild-simulated Ginseng (*Panax ginseng* C.A. Meyer)

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ABSTRACT

Background : Soil properties are one of the major factors determining the growth of vegetation. These properties drive the selection of the dominant bacterial community profiles, which eventually determines the soil quality and fertility. The abundance of preferential bacterial community assists in better productivity of a particular type of vegetation. The increasing focus on the health and well-being of the human population has resulted in a shift in paradigm to concentrate on the cultivation of medicinal plants such as Wild-simulated ginseng(WSG). This study was conducted to decipher the bacterial community profiles and their correlation with soil chemical properties, which would give a broader idea about the optimum growing conditions of such an important medicinal plant.

Methods and Results : Each sequenced sample was prepared according to the Illumina 16S Metagenomics Sequencing Library protocols(Macrogen, Seoul, Korea). Raw sequences of bacterial DNA were processed using Mothur pipeline. Differences in bacterial community composition were tested using Bray-Curtis dissimilarity values with permutational analysis of variance(PERMANOVA), which is a nonparametric technique used to differentiate groups based on dissimilarity matrix. The principal coordinate analysis(PCoA) was performed using Mothur to visualize the relationship with soil factors based on bacterial community composition. The important edaphic factor determined in this study was the soil pH, which was recorded to be acidic in all the studied cultivation sites. In agreement with the edaphic factor, the relative abundance of *Acidobacteria* was found to be highest as this phylum prefers to grow in acidic soils. Moreover, the total organic matter, total nitrogen and cation exchange capacity were found to be significantly correlated with the bacterial community.

Conclusion : This study will enable us to provide a broader idea about the optimum cultivation condition for WSG in natural vegetation condition. In addition, it is believed that more definite information could be provided if a correlation study was conducted on the growth characteristics of WSG and soil bacterial communities according to forest physiognomy and surrounding vegetation along with soil properties. Hence, these results will help to identify the suitable cultivation sites for WSG and increase the productivity of these medicinal plants.

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황기 재배지 토양 물리적 환경에 따른 습해 정도

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The degree of wet injury by the physical environment of the cultivated soil of

Astragalus membranaceus (Fisch.) Bunge

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ABSTRACT

Background : *Astragalus membranaceus* (Fisch.) Bunge is a medicinal crop for medicinal use of the underground part. The aim of this study was to investigate the degree of wet injury of *Astragalus membranaceus* (Fisch.) Bunge according to the soil physical environment.

Methods and Results : The soil texture of the plow layer, drainage grade, soil slope (%), the height and width of the ridge (cm) were measured at 26 cultivation place of the *Astragalus membranaceus* (Fisch.) Bunge farmhouse located in Jecheon-si whose GAP contract cultivation was conducted. Also soil moisture content (%), electrical conductivity (ds/m), and temperature (°C) were surveyed and wet injury rate (%) was expressed by the percentage of damaged population in the total area population. As a result, *Astragalus membranaceus* (Fisch.) Bunge cultivated in a place on sandy loam was less likely to be damaged to death than in clay loam and the wet injury rate was low in well drained condition. Among the soil slope, the damage was the least in grade B (2 - 7%). In addition, when drainage occurred smoothly along the drainage channel, mulching cultivation was conducted and the height of the ridge was more than 30 cm, the wet injury decreased. Also it is recommended that the ridge direction coincide with the slope when the soil slope is less than 15%, and are at right angles when the soil slope is over 15%.

Conclusion : In order to reduce the wet injury, it is important to cultivate on sandy loam with good drainage grade and drainage channel, and to cultivate in a place with a grade B slope (2 - 7%) and to increase the height of the ridge more than 30 cm.

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광질 및 광도 조건이 일당귀 생육과 기능성분 함량에 미치는 영향

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**Changes in Growth Characteristics and Functional Components of
Angelica acutiloba Kitagawa by LED**

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ABSTRACT

Background : *Angelica acutiloba*, belonging family Apiaceae, is a perennial and famous medical plant growing in Korea, Japan, and China. The aims of this study was to comparison the growth and functional exploration and accumulated Z-ligustilide of *A.acutiloba* under LED.

Methods and Results : For the energy-saving production of fresh vegetables in poor environment such as the Antarctic, a container-type plant factory was designed and developed. To maximize space usage of the 20 feet container (L5.9 m × W2.4 m × H2.4 m), the plants were sowed in fully controlled plant factory for 120 days. Plants were cultivated with LED (red: peak wavelength 660 nm, blue: peak wavelength 450 nm, White) irradiated at 215.2 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ at the top of plant for 120 days. The results showed that the plant height, leaf length, plant width, number of leaf, root analysis (length, width), SPAD value, fresh weight, dry weight was found to be influenced when plant were exposed to LED. The above ground growth characteristics were best in Red LED + White LED. Underground growth characteristics were best in Red LED + Blue LED + White LED. All growth characteristics appeared better when the light intensity was high. The SPAD value was high when the light intensity was high. The antioxidant effect was better as the amount of LED light. There was no significant difference in anti-inflammatory effect according to LED. The contents of Z-ligustilide were higher as the amount of LED light.

