PROCEEDING

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2016

"The Future of Tropical Horticulture"

Organized by

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Editor :
Dr. Awang Maharijaya, SP, M.Si
Dr. Ir. Darda Efendi, M.Si

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Ferdhi Isnan Nuryana, SP

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Telp. (0251) 8326881; Fax. (0251) 8326881

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FOREWORD

The International Seminar on Tropical Horticulture 2016 was held in IPB International Convention Center, Bogor, Indonesia 28 – 29 November 2016. This seminar was organized by Center of Excellence for Tropical Horticulture Studies (PKHT), Center of Excellence in University (PUI-PT), Bogor Agricultural University (IPB), and supported by an excellent collaboration with International Tropical Fruits Network (TF Net).

We're very glad to know the fact that the seminar displayed a very wide discussion about tropical horticulture with delegates from 5 countries (Taiwan, Thailand, Malaysia, Japan and Indonesia) as keynote speech and participants. 24 papers were selected to be included in this proceeding from 28 oral and 31 poster presentation.

This proceeding is contained of three sub chapter, that is fruits, vegetables and miscellaneous. There are 9 papers of fruits chapter, 12 papers of vegetables chapter and 3 papers of miscellaneous chapter. We wish to thank Sanjeet Kumar, Ph.D, Prof. Sobir, Prof Masayoshi Shigyo, Dr. Mohd Desa Haji Hassim, Parson Saradhuldhat, Ph.D for being keynote speech at this international seminar and all participants for very lively atmosphere during and after the seminar.

Bogor, May 2017

Editor

Dr. Darda Efendi
Dr. Awang Maharijaya

SYMPOSIUM PROGRAM

28 November 2016

07.30 – 09.00	*Registration desk open and morning coffee*
09.00 – 09.30	Welcome addresses **Dr. Darda Efendi**, Director of Center for Tropical Horticulture Studies, Indonesia **Prof. Herry Suhardiyanto,** Rector of Bogor Agricultural University, Indonesia
09.30 – 12.00 (20 minutes presentation + 10 minutes discussion)	**Session 1: Introductory Topics** **Dr. Sanjeet Kumar,** World Vegetable Center, Taiwan *"Science and Art of Tropical Horticulture: Stories, Impacts and Prospects"* **Prof. Sobir,** Indonesian Center of Excellence for Tropical Horticulture *"Tropical Horticulture: Past, Present and Future"* **Gregori Hambali, MSc,** Mekarsari, Indonesia *"Managing Tropical Fruit Collection"*
12.00 – 13.00	*Lunch*
13.00 – 14.30 (20 minutes presentation + 10 minutes discussion)	**Session 2: Opportunity in Tropical Horticulture Industry** **Prof. Muhammad Firdaus,** Bogor Agricultural University *"Enhancing the Competitiveness of Tropical Horticulture Products"* **Dr. Mohd Desa Haji Hassim,** International Tropical Fruit Network, Selangor, Malaysia *"Issues and Challenges in The Global Tropical Fruit Market"* **Parson Saradhuldat, Ph.D,** Department of Horticulture, Kasestsart University, Thailand *"Tropical Horticulture Business in Thailand"*
14.30 – 16.00 (20 minutes presentation + 10 minutes discussion)	**Session 3: Quality of Horticultural Products** **Dr. Darda Efendi,** Center for Tropical Horticulture Studies, Indonesia *"Quality Issues in Tropical Horticultural Products"*

	Tatas H. P. Brotosudarmo, PhD, Ma Chung University *"*Non-optical and optical spectroscopy as metabolomics platforms for determining the quality of horticultural products*"* **Dr. Irmanida Batubara,** Tropical Biopharmaca Research Center *" Quality Control on Herbal Medicine"*

29 November 2016

07.30 – 08.30	*Registration desk open*	
08.30 – 10.15	**Parallel session 1**	**Parallel session 2**
10.15 – 10.30	*Coffee Break and Poster Session*	
10.30 – 12.15	**Parallel session 3**	**Parallel session 4**
12.15 – 13.00	*Lunch*	
13.00 – 15.00 (@20 minutes presentation + 10 minutes discussion)	**Session 4 : Technology Needs for Improving Horticulture in The Tropics** **Prof. Masayoshi Shigyo,** Yamaguchi University, Japan *"Proposal for a forwarding model in order to encourage social interaction among HRs and/or PGRs via platform operation based on research collaboration in Indonesian vegetable crops"* **Prof. Sri Hendrastuti Hidayat,** Department of Plant Protection. Faculty of Agriculture. Bogor Agricultural University *"Integrated Disease Management for Vegetable Crops: Concepts and Practices"* **Dr. Catur Hermanto,** Indonesian Vegetables Research Institute (IVEGRI) *"Pest And Disease Threats and Challenges For Future Vegetable In The Tropic*"	
15.00 – 16.00	*Concluding and Remarks*	
16.00 – 18.00	*Farewell Drink*	

