2016 한국원예학회 정기총회 및 제104차 총계학술회포회 자료집

Program & Abstracts
2016 Annual Spring Conference of the Korean Society for Horticultural Science

주제 스마트 원예(Smart Horticulture)의 현황과 발전방안

일자 및 장소 2016. 5. 25(수)~28(토), 창원컨벤션센터(CECO)

주최 (사)한국원예학회
후원 경상남도·창원시·경남컨벤션부로
한국과학기술단체총연합회·코레곤총묘·원예산업신문
행사일정

* 행사명: 2016 한국원예학회 정기총회 및 제104차 축제학술발표회
* 주 제: 스마트 원예(Smart Horticulture)의 현황과 발전방안
* 일자 및 장소: 2016. 5. 25(수)~26(목), 청원컨벤션센터(CECO)

5월 25일(수)
16:00-21:00 육영이사 사전점검회의

5월 26일(목)
08:30-09:00 등록(301·302호 로비) 및 포스터(홀3) 부착(컨벤션홀 로비)
09:00-10:00 이사회(602호)
10:00-11:40 특별강연(컨벤션홀3)(최장: 손정익, 서울대학교)
1) IoT 기반 스마트 원예 현황과 표준화 동향(이현 교수, 순천대학교 정보통신공학과)
2) 전자산업 ICT 통합의 전략과 정책과제(김성희, 삼성전자연구원, 한국농업경제연구원 자원환경연구부)
11:40-12:00 사전식(컨벤션홀3)
- 제39회 우수논문상 및 제3회 최대민의영상우수논문상 시상
- 2015 최우수보건복지담당자 시상 및 최우수사원상 시상
- 2015 취교학술발표회 우수발표상 시상
12:00-13:00 정기총회(컨벤션홀3)
- 총무 및 감사 보고(사무총장 유용권, 감사 고두은, 김승우)
- 회장 및 북인의사(회장 고문은, 선임의사 송정만)
- 차기호이 발표(신임의사 송정만)
13:00-14:00 종식(컨벤션홀1)
14:00-15:00 포스터 발표(홀3) 및 심사(컨벤션홀 로비)
15:00-17:00 구두발표 1 채 소(컨벤션홀3) 화 핵(컨벤션홀2) 과 수(301·302호)
17:00-17:30 전문분과회의 채 소(컨벤션홀3) 화 핵(컨벤션홀2) 과 수(301·302호)
17:30-18:00 유전🌝등(컨벤션홀3) 사설회계(컨벤션홀2) 수학후관리(301·302호)

5월 27일(금)
08:30-09:00 등록(301·302호 로비) 및 포스터(주관) 부착(컨벤션홀 로비)
09:00-10:00 편집위원회(301·302호)
10:00-12:00 상호 지염(301·302호 로비)
채 소(컨벤션홀3) (최장: 김길성, 경원대학교)
1. 우리나라 스마트팜 연구 동향(김재성, 농촌진흥청)
2. 제비 kurs 스태트 팩 활용(김성현, KT 융합기술원 컨버전소연구소)
3. 스마트팜 농사 계약소와 스마트 팩 확장 비즈니스 모델(전재욱, 서울대학교)
화 핵(컨벤션홀2) (최장: 정병종, 경상대학교)
1. 생활원예의 IoT 환경 활용 현황 및 적용 방안(김광현, 국립원예정책연구원)
2. ICT를 활용한 원예특산물 균질화 방안(김용중, 과학대학교)
3. 사이버 환경리더를 양성하기 위한 스마트 팩 기술(이영훈, 전남대학교)
과 수(301·302호) (최장: 남기웅, 경상대학교)
1. 환경적응성 스마트 과수 촌리의 국내외 개발 동향과 발전방향(황시진, 명덕대학교)
2. ICT를 활용한 가짜비해 행성의 연구 동향과 발전방향(문범희, 명덕대학교 연구소)
3. ICT를 활용한 과수 영농 촌리의 발전방향(이영훈, 국립원예정책과학원 사과연구소)
12:00-13:00 포스터 발표(주관) 및 심사(컨벤션홀 로비)
13:00-14:00 종식(컨벤션홀1)
14:00-16:00 구두발표 2 채 소(컨벤션홀3) 화 핵(컨벤션홀2) 과 수(301·302호)

5월 28일(토)
09:00-13:00 현지견학(개별 방문)

* 구두 발표(발표 12분, 질의 3분), 포스터 발표(발표자 인스펙 필수, 29일 18:00, 30일 16:00 이후 포스터 회수)
P-1-④ Characterization of Branched-chain Amino Acid Transaminase Genes in Cucumber

P-1-④ 동양계 밭기 품종 유래 자식세대의 세대별 과실 특성 비교

P-1-④ Development of SNP Markers for Background Selection in Tomato (Solanum lycopersicum L.)