Conclusion : In conclusion, we found that the growth of *A.acutiloba* is depend on light intensity and even at same intensity, the growth is different among the LED light. Therefore, the selection of optimum LED light should be considered in the plant factory system that has only weak light density. *A.acutiloba* growth, functionality and contents of Z-ligustilide were promoted by amount of LED light.

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진안 홍삼 품질인증 제품의 잔류농약 안전성 조사

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(재)진안홍삼연구소

A Safety Survey of Pesticide Residues in Quality Certified Products of Jinan Red Ginseng

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ABSTRACT

Background : Jinan-gun, Jeollabuk-do, is implementing the red ginseng product quality certification system to guarantee the quality of red ginseng products, among which pesticide residues are also analyzed. Pesticides are used for the purpose of controlling pests and weeds in the production process of agricultural products, and are essential agricultural materials used for positive expected effects such as improving the quality and productivity of agricultural products, increasing yields, and reducing labor. Therefore, while the use of pesticides in farm households is gradually increasing, the question of the potential human risk of pesticides continues. Therefore, in order to solve this problem, it is necessary to produce high-quality agricultural products by appropriate use of pesticides by producers. In addition, continuous monitoring and safety evaluation are needed so that healthy food can be provided to consumers who consume the product.

Methods and Results : 12 compounds were analyzed using LC-MS/MS and LC-DAD, and 21 compounds were analyzed using GC-MS. The number of samples analyzed was 57, and the analysis methods were the Ministry of Food and Drug Safety's multi-residue pesticide analysis methods and the carbosulfan analysis method. As a result of the analysis, all 57 kinds of Jinan red ginseng products did not exceed the acceptable standards for pesticide residues.

Conclusion : As a result of pesticide residues analysis of Jinan red ginseng products, trace amounts of pesticides below the allowable level of pesticide residues were detected. Therefore, it was confirmed that Jinan red ginseng products are safe to consume.

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** (Acknowledgement) 본 연구는 진안군 홍삼가공품 품질인증제 과제에 의해 이루어진 결과로 이에 감사드립니다

건조방법에 따른 흑삼의 외형 특성에 관한 연구

Study on the appearance characteristics of black ginseng (*Panax ginseng* C. A. Meyer) by drying methods

정다은, 이지원, 나수창, 유종희, 오효빈*, 박충범
(재)진안홍삼연구소

Da Eun Jeong, Ji Won Lee, Soo Chang Na, Jong Hee Yoo, Hyo Bin Oh* and Chung Berm Park
Institute of Jinan Red Ginseng, Jinan 55442, Korea.

ABSTRACT

Background : Black ginseng (*Panax ginseng* C. A. Meyer) is processed by repeated steaming and is known to contain high concentrations of ginsenoside Rg3, Rg5, Rh1, Rh2, and Rk1. Studies have shown that the anticancer and obesity inhibition effects are superior when compared to existing white or red ginseng. In the process of producing red ginsengs and black ginseng from raw ginsengs, there occur several undesirable defects on ginsengs such as cracks of ginseng body, inside cavity and inside white. These defects lead to deterioration in product qualities. Due to the rapid drying of the black ginseng surface, a film is formed on the outside, which prevents the internal moisture from moving to the outside and separates the internal and external tissues, resulting in cracks, inside cavity and inside white in the internal tissues. Active ingredients are released to the outside of the fresh ginseng through cracks. Therefore an improved control method that minimizes these undesirable defects is needed in order to increase the yield of high quality black ginsengs.

Methods and Results : We produced black ginseng at institute and four manufacturers using different drying methods and equipment under the same steaming conditions, and compared the cross-section and color difference of black ginseng through this. As a result, although steamed under the same conditions, there was a difference in the color difference between the our institute and four manufacturers was large, and there were few defects in the cross section of the institute and one manufacturer, which performed oven drying and natural drying in parallel. There were no difference in appearance between each regions.

Conclusion : In order to reduce these factors, it is judged that it is correct to proceed with oven drying and natural drying for a certain period of time instead of continuously applying oven drying. We believe that this study will contribute to the production of high-quality black ginseng by examining black ginseng manufactured by several manufacturers.

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** (Acknowledgement) This work supported by Jinan-gun red ginseng processed product quality certification system.

인삼 해가림 자재 차광지 폭에 따른 생육특성

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¹⁾충청남도농업기술원 인삼약초연구소

²⁾농촌진흥청 인삼특작부 인삼과

Growth Characteristics according to the Widths of Shading Sheet

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²⁾Department of Herbal Crop research, RDA, Eumseong 27709, Korea.

ABSTRACT

Background : Ginseng is a half shadow plant that needs to be cultivated under artificial shade. Currently, various types of artificial shade facilities are used. This experiment was conducted to find out low temperature damages and growth characteristics according to the widths of shading sheet among many artificial shade materials.

Methods and Results : The widths of shading sheet are 100, 120, 140 and 160 cm, and four-layered polyethylene net (width: 155 cm) was used for conventional shading. Two-layered polyethylene net was additionally covered in the polyethylene processing from June to October. The ginseng is two years old and was planted on March 20. The low temperature damages were investigated on May 10, and growth characteristics were investigated in mid-August for the weight, length and diameter of roots.