ORAL PRESENTATION SCHEDULE

Tuesday, November 29th 2016

Paralel 1

TIME	PRESENTER NAME	CODE	TITLE
08.30 – 08.45	Slamet Susanto	OP 1	Prolong Shelflife of Seedless Pummelo (*Citrus maxima* (L.) Osbeck) Fruit During Storage
08.45 – 09.00	Dini Hervani	OP 2	Cryopreservation of Long-term Plant Germplasm Storage
09.00 – 09.15	Sulassih	OP 3	Variability of Jackfruit Based on Morphology and Molecular ISSR
09.15 – 09.30	Ahmad Solikin	OP 4	Characterization of Local Durian Varieties In Central Java Using Molecular Markers Inter Simple Sequence Repeats (ISSR)
09.30 – 09.45	Nelinda	OP 5	Packaging Design and Postharvest Treatment to Maintain the Quality of Rambutan (*Nephelium Lappaceum* L.) in Distribution System
09.45 – 10.00	Maxmilyand Leiwakabessy	OP 6	Disease Incidence and Molecular Analysis of Banana Bunchy Top Virus in Bogor, West Java
10.00 – 10.15	Ajmir Akmal	OP 7	Transpiration rate of relationship fruit with Gamboge of Mangosteen (*Garcinia mangostana* L.)

Paralel 2

TIME	PRESENTER NAME	CODE	TITLE
08.30 – 08.45	Juang Gema Kartika	OP 8	Growth and Production of Some *Moringa oleifera* Lam. Accession at Several Harvesting Interval
08.45 – 09.00	Lutfi Izhar	OP 9	Conservation Agriculture with Soil Health: Optimal Fosfor Fertilizer Rate for Tomato (*Lycopersicon esculentum* Mill. L) on Inceptisols
09.00 – 09.15	Adhitya Mahendra K	OP 10	Stakeholders Analysis in Seed Provision System Development Originated from True Seed of Shallot
09.15 – 09.30	Endro Gunawan	OP 11	Policy Analysis on Shallot Stock Seed Program Though The Botanical Seed (*True Shallot Seed*) TSS
09.30 – 09.45	Ali Asgar	OP 12	Integrating Understanding of Indigenous Vegetable Nutrients and Benefits
09.45 – 10.00	Marlin	OP 13	Metabolite Changes in Shallot (*Allium cepa* var *aggregatum*) during Vernalization
10.00 – 10.15	Suhesti Kusuma Dewi	OP 14	The Effects of Vernalization and Photoperiod on Flowering of Shallot (*Allium cepa* var. *ascalonicum* Baker) in Lowland Area

Paralel 3

TIME	PRESENTER NAME	CODE	TITLE
10.30 – 10.45	Satriyas Ilyas	OP 15	Study of Phenology and Determination of Seed Physiological Maturity of Long Bean (*Vigna sinensis* L.) Based on Heat Unit
10.45 – 11.00	Endah Retno Palupi	OP 16	Chromosome Number Estimation of Diploid, Autotetraploid and Triploid Hybrid 'Rejang' Banana Using Protoplast from Male Flower (anther)
11.00 – 11.15	Yudiwanti Wahyu	OP 17	Performance of Some First Generation Corn Populations derived from Selfing and Sibbing for Developing Baby Corn Varieties
11.15 – 11.30	Ady Daryanto	OP 18	Inheritance of Chili Pepper Resistance Against Infestation of *Aphis gossypii* Glover (Hemiptera: Aphididae)
11.30 – 11.45	Edi Santosa	OP 19	Variation in Floral Morphology of Agamosporous *Amorphophallus Muelleri* Blume of Natural and Gibberellins Treatment
11.45 – 12.00	Kusuma Darma	OP 20	The Eco-Friendly Technology to Control Pests and Diseases of Shallot
12.00 – 12.15	Filemon Yusuf	OP 21	Phylogenetic Study of Indigenous Pulses Based on Morphological and Inter Simple Sequence Repeat (ISSR) Markers