P-1-④ Genomic and Post-Translational Modification Analysis of Leucine-Rich-Repeat Receptor-Like Kinases in Brassica rapa

P-1-④ Virus-induced Gene Silencing (VIGS)를 이용한 고추의 CaTin1-2 like protein 유전자 기능분석

P-1-④ Genome-wide Analysis and Characterization of Aux/IAA Family Genes in Brassica rapa

P-1-④ 토마토 황화액말리버러스 저항성 분자표지 개발

P-1-④ Assessment of Genetic Diversity of Commercial Radish Cultivars using Morphological Traits and SSR Markers

P-1-④ 왜성 고추 Micropep에서의 과색 조절 유전자 변이 연구

P-1-④ Identification and Molecular Characterization of CDPK Genes in Brassica oleracea

P-1-④ Development of Stable Red Colored Anthocyanins Rich Chinese Cabbage (Brassica rapa) through Introggression of Genes from Red Cabbage (Brassica oleracea)

P-1-④ Genotype-Specific Variations in Glucosinolate Biosynthesis and Gene Expression in Low and High Wax-Depositing Brassica oleracea L. capitata Subspecies

P-1-④ Identification and Characterization of Peroxidase and Glucan Synthase Like Genes under Podosphaera xanthii Infection and Phytohormone Treatments in Cucumis melo L.

P-1-④ De Novo Transcriptome Analysis of Differentially Expressed Genes from Floral Buds and Flowers of Male Sterile and Fertile Lines in Watermelon

P-1-④ Development of Mutagenesis System and Plant Resources for Mutation Breeding Based on Irradiation in Pepper

P-1-⑤ 맛기 조직배양 시 BA 및 CPPU 처리에 따른 기내증식율 및 체세포 변이율 비교

P-1-⑤ Development of Edible Vaccine by Expressing Fusion Proteins in Chinese Cabbage

P-1-⑤ 국내외 사계성 맛기 품종 판별을 위한 SSR 마커 선발 및 유전자 다양성 비교

P-1-⑤ 국내 다양한 배추 품종의 소포자 배양 결과

P-1-⑤ CMV 저항성 GM고추의 도입유전자 정량분석법 확립

P-1-⑤ 농가의 성숙도에 따른 항성화능력 비교와 아세틸콜린에스테라제 저해효과

P-1-⑤ 미나수박 품종별 라이코펜 및 당 성분 함량

P-1-⑤ 맛기의 성숙도에 따른 항성화능력 비교와 아세틸콜린에스테라제 저해효과

P-1-⑤ 미나수박 품종별 라이코펜 및 당 성분 함량

The PSY and CCS Genes Control Mature Fruit Colors of *Capsicum annuum* `Micropep`  

Ha-young Kong*, Joo-hee Kim, Young-Hee Kim, Sung-Young Kim, and Young-choi Kang$  

Department of Plant Science, Plant Genomics and Breeding Institute, and Vegetables Breeding Research Center, College of Agriculture and Life Sciences, Seoul National University, Seoul 08826, Korea; *Food and Nutrition in Home Economics, Korea National Open University, Seoul 02841, Korea.