Conclusion : Regarding the incident rate of low temperature damages during the budding period by each sun shading, the polyethylene net (PE4) showed the highest rate (30.0%). In the shading sheet, 100 cm was 14.7%, 120 cm was 7.3%, 140 cm was 7.3%, and 160 cm was 4.76%, which indicates that the bigger the width of shading sheet is, the less low temperature damages occur. Regarding the weight of roots, the polyethylene net showed the least (2.2 g). In the shading sheet, 120 cm was the highest (5.3 g), and 100 cm and 140 cm showed similar weight (5.0 g, 5.2 g respectively). However, the weight was the lowest in 160 cm (4.0 g). The length of root was 13.5 cm in the polyethylene net, but it was 23.2 cm in 120 cm shading sheet. The diameter of root was 8.0 mm in the polyethylene net, but it was the thickest in 120 cm shading sheet (9.6 mm). The growth under the ground was better in the shading sheet than in the polyethylene net, and 120 cm shading sheet showed the best growth.

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2021년도

(사)한국약용작물학회 정기총회

2021.5.13.(목)



(사)한국약용작물학회
The Korean Society of Medicinal Crop Science

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○ 회장인사

○ 공로상/학술상 시상

○ 경과보고

○ 안건심의

- 1. 2020년도 사업실적 및 결산 보고**
- 2. 2021년도 사업계획 및 예산(안) 심의**
- 3. 제14대 학회장 선정**
- 4. 정관 변경(안)**

○ 기타 토의

○ 폐 회

1. 2020년 사업실적 보고

1. 회의(총 3회 개최)

□ 이사회(제1차)

- 일시 / 장소 : 2020. 4. 14(화) 14:00 / 서면 및 온라인
- 주요 안건
 - 2020년도 사업예산(안) 심의, 2020년 춘계학술발표회 개최(통합 1회)
- 참석자 : 차선우 회장 등 28명 참석

□ 이사회(제2차)

- 일시 / 장소 : 2020. 7. 8.(수) 16:00 / 인삼특작부 중회의실
- 주요 안건
 - 2020년 학술발표회 개최, 학술상/공로상 선정, 학회 분과위원회 구성 및 학회장 선출 변경 검토
- 참석자 : 차선우 회장, 임정대 편집위원장 등 14명

□ 이사회(제3차)

- 일시 / 장소 : 2020. 12. 8일(화) / 온나라 pc 영상회의
- 주요안건 : 2020년 학술발표대회 결산, 2021년 춘계학술발표회 개최 건, 2021년 추계학술발표회(2021 영주세계풍기인삼엑스포 진행기간에 영주시 개최), 회장선출 방법 개선안 등
- 참석자 : 한국약용작물학회 차선우 회장 등 13명

2. 학술발표회 사항(총 1회)

- 기 간 : 2020년 10월 7일(수)
- 장 소 : 온라인(유튜브 생중계)
- 주 제 : 4차 산업에 대비한 약용작물의 산업 육성 및 연구 전략
- 주요내용
 - 심포지엄 : “4차 산업혁명과 식품산업” 등 5주제 발표
(고려대학교 박현진 교수 등)
 - 학술발표 : 포스터발표 168건
 - 권아름 회원의 “흰털오갈피 우량종자 생산을 위한 적정 채종시기” 등
 - ※ 우수 포스터 발표상 17건 선정
- 결산결과
 - 수입 : 14,980,000원, 지출 : 14,490,440원 → 잔액 : 489,560원
 - ※ 코로나 감염 확산으로 춘·추계를 통합하여 학술대회 1회 진행

3. 학회지 발간 사항(한국연구재단 KCI우수등재지, 총 41편)

- 28권 1호(2020년 2월 28일) : 논문 6편
- 28권 2호(2020년 4월 30일) : 논문 8편
- 28권 3호(2020년 6월 30일) : 논문 5편
- 28권 4호(2020년 8월 30일) : 논문 6편
- 28권 5호(2020년 10월 30일) : 논문 7편
- 28권 6호(2020년 12월 30일) : 논문 9편

4. 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	

5. 주요 업무 추진 현황

일시 (월.일)	추진내용
20.2.28	학회지 발간 (28권 1호, 논문 6편)
4. 7	한국과총 학술활동지원사업(학술대회, 학술지) 신청
4. 9	28권 1호 저널레터 단체 이메일 발송
4.10	제30회 과학기술우수논문상 후보 추천
4.14	한국약용작물학회 긴급이사회 개최(온라인/사무국)
4.30	학회지 발간(28권 2호, 논문 8편)
5.13	한국과총 총연합회 총회 참석(한국과학기술회관, 차선우 회장)
6.30	학회지 발간(28권 3호, 논문 5편)
7.3	제30회 과학기술우수논문상 선정(인삼특작부 서수정 박사)
7.3	KCI우수등재지의 Scopus 등재 준비 워크숍 참석(임정대 편집위원장)
7.8	한국약용작물학회 2차 이사회 개최(인삼특작부)
7.17	한국과학기술단체총연합회 학술활동지원사업 지원금 확정
8.30	학회지 발간 (28권 4호, 논문 6편)
9. 4	2020 과총 학술지 발행 역량강화 워크숍 참석(온라인)
10. 7	2020년도 한국약용작물학회 학술발표회 개최(비대면, youtube 생중계)
10.30	학회지 발간(28권 5호, 논문 7편)
12.8	한국약용작물학회 3차 이사회 개최(온나라 pc 영상회의)
12.30	학회지 발간 (28권 6호, 논문 9편)
21. 2. 28	학회지 발간 (29권 1호, 논문 7편)
21. 3. 24	한국약용작물학회 1차 이사회 개최(온라인)
21. 4. 30	학회지 발간 (29권 2호, 논문 6편)
21. 5. 현재	한국약용작물학회지 Scopus 등재 확정 후 색인 작업 중 한국과학기술단체총연합회 학술활동지원사업 지원금 신청완료