Paralel 4

TIME	PRESENTER NAME	CODE	TITLE
10.30 – 10.45	Ririh Sekar Mardisiwi	OP 22	Growth and Production of Black Cumin (*Nigela sativa* L.) at Several Composition Media and Watering Interval
10.45 – 11.00	Evi Setiawati	OP 23	Growth and Production of Black Cumin (*Nigela sativa* L.) at Shade Levels and Nitrogen Doses
11.00 – 11.15	Tatik Raisawati	OP 24	The Nutritional Value and Total Flavonoid Content of *Sonchus arvensis* L. Leave
11.15 – 11.30	Dewi Sukma	OP 25	Diversity Analysis of Phalaenopsis by Using SNAP Marker
11.30 – 11.45	Widya Sari	OP 26	Morphological, Molecular Charactheristics and Pathogenicity of *Fusarium* spp. from Some Cultivars of Banana
11.45 – 12.00	Juwartina Ida Royani	OP 27	In Vitro Shoots Multiplication of Sapodilla (*Manilkara zapotta* Van Royen) with Modified MS Media
12.00 – 12.15	Willy B. Suwarno	OP 28	Melon Breeding: Past Experience and Future Challenge

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Metabolite Changes in Shallot (*Allium cepa* var *aggregatum*) during Vernalization

Marlin[1,2], Awang Maharijaya[2,3], Sobir[2,3], Agus Purwito[2]

[1)] *Department of Agronomy, University of Bengkulu, Indonesia*
[2)] *Department of Agronomy and Horticulture, Bogor Agricultural University, Indonesia.*
[3)] *Center for Tropical Horticulture Studies, Bogor Agricultural University, Indonesia*

Abstract

The flower induction in shallot can be initiated by providing a vernalization treatments. The vernalization might affect the composition of metabolome. The metabolomic composition determines the physiological processes and functions of the plants and parts. Metabolomes can spatially define the structure of tissues and organs including flower. The objective of this research is to determine metabolite composition in four different growth stadia of bulbs with different vernalization treatment. GC-MS analysis detected 88 compounds that were different at different growth stadia of bulbs. The results demonstrated that phytol is a major compound that suggested corresponding to metabolite changes during vernalization with regard to bulbs growth stadia. The correlation analysis confirm that the differences of metabolite profile might play a key role in flowering initiation in shallot.

Keywords : Shallot, vernalization, flower induction, metabolomic, GC-MS analysis

1. Introduction

Shallot (*Allium cepa* var. *aggregatum*) is vegetatively propagated using its bulbs which spreads of contaminations and deseases to the next generation. Propagation by generative part experienced problems because some genotypes unable to initiate the flowering. In onion plants, flowering can be induced by providing vernalization treatment at 4-5°C (Ami *et al* 2013; Elsiddig 2015). Transition of vegetative phase into a reproductive phase involves a number of biological and biochemistry processes of plants (Halevy 1990; Bernier *et al.* 1993). The changes occur during metabolite process can be an important indicator to show the status of plant growth and development.

The last decade has seen an enormous trend towards plant extracts such as essential oils, volatiles, and other compound released by the secondary metabolism of plants. Secondary metabolites that are formed during the process secondary metabolism can be measured by GC-MS analysis. The analytical strategy (GC-MS) used to analyze the volatile compounds, and selected compounds were structurally analysed by mass spectrometry transposing the method to GC-MS (Lekshmi *et al.* 2014). Metabolomic technologies have recently revealed new insights in biological systems through metabolic dynamics (Iijima 2014). Investigation on the biological activities of *Allium* compounds, as well as other phyto-compounds, and their mechanisms of action is still a major challenge for biochemistry, microbiology and plant breeding program. This study aims to determine metabolite composition in four different growth stadia of bulbs with different vernalization treatment.

2. Materials and Methods

Plant materials

Shallot bulbs of variety Bima Brebes were used as planting materials. Bulbs weight at 5-7 g were selected and germinated to shoot growth (1-3 cm in lenght). The treatments consisted of vernalization treatments, and noticed as non-vernalized bulbs (S_0), and vernalized bulbs at 3 growth stadia (S_1 = 1 cm of shoot, S_2 =2 cm of shoot, S_3 = 3 cm of shoot). The vernalization treatment were placed in chamber at 8°C for 5 weeks. The bulbs were then planted in 45 cm diameter polythene bags containing 8 kg of growing media (soil: manure: husk = 2: 1: 1). Each polybags planted three bulbs. Before planting shallot bulbs soaked in a fungicide solution with the active ingredient benomil 50% at a concentration of 2 g/L for 15 minutes. Furthermore tubers soaked back into solution PGPR (plant growth promoting root) with a concentration of 5 g/L for 15 minutes. NPK fertilizers is given with a ratio of 15:15:15, a dose of 600 kg/ha or 2.4 g/polybag. The fresh leaves at 4 weeks after planting were carried directly to GCMS investigation.