Carotenoids are major pigments coloring yellow, orange and red in pepper. In *Capsicum*, phytoene synthase (PSY), capsanthin-capsorubin reductase (CCR), β-carotene hydroxylase (Crtz-2) and lycopene β-cyclase (Lycb) were identified to be involved in the carotenoid biosynthesis pathway. Orange and yellow colors in pepper can be Yielded from mutations in these four genes, but the relationship between the colors and the four candidate genes is not fully elucidated. We examined these four carotenoid biosynthesis genes and measured the carotenoid contents of *C. annuum* cultivars. Pepper Red (MR), Micropep Yellow (MY) and their F1; Micropep lines have dwarf phenotypes. Mutation of the two candidate genes, PSY and CCS, were investigated in the MY cultivar turned out that there is an insertion of about 9 kb in the PSY gene and a big insertion with unknown size in the CCS gene. These mutations of PSY and CCS genes cosegregated with the red color in the F2 population with a phenotypic ratio of 9:3 ratios (red:orange:yellow). In the F2 population, red peppers (psyc/ccs) accumulate higher levels of total carotenoid than those of yellow peppers (psyc/ccs). In the orange peppers, we were able to identify the carotenoid content profile according to genotypes of PSY and CCS. Total carotenoid content in type1 (PSY/ccs) was much higher that in type2 (psyc/CCS) butcapsanthin was accumulated even in type2 than type1. These results show that PSY and CCS genes affect the fruit colors of pepper in different ways in the breeding pathway. Moreover markers developed in this study can be used to distinguish the fruit colors of pepper.
Carotenoids are major pigments coloring yellow, orange and red in plants. In Capsicum, phytoene synthase (PSY), capsanthin-capsorubin synthase (CCS), β-Carotene hydroxylase (Crz-2) and lycopene β-cyclase (Lcyb) were identified to be involved in the carotenoid synthesis pathway. Orange and yellow colors in pepper can be results from mutations in these four genes but the relationship between the colors and the four candidate genes has not been fully elucidated. We examined these four carotenoid biosynthesis genes and measured the carotenoid contents of C. annuum cultivars Micropep Red (MR), Micropep Yellow (MY) and their F1 population. Micropep lines have dwarf phenotypes. Mutation of the two candidate genes, PSY and CCS, were identified in the MY line. These mutations of PSY and CCS genes cosegregated with the fruit colors in the F2 population with a phenotypic ratio of 9:6:1(red:orange:yellow). In the F2 population, red peppers (PSY/CCS) accumulate higher levels of total carotenoid than those of yellow peppers (psy/ccs). In the orange peppers, we were able to classify the carotenoid content profile according to genotypes of PSY and CCS. Total carotenoid content in type 1 (psy/ccs) was much higher than in type 2 (psycs). These results show that PSY and CCS genes affect the fruit colors of pepper in different ways in the carotenoid pathway. Moreover markers developed in this study can be used to distinguish the fruit colors of pepper.

Carotenoid profile

The major carotenoid in the red fruits was capsanthin (Table 1). In the yellow fruits, only trace amounts of carotenoids were accumulated. In the orange fruits, we were able to profile the carotenoid contents according to the genotypes of PSY and CCS. In type 1 (psy/ccs) and type 2 (psycs) populations, the major carotenoid was zeaxanthin and capsanthin, respectively. Total carotenoid content in type 1 was much higher than that in type 2, but capsanthin, the final carotenoid product, was more accumulated in type 2 than type 1. Distinguishing the individual fruits between type 1 and type 2 by naked eyes was difficult, but when comparing the populations of type 1 and type 2, the type 2 population tended to be redder than type 1. The content of individual carotenoids differed among the populations (Table 1).

Table 1. Carotenoid accumulation in Capsicum fruit expressed as μg g-1 fresh wt pericarp, in mature fruit. F2 red, orange, yellow: fruits with red, orange, yellow color in Micropep red × Micropep yellow. F2 Orange fruits have two genotypes.

<table>
<thead>
<tr>
<th>Genotype</th>
<th>PSY</th>
<th>CCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capsanthin</td>
<td>300.5 ± 25.2</td>
<td>20.6 ± 0.6</td>
</tr>
<tr>
<td>Lycopene</td>
<td>107.1 ± 2.6</td>
<td>13.7 ± 0.3</td>
</tr>
<tr>
<td>Zeaxanthin</td>
<td>0 ± 0</td>
<td>0 ± 0</td>
</tr>
<tr>
<td>Total carotenoids</td>
<td>431.1 ± 27.7</td>
<td>21.6 ± 0.3</td>
</tr>
</tbody>
</table>

* ND. Not detected.

PCR polymorphism

PCR amplification was performed using the total DNA of two parents and F1 population with primers for the PSY, Crz-2, Lcyb and CCS genes. Fragments of the PSY and CCS gene were obtained from the pepper plants with red fruits, but not from those yellow fruits. We identified PCR fragments that were detected between the two parents for Crz-2 and Lcyb. The presence or absence of the amplified fragment almost completely cosegregated with the red, orange or yellow fruit color, respectively, in the F1 population (Figure 6A, Table 2A). From cDNA, we couldn’t amplify fragment of the PSY gene from the plants with yellow fruits. We identified premature stop codon in CCS from the plants with yellow fruits.

Table 2. Analysis of genotype and phenotype in the F2 segregating population.

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Red</th>
<th>Orange</th>
<th>Yellow</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSY/CCS</td>
<td>158</td>
<td>2</td>
<td>165</td>
<td></td>
</tr>
<tr>
<td>1/1</td>
<td>48</td>
<td>4</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>65</td>
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<tr>
<td>14</td>
<td>14</td>
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</table>

<table>
<thead>
<tr>
<th>Phenotype</th>
<th>9/61</th>
<th>158/11820</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genotype</td>
<td>9/31</td>
<td>170/547016</td>
</tr>
</tbody>
</table>

References

Acknowledgement

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