2. 2020년도 사업 결산 보고

1. 세입·세출 총괄표

2020년 1월 1일 ~ 2020년 12월 31일

(단위 : 원)

세 입		세 출	
전기이월금액	13,076,923	세 출 총 액	69,640,722
세 입 총 액	67,013,585	차기이월금액	10,449,786
합 계	80,090,508	합 계	80,090,508

2. 세입 결산

2020년 1월 1일 ~ 2020년 12월 31일

(단위 : 원)

항	목	2020년 예산액	2020년 결산액	결산 증감액
회비수입	계	41,000,000	19,380,000	▽ 21,620,000
	기 관 회 비	1,000,000	1,000,000	-
	일 반 회 비	10,000,000	3,400,000	▽ 6,600,000
	참가등록비	30,000,000	14,980,000	▽ 15,020,000
지 원 금	계	15,000,000	15,000,000	-
	한 국 과 총	13,000,000	15,000,000	△ 2,000,000
	후 원 금	2,000,000	-	▽ 2,000,000
일반수입	계	19,200,000	22,460,000	△ 3,260,000
	논문게재료	19,200,000	22,460,000	
기금운영	계	40,000,000	10,000,000	▽ 30,000,000
	기 금 운 영	40,000,000	10,000,000	
잡 수 입	계	500,000	173,585	▽ 326,145
	이자 및 저작권료	500,000	173,585	
소 계	-	115,700,000	67,013,585	▽ 48,686,415
전기이월금		13,076,923	13,076,923	-
합 계		128,776,923	80,090,508	▽ 48,686,415

3. 세출 결산

2020년 1월 1일 ~ 2020년 12월 31일

(단위 : 원)

항	목	2020년 예산액(A)	2020년 결산액(B)	결산 증감액(B-A)
기본사업비	계	104,480,000	54,313,870	▽ -50,166,130
	학회지 발간	17,280,000	17,693,750	△ 413,750
	논문 심사료	7,200,000	5,700,000	▽ -1,500,000
	SCI-E 추진비	30,000,000	10,274,000	▽ -19,726,000
	학 술 대 회	42,000,000	14,490,440	▽ -37,509,560
	자 체 워 크 슝	2,000,000	-	▽ -2,000,000
	학 회 상	3,000,000	5,400,000	△ 2,400,000
	회 의 비	3,000,000	755,680	▽ -2,244,320
일반관리비	계	18,810,000	15,326,852	▽ -3,483,148
	편집/총무수당	4,800,000	4,800,000	-
	업무추진비	2,400,000	2,220,000	▽ -180,000
	유지보수비	3,960,000	3,740,000	▽ -220,000
	사무운영비	3,000,000	2,327,172	▽ -672,828
	여비 및 참가비	1,600,000	189,680	▽ -1,410,320
	소 모 품 비	1,500,000	1,050,000	▽ -450,000
	단 체 회 비	1,550,000	1,000,000	▽ -550,000
소 계		123,290,000	69,640,722	▽ -53,649,278
차기이월금		5,486,923	10,449,786	△ 4,962,863
합 계		128,776,923	80,090,508	▽ -48,686,415

※ 코로나바이러스감염증-19 확산으로 2020년도 사업이 추진되지 못하여 예산대비 세입, 세출에 상당 부분 미치지 못하였음.

3. 2020년도 감사 보고서

감 사 의 견 서

수 신 : (사)한국약용작물학회장

제 목 : 감사결과보고

정관 제28조에 의거 2020학회년도 한국약용작물학회 재정(기금, 일반회계) 운영사항을 감사한 바 그 의견은 다음과 같습니다.

- 2020년도 수입/지출 결의서, 기금, 운영비통장 등을 세밀하게 검토한 결과
- 2020년도 수입 지출과 2021년도 예산 수립에는 지적사항이 없습니다.
- 2020년도는 코로나-19로 춘계, 추계학술행사를 온라인으로 개최하여 학회 등록비 등 수입이 크게 줄었으나 대면 학술행사 개최로 경비가 많이 절약되었습니다. 그리고 학회 회원들의 논문 투고 게재료와 학술단체 지원금 등으로 수입이 다소 늘어나 기금 운영에는 큰 무리가 없었습니다.
- 2021년에는 코로나-19가 극복되어 춘계, 추계 학술대회가 대면으로 성대하게 개최되어 연구자들의 발표와 토론의 장이 활성화되기를 기대합니다.