GC-MS analysis

The samples were the leaves of shallot plants at 4 weeks after planting. GC-MS pyrolisis unit was carried out on an GCMS-QP2010 system coupled to Mass Spectrometer Detector. The sample were inserted into the quartz chamber in the pyrolysis unit. Helium was used as a carrier gas in a constant flow mode at 0.85 ml/min. The pyrolisis chamber were heated in an oxygen-free environment at a temperature of 400°C for 0.2 minutes. The reaction will produce heat-mediated cleavage of chemical bonds in the macromolecular structure and produce low molecular weight with a chemical composition that identify specific compound of metabolite. Compound mixtures were then passed trhough the column GC-MS analysis. The column is Rt x 5 MS, with length 60.0 m, thickness 0.25 µm, and diameter 0.25 mm.

The initial temperature of the column was 50°C, which was gradually increased by 10°C up to 280°C. At the end of this period, the column oven temperature was 50 °C raised up to 280°C. Injection port temperature was ensured as 280°C and helium flow rate as 0.85 ml/min. Mass spectrometer detector was employed to detect compounds when they were vented from the column. Temperature of the detector was 200°C. The mass spectra obtained through GC–MS were analysed by using data library such as WILEY7.LIB and the NIST webbook database. The volatile compounds of the plant samples were then identified for each treatments.

3. Results and Discussion

The edible Allium are characterized by their rich content of thiosulfinated and other organosulfur compound. Metabolite composition in the shallot leaves extracts were identified by GC-MS analysis. The 88 metabolites were identified in this research.

GC-MS analysis of the shallot leaves in this research showed that the different of vernalization treatment contains different metabolite composition. In non-vernalized bulbs has the highest content of formamide (CAS) methanamide (37.00%). While in vernalization bulbs (with 1 cm of shoot) contains methanamine, N-methyl (CAS) dimethylamine (41.45%), butane (5.98%), and phytol (6.81%). (Figure 1a). Formamide is a clear liquid which is miscible with water and has an ammonia-like odor. Lokke *et al.* (2012) reported that in onion bulbs had the highest concentrations propanethiol and had an odor activity value 20 times higher than dipropyl disulfide.

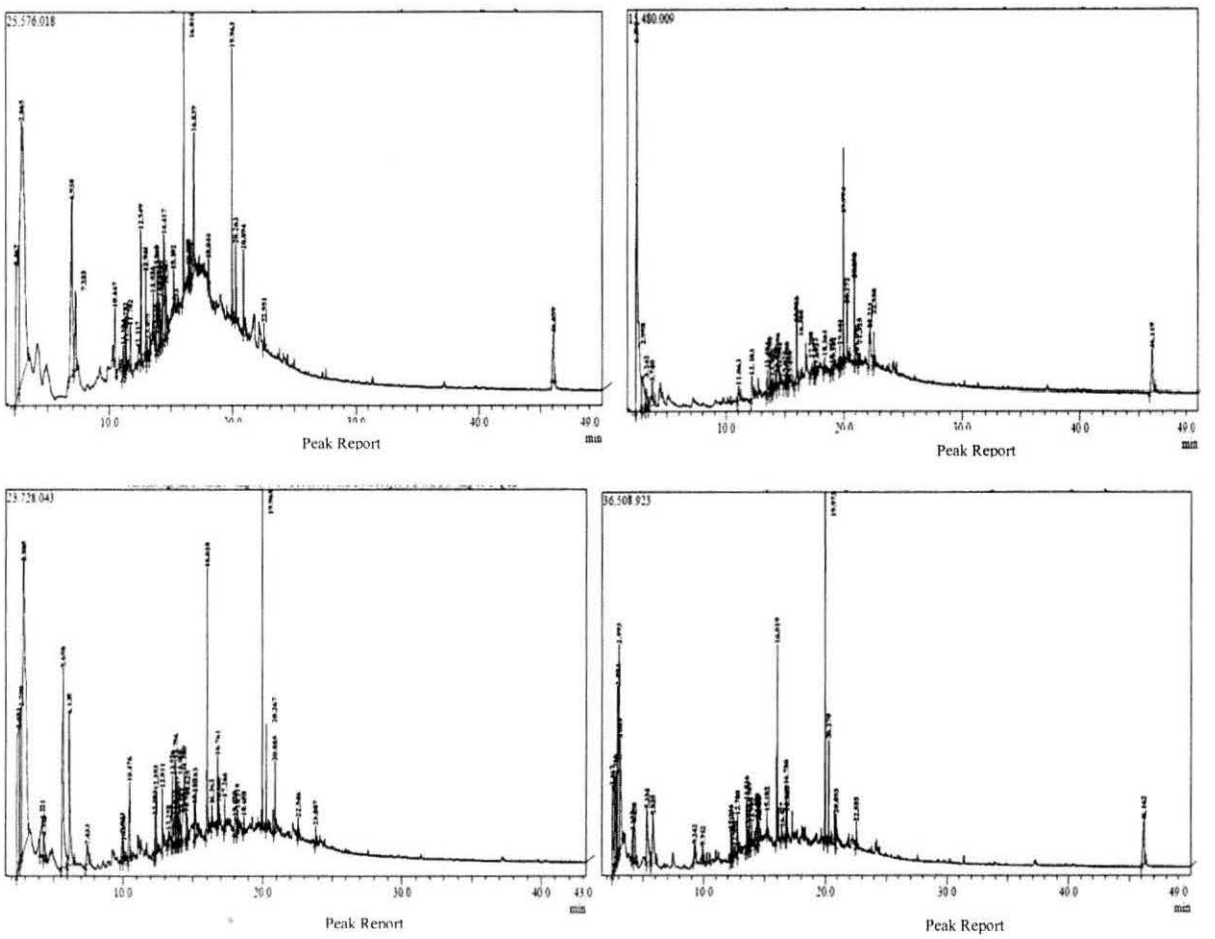
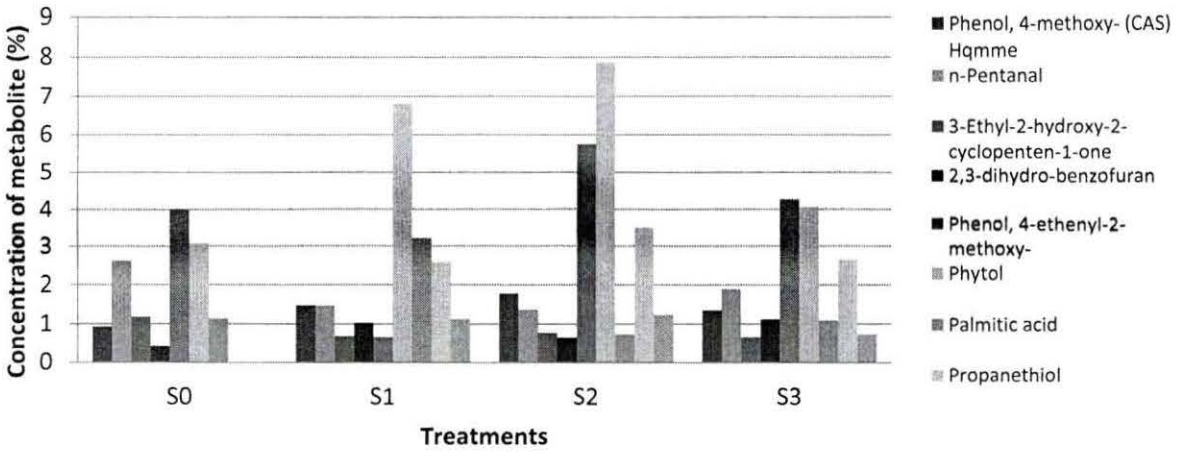


Figure 1. Metabolite changes in shallot. a) non-vernalized bulbs, b) vernalized bulb, bulbs stadia with 1 cm of shoot, c) vernalized bulbs, bulbs stadia with 2 cm of shoot, d) vernalized bulbs, bulbs stadia with 3 cm of shoot.



S_0 = non-vernalized bulbs, S_1 = vernalized bulbs, bulbs stadia with 1 cm of shoot, S_2 = vernalized bulbs, bulbs stadia with 2 cm of shoot, S_3 = vernalized bulbs, bulbs stadia with 3 cm of shoot

Figure 2. Metabolite composition in non-vernalized and vernalized bulbs of shallot (4 weeks after planting)

The results showed metabolite composition with different concentrations in all treatments. The content of phytol in vernalized bulbs were higher (4.28 to 7.86 %) compared with non-vernalized bulbs (4.01 %). Phytol is an acyclic diterpene alcohol that can be used as a precursor for the manufacture of synthetic forms of vitamin E and vitamin K1. Percentage of flowering plants in non-vernalized bulbs was only 29.63% which is significantly different from vernalized bulbs (79.63%), *data is not shown*. Continued research in biochemical and physiological are needed to prove the role of phytol in flower initiation process of shallot.