2021년 2월 24일

감 사 이 성 우 (인)



감 사 의 견 서

수 신 : (사)한국약용작물학회장

제 목 : 감사결과보고

정관 제28조에 의거 2020학회년도 한국약용작물학회 재정(기금, 일반회계) 운영사항을 감사한 바 그 의견은 다음과 같습니다.

- 2020년도 수입/지출 결의서, 기금, 운영비통장 등을 세밀하게 검토한 결과
- 적정하게 집행되었음을 확인하였습니다.

2021년 2월 25 일

감 사 노 일 래



4. 2021년도 사업 계획(안)

1. 사업내용

1) 한국약용작물학회지 총 6회 발간

- 세부내용 : 한국약용작물학회지 투고규정에 준한 논문 접수 및 심사 후 게재
- 발간예정 : 2021년 2월, 4월, 6월, 8월, 10월, 12월
- 게재예정편수 : 50편

2) 춘계 학술발표회 개최

- 주 제 : 포스트 코로나19 시대의 농업, 무엇을 대비해야 하나?
- 개최일 : 2021년 5월 13일(목)~5월 14일(금)
- 장 소 : 부여 롯데리조트

3) 30주년 심포지엄 및 추계 학술발표회 개최

- 주 제 : 미정
- 개최일 : 2021년 10월 7일(목)~8일(금)

4) 2021년 학술상 및 공로상 시상

- 세부내용 : 최근 3년('18~'20) 동안 다수의 우수한 논문을 게재한 회원과 학회에 대한 공로가 큰 회원 선정
- 제1차 이사회(3.24.)에서 학술상(장인배 회원), 공로상(이성우 회원) 수상자 선정
- 시상 : 2021년 5월 13일 한국약용작물학회 정기총회 시 수여 예정

5. 2021년도 예산(안)

1. 세입·세출 총괄표

2021년 1월 1일 ~ 2021년 12월 31일

(단위 : 원)

세 입		세 출	
전기이월금액	10,449,786	세 출 총 액	130,480,000
세 입 총 액	121,160,000	차기이월금액	1,129,786
합 계	131,609,786	합 계	131,609,786

2. 세입 예산(안)

2021년 1월 1일 ~ 2021년 12월 31일

(단위 : 원)

항	목	2020년 결산액	2021년 예산액
회비수입	계	19,380,000	42,000,000
	기 관 회 비	1,000,000	1,000,000
	일 반 회 비	3,400,000	9,000,000
	참가등록비	14,980,000	32,000,000
지 원 금	계	15,000,000	19,000,000
	한 국 과 총	15,000,000	17,000,000
	후 원 금	-	2,000,000
일반수입	계	22,460,000	20,160,000
	논문게재료	22,460,000	20,040,000
기금운영	계	10,000,000	40,000,000
	기 금 운 영	10,000,000	40,000,000
잡 수 입	계	173,585	-
	이자 및 저작권료	173,585	-
소 계	-	67,013,585	121,160,000
전기이월금		13,076,923	10,449,786
합 계		80,090,508	131,609,786

※ 저작권 비독점 계약으로 2020년부터 저작권 수입 없음.

3. 세출 예산(안)

2021년 1월 1일 ~ 2021년 12월 31일

(단위 : 원)

항	목	2020년 결산액	2021년 예산액
기본사업비	계	54,313,870	112,930,000
	학회지 발간	17,693,750	17,280,000
	논문 심사료	5,700,000	7,650,000
	SCI-E 추진비	10,274,000	30,000,000
	학 술 대 회	14,490,440	50,000,000
	자 체 위 크 슝	-	2,000,000
	학 회 상	5,400,000	4,000,000
	회 의 비	755,680	2,000,000
일반관리비	계	15,326,852	17,550,000
	편집/총무수당	4,800,000	4,800,000
	업무추진비	2,220,000	2,400,000
	유지보수비	3,740,000	3,600,000
	사무운영비	2,327,172	3,000,000
	여비 및 참가비	189,680	1,600,000
	소 모 품 비	1,050,000	600,000
	단 체 회 비	1,000,000	1,550,000
소 계		69,640,722	130,480,000
차기이월금		10,449,786	1,129,786
합 계		80,090,508	131,609,786

6. 정관변경(안)

1) 개정 사유

- 수석부회장 직무 및 선출 방법 추가
 - 총회, 이사회 등 개최시기 조정
 - 코로나-19사태 장기화 등 감염병 확산 또는 천재지변 등을 고려하여 이사회 및 대면 회의가 불가능한 상황 발생 시 대비책 마련
- ※ 국무총리실에서는 코로나-19 확산 관련 법무부 등 관계기관과 협의하여 비대면 이사회 또는 총회 개최 가능 지침 마련(2020.03.05.)