The results was also revealed that metabolite composition in vernalized bulbs were higher than the non-vernalized bulbs. But, the content of n-pentanal and 3-ethyl-2-hydroxy-2-cyclopenten-1-one, in non-vernalized bulbs were higher than vernalized bulbs (Figure 2). Pentanal, also called pentanaldehyde or valeraldehyde, is an alkyl aldehyde, molecular formula $C_5H_{10}O$. It is used in flavorings, resin chemistry, and rubber accelerators (https://en.wikipedia.org/wiki/Pentanal). The results clearly showed that the odors and the flavours compound were identified higher in non-vernalized bulbs than vernalized bulbs of shallot. Most of the disulphides and thiol groups in onion were also determined by Lokke *et al.* (2012) and Lekshmi *et al.* (2014) determined the presence of ethanol, isoamyl acetate, isobutyl alcohol, propyl alcohol, palmitic acid, stearic acid, and lanosterol in the onion cultivars.

There are 7 metabolites composition were be found in each vernalization and bulbs growth stadia treatments with different level concentrations. The vernalized bulbs seemed had a higher concentration of metabolite compared to non-vernalized bulbs of shallot. There are also two compounds in vernalized bulbs but can not be found in non-vernalized bulb, namely 1-propanethiol (CAS) propanethiol and phenol, 4-ethyl- (CAS) p-ethylphenol. Propanethiol is an organic compound with the molecular formulas and structural formulas similar to alcohols, except that sulfur-containing sulfhydryl group (-SH) replaces the oxygen-containing hydroxyl group in the molecule. It is a colorless liquid with a strong, offensive odor (https://en.wikipedia.org/wiki/Propanethiol). Further study is recuired to prove a specific compound responsibility in flowering initiation in shallot. Mass spectrometry combined with a separation technique offers tremendous opportunities for analysis of complex biological samples because it enables the determination and identification of a large number of metabolites in a single analysis (Villas-Boas *et al.* 2005).

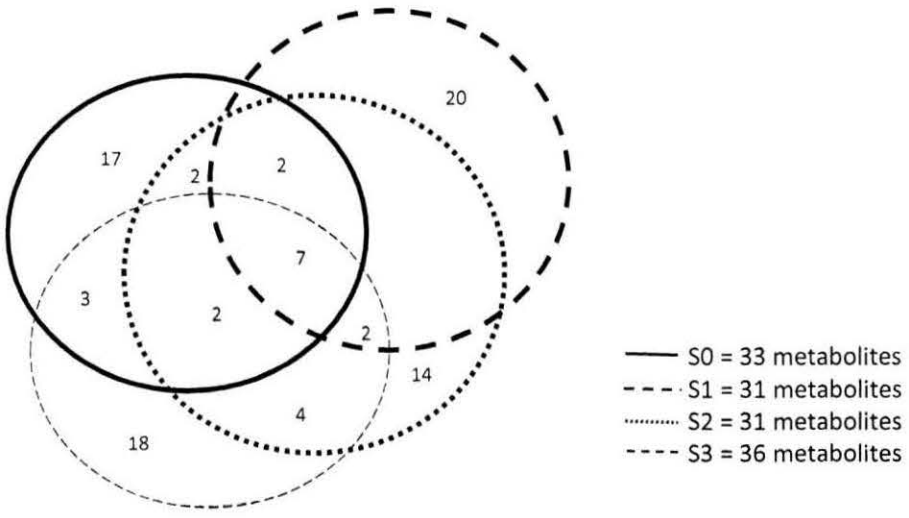


Figure 3. Metabolites distribution in non-vernalized and vernalized bulbs of shallot

4. Conclusions

The investigation metabolites compound in shallot by GC-MS revealed the dynamics of the emission of metabolites change during vernalization of germinated bulbs. By means of GC-MS, an estimate of the concentrations of different compounds in the freshly leaves of shallot was indentified. The results demonstrated that phytol is a major compound that suggested corresponding to metabolites changes during vernalization with regards to bulb germinated stage.

Acknowledgement

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