<정관 개정안>

현 행	개 정(안)	비 고
제9조(임원의 구성) 회의 운영을 위하여 다음의 임원을 둘 수 있다. 1. 회장 1인 2. 부회장 약간명 3. 편집위원장 1인 4. 총무이사 1인 5. 상임이사 약간명 6. 감사 2인	제9조(임원의구성) 회의 운영을 위하여 다음의 임원을 둘 수 있다. 1. 회장 1인 2. 수석부회장(차기회장) 1명 3. 부회장 약간명 4. 편집위원장 1인 5. 총무이사 1인 6. 상임이사 약간명 7. 감사 2인	수석부회장(차기회장) 추가
제10조(임원의 임기) 본 회의 임원 임기는 2년으로 하며, 회장은 연임할 수 없고 부회장, 편집위원장, 총무이사, 상임이사과 감사의 임기는 연임할 수 있다.	제10조(임원의 임기) 본 회의 임원 임기는 2년으로 하며, 회장과 수석부회장(차기회장)은 연임할 수 없고 부회장, 편집위원장, 총무이사, 상임이사과 감사의 임기는 연임할 수 있다.	수석부회장(차기회장) 임기 추가

<p>제11조(임원의 선출 및 총원) 임원의 선출은 다음과 같이 한다.</p> <p>① 회장을 포함하는 모든 임원은 이사회(상임이사)에서 선출하고 총회의 인준을 받아야한다.</p> <p>② 임원 중에 결원이 생긴 때에는 60일 이내에 이를 총원하여야 한다. 이사회에서 보선하고, 보선된 임원의 임기는 전임자의 잔여기간으로 한다.</p>	<p>제11조(임원의 선출 및 총원) 임원의 선출은 다음과 같이 한다.</p> <p>① 회장을 포함하는 모든 임원은 이사회에서 선출하고 총회의 인준을 받아야한다.</p> <p>② (현행과 동일)</p>	
<p>제13조(임원의 직무) 임원은 다음과 같은 직무를 수행한다.</p> <p>① 회장은 본회를 대표하며 총회와 이사회의 의장이 된다.</p> <p>② 부회장은 기획, 재무, 대외협력, 국제, 홍보 등의 각 분야를 맡아 회장을 보좌하고 회장 유고시 이사회의 의결을 거쳐 회장의 직무를 대행한다.</p> <p>③ 총무이사는 회무 전반에 대하여 회장을 보좌하고, 사무국 운영에 관한 업무를 맡는다.</p> <p>④ 상임이사는 이사회에 출석하여 본 회 업무에 관한 사항을 의결하며 이사회 또는 회장으로부터 위임받은 사항을 수행한다.</p> <p>⑤ 편집위원장은 학회지 및 학술발표요지의 편집에 관한 업무와 각종 수상(학술상, 과총 우수논문상) 대상자를 추천한다.</p> <p>⑥ 감사는 다음의 직무를 수행</p>	<p>제13조(임원의 직무) 임원은 다음과 같은 직무를 수행한다.</p> <p>① 회장은 본회를 대표하며 총회와 이사회의 의장이 된다.</p> <p>② 수석부회장(차기회장은) 회무 전반에 대하여 회장을 보좌하며, 회장 유고시 회장의 직무를 대행한다.</p> <p>③ 부회장은 기획, 재무, 대외협력, 국제, 홍보 등의 각 분야를 맡아 회장을 보좌한다.</p> <p>④ 총무이사는 회무 전반에 대하여 회장을 보좌하고, 사무국 운영에 관한 업무를 맡는다.</p> <p>⑤ 상임이사는 이사회에 출석하여 본 회 업무에 관한 사항을 의결하며 이사회 또는 회장으로부터 위임받은 사항을 수행한다.</p> <p>⑥ 편집위원장은 학회지 및 학</p>	<p>수석부회장(차기회장) 직무 추가</p>

<p>한다.</p> <ol style="list-style-type: none"> 1. 본 회의 재산 현황 및 운영을 감사하는 일 2. 이사회와 그 업무에 관한 사항을 감사하는 일 3. 제1항, 제2항, 제3항의 감사결과 부정 또는 부당한 점이 있음을 발견한 때 이사회 및 총회에 그 시정을 요구하고 주무관청에 보고하는 일 4. 3호의 시정요구 및 보고를 위해 필요한 때 총회 및 이사회를 소집을 요구하는 일 5. 본 회의 재산상황 또는 총회와 이사회와 그 업무에 관한 사항에 대하여 회장 또는 총회나 이사회에 출석하여 의견을 진술하는 일 	<p>술발표요지의 편집에 관한 업무와 각종 수상(학술상, 과총우수논문상) 대상자를 추천한다.</p> <p>⑦ 감사는 다음의 직무를 수행한다.</p> <ol style="list-style-type: none"> 1. 본 회의 재산 현황 및 운영을 감사하는 일 2. 이사회와 그 업무에 관한 사항을 감사하는 일 3. 제1항, 제2항, 제3항의 감사결과 부정 또는 부당한 점이 있음을 발견한 때 이사회 및 총회에 그 시정을 요구하고 주무관청에 보고하는 일 4. 3호의 시정요구 및 보고를 위해 필요한 때 총회 및 이사회를 소집을 요구하는 일 5. 본 회의 재산상황 또는 총회와 이사회와 그 업무에 관한 사항에 대하여 회장 또는 총회나 이사회에 출석하 	
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	여 의견을 진술하는 일	
<p>제16조(총회)</p> <p>① 총회는 정기총회와 임시총회로 구분한다.</p> <p>② 정기총회는 매년 춘계학술대회 기간 중에 개최하며 총회의 의결사항은 정회원 과반수의 출석과 출석회원 과반수의 찬성으로 의결한다. 단, 가부동수인 경우는 회장이 결정 할수있다. 임시총회는 추계학술대회 기간, 회장이 필요로 할 때, 이사회의 결의 또는 정회원 1/3이상의 요구가 있을 때에 소집한다.</p> <p>③ 총회를 소집하고자 할 때에는 회의일시, 장소, 안건 등을 명시하여 총회 개최 1주일 전까지 각 정회원에게 서면 또는 전자우편으로 통지하여야 한다.</p>	<p>제16조(총회)</p> <p>①항 (현행과 동일)</p> <p>② 정기총회는 매년 상반기 중에 개최하며, 임시총회는 회장이 필요로 할 때, 이사회의 결의 또는 정회원 1/3이상의 요구가 있을 때에 소집한다. 총회의 의결사항은 정회원 과반수의 출석과 출석회원 과반수의 찬성으로 의결한다. 단, 가부동수인 경우는 회장이 결정 할 수 있다.</p> <p>③ 항 (현행과 동일)</p> <p>④ 총회는 대면회의 실시를 원칙으로 한다. 다만, 감염병 또는 천재지변 등 대면회의 실시가 어려운 불가항력적인 경우 원격통신수단 등의 방식으로 심의 · 의결할수 있다. 단, 비공개 또는 무기명 투표가 요구되는 안건은 의결할 수 없다.</p>	<p>총회의 개최시기 수정 및 화상회의 등을 통한 총회 운영 근거 조항 신설</p>
<p>제20조(이사회의 구성)</p> <p>본회의 원활한 발전육성을 위해 이사회를 구성한다. 이사회</p>	<p>제20조(이사회의 구성)</p> <p>본회의 원활한 발전육성을 위해 이사회를 구성한다. 이사회</p>	<p>이사회 구성시 수석 부회장 (차기 회장) 추가</p>

<p>는 회장, 부회장, 편집위원장, 총무이사, 상임이사, 감사로 구성한다.</p>	<p>는 회장, 수석부회장(차기회장), 부회장, 편집위원장, 총무이사, 상임이사, 감사로 구성한다.</p>	
<p>제21조(회의 소집 등)</p> <p>① 이사회는 정기이사회와 임시이사회로 구분한다.</p> <p>② 정기이사회는 매년 분기별로 회장이 소집하며, 임시이사회는 회장이 필요하다고 인정할 때와 재적이사 3분의 1이상의 요구가 있을 때 또는 감사의 요구가 있을 때에 회장이 소집한다.</p> <p>③ 이사회는 별도의 규정이 없는 한 재적이사 과반수의 출석으로 개최하고 출석이사 과반수의 찬성으로 의결한다.</p> <p>④ 이사회를 소집하고자 할 때에는 회의일시, 장소, 안건등을 명시하여 회의 개최 7일 전까지 각 이사에게 통보하여야 한다.</p>	<p>제21조(회의 소집 등)</p> <p>①항 (현행과 동일)</p> <p>② 정기이사회는 매년 상반기 중에 개최하며, 임시이사회는 회장이 필요하다고 인정할 때와 재적이사 3분의 1이상의 요구가 있을 때 또는 감사의 요구가 있을 때에 회장이 소집한다.</p> <p>③ ④항 (현행과 동일)</p> <p>⑤ 이사회는 대면회의 실시를 원칙으로 한다. 다만, 감염병 또는 천재지변 등 대면회의 실시가 어려운 불가항력적인 경우 원격통신수단 등의 방식으로 심의 · 의결할 수 있다. 단, 비공개 또는 무기명 투표가 요구되는 안건은 의결할 수 없다.</p>	<p>이사회 개최시기 수정 및 화상회의 등을 통한 이사회 운영 근거 조항 신설</p>

(사)한국약용작물학회

학술발표상

수상자 목록

- 2018년도 춘계학술발표대회

수상번호	주저자	소속	초록제목
구두 제 18-1호	김진성	금산국제인삼약초연구소	비 알콜성 지방간에 의해 유도된 제2형 당뇨병에서 AMPK와 PPAR-α 활성 조절에 기인한 축삼의 효과
구두 제 18-2호	사키나 야스민 시무	경희대학교	알부민과메조폴러스실리카나노입자에결합된진세노사이드 F1의 지질 축적 및 지방간 질환 억제 활성 효과
포스터 제 18-1호	안영남	경기도농업기술원	광복 해가림시설의 차광자재에 따른 미기상과 4년생 인삼의 생육특성
포스터 제 18-2호	서상영	전라북도농업기술원	다단재배 시설에서 LED 처리가 인삼 생육에 미치는 영향
포스터 제 18-3호	라가벤드란 아바이	경희대학교	llyonectria mors-panacis 감염 중 실리카 나노입자의 sterol 생합성 경로 조절에 의한 인삼 뿌리 썩음병 내성 향상
포스터 제 18-4호	최승혁	강원대학교	발효산삼배양근 유래 PgTRxl 유전자의 모델식물 (Nicotiana benthamiana) Transient assay 및 기능성 검증
포스터 제 18-5호	이재국	화진바이오코스메틱	Precursor 처리에 의한 산삼배양근의 ginsenoside 함량 조성변화 연구
포스터 제 18-6호	한신희	국립원예특작과학원	오미자 수집종의 유효성분 분석을 통한 우수계통 선발
포스터 제 18-7호	오선민	국립원예특작과학원	조팝나무로부터 분리된 화합물의 동정 및 정량분석
포스터 제 18-8호	이승호	국립원예특작과학원	식물 세포벽 분해 효소 유전자를 이용한 인삼뿌리썩음병원균 검출 마커 개발
포스터 제 18-9호	손승완	충청남도농업기술원	구기자에서 분리한 탄저병의 살균제 저항성 검증
포스터 제 18-10호	지무근	충청남도농업기술원	인삼 육성계통(수집자원) 및 품종의 유전적 다양성 분석
포스터 제 18-11호	허윤선	충청북도농업기술원	열처리, 화학처리 및 정단배양 방법을 이용한 지형의 바이러스 제거효율 비교

- 2018년도 추계학술발표대회

수상번호	주저자	소속	초록제목
구두 제 18-3호	남효훈	경상북도농업기술원	NDVI를 활용한 약용작물 생육진단
구두 제 18-4호	SanjidaKhanom	전남대학교	인삼유래CYP유전자의지베렐린생합성유전자조절을통한식물생장조절과 제초제 저항성 기능
포스터 제 18-12호	남효훈	경상북도농업기술원	이미지 분석을 통한 일천궁 고온피해 진단
포스터 제 18-13호	안효섭	전라남도농업기술원	파종시기와시비방법에따른배조항종자 수량 특성
포스터 제 18-14호	김승한	경상북도농업기술원	인삼에서 엽록소형광분석에 의한 스트레스의 지표화
포스터 제 18-15호	김수동	충청남도농업기술원	원뿔오가피삽목시기와생장조정제처리가발근에미치는영향
포스터 제 18-16호	박창하	충남대학교	RNA-Seq를이용한석산의전사체프로파일분석
포스터 제 18-17호	김장욱	국립원예특작과학원	인삼 논재배 직파 적용 품종 및 우량계통 선발
포스터 제 18-18호	이호선	국립농업과학원	들깨 국내 재래종 및 육성종 유전자원의 균형병 저항성 검증
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	홍삼가수분해능축역 (GS-E3D)의 피부 안전성 평가를 위한 인체침포시험
포스터 제 18-22호	허성일	(재)홍천메디칼허브연구소	유용미생물발효를 적용한 고려엉귀의 면역증강효능연구
포스터 제 18-23호	이민지	식품의약품안전평가원	생약표준품 지표성분의 안정성 평가 연구
포스터 제 18-24호	Indra Batjikh	경희대학교	옴나무 뿌리를 이용한 산화 아연 나노파티클 생합성 및 메틸렌 블루의 분해를 위한 광촉매 활성
포스터 제 18-25호	김민조	국립원예특작과학원	잇꽃씨추출물의스코폴라민으로유발시킨기억상실마우스에서산화적스트레스와 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 Cylindrocarpou destructans와 Fusarium solani를 동시 진단할 수 있는 새로운 real time PCR 진단법 개발
포스터 제 18-28호	박봉균	한국한의학연구원	고삼투압 유발한사람각세포에서호장근열수추출물의효능실험
포스터 제 18-29호	안태진	국립원예특작과학원	Phytpthorassomeana에의한큰꽃삼주역병보고

- 2019년도 춘계학술발표대회

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	말기 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, Verbasin, 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 블렌딩 조성물의 항산화 활성 및 항미생물 검정
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 추계학술발표대회

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 잔재를 추출액의 농업현장 활용가능성 검토
포스터 제 19-18호	성봉재	충청남도농업기술원	연근별 인삼의 새싹 인삼 재배시 재배기간별 사포닌 및 물질 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 맛두를 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

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수상번호	주저자	소속	초록제목
포스터 제 20-1호	권아름	충청남도농업기술원	원털오갈피 우량종자 생산을 위한 적정 재증시기
포스터 제 20-2호	서해성	전남대학교	인삼 유래 PgCYP736A12와 PgCYP76B93의 페닐우레아계 제조제 저항성 관련 기능 연구
포스터 제 20-3호	모영문	강원도농업기술원	중북부 평야지 큰꽃삼주의 채종시기 및 저온저장기간에 따른 발아특성
포스터 제 20-4호	이재웅	한국한의학진흥원	번하 callus를 활용한 식물체 분화 및 실외 적응 연구
포스터 제 20-5호	인준교	한국인삼공사	비가림 소형터널을 적용한 무농약 묘삼의 생산
포스터 제 20-6호	길진수	충북대학교	참당귀 엽록체 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



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