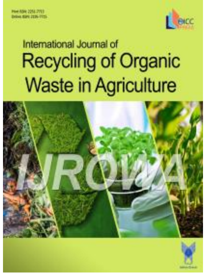

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Research Article

Effects of Water Hyacinth Compost on Growth of *Rhodomyrtus Tomentosa* (Aiton) Hassk. and Rhodomyrtone Yield

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Abstract

Purpose: Water hyacinth (WH) is an aquatic weed that has negatively impacted aquatic ecosystems. WH can be easily composted and used as a soil ameliorant to improve plant growth. In this study, the effects of WH compost on the growth of *Rhodomyrtus tomentosa* were evaluated.
Methods: Native *R. tomentosa* seedlings were cultivated with WH compost in two different systems: a pot cultivation with soil: WH compost mixed in ratios ranging from 10:0 to 7:3 and an open field cultivation with 1 to 3 parts of WH added to the topsoil. Plant growth characteristics and rhodomyrtone yield were also investigated.
Results: Plant height and numbers of stems were not significantly different between the two cultivation methods ($p>0.05$). Plants treated with WH compost had more leaves than those not treated with WH compost ($p<0.05$). Growing the plants with WH compost resulted in significant increases in leaf biomass, especially, rhodomyrtone content in both cultivation systems. In the pot cultivation system, the highest rhodomyrtone yield (0.99 mg/mL) was obtained from *R. tomentosa* leaf from plants growing in a soil and coconut coir medium enriched with 1 part of WH compost by volume. In the field cultivation system, the highest rhodomyrtone yield (0.86 mg/mL) was obtained from *R. tomentosa* leaf sampling from plants growing in soil with 1 part of WH added to the soil at the planting period and once every month.
Conclusion: WH compost demonstrated its potential for sustainable cultivation of *R. tomentosa* that can be fruitfully propagated for commercial purposes.

Keywords: Cultivation; Field planting; Potting soil; *Rhodomyrtus tomentosa*; Rhodomyrtone; Water hyacinth compost

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1. Introduction

Eichhornia crassipes (water hyacinth, WH) is perhaps the most harmful aquatic weed in the world due to its negative effect on aquatic ecosystems and associated livelihoods (Wilson et al., 2005). However, WH can be composted into organic matter for soil amelioration. WH is increasingly being used as a source of nutrients either as green manure or compost (Malik, 2007). The use of WH compost on different crops has resulted in improved yields (Gupta et al., 2004).

WH compost can be efficiently used to enhance crop production and restoration of soil health (Osoro et al., 2014) and fertility, mainly due to positive physical, chemical, and biological effects (Najarian & Souri, 2020; Souri & Neumann, 2018; Begum et al., 2021).

WH compost is a rich source of nitrogen (Khan & Sarwar, 2002; Gunnarsson & Petersen, 2007). Use of WH compost resulted in an increase in the morphophysiological parameters of various plants, for example, tomato (Mashavira et al., 2015), cayenne pepper (Safitri et al., 2023), soybean (Ogbuehi & Ibe, 2021), and lettuce (Kumngen et al., 2023).

The addition of water hyacinth-based compost alone can increase plant height, wet weight and dry weight of cayenne pepper plants (Safitri et al., 2023) and can increase plant height and number of leaves of soybean (Ogbuehi & Ibe, 2021).

Rhodomyrtus tomentosa (Aiton) Hassk. (rose myrtle) is a flowering shrub in the family Myrtaceae (Liang et al., 2013). It is native to Southeast Asia, including Thailand (Zhao et al., 2020).

In recent decades, *R. tomentosa* has been recognized as a plant of economic importance, and it also became obvious that this plant species is a source of an extremely valuable natural compound, rhodomyrtone, with interesting chemical profiles (Zhao et al., 2020). Numerous studies have clearly demonstrated that this acyl phloroglucinol derivative can exert extremely potent and broad antimicrobial activity against Gram-positive bacteria (Limsuwan et al., 2011; Limsuwan et al., 2012; Na-Phatthalung et al., 2017; Mordmuang et al., 2019). The antibacterial potency of rhodomyrtone is considered to be comparable to last-line antibiotics in the glycopeptide and lipopeptide groups (Sianglum et al., 2011; Visutthi et al., 2011; Sianglum et al., 2012). Moreover, rhodomyrtone has been shown to inhibit multidrug-resistant (Sianglum et al., 2011; Visutthi et al., 2011; Sianglum et al., 2012), capsule-forming (Mitsuwan et al., 2017), endospore-producing (Voravuthikunchai et al., 2010; Srisuwan et al., 2018), and biofilm-producing (Saising et al., 2015) pathogens. Rhodomyrtone hinders bacterial adhesion to human HaCaT keratinocytes (Srisuwan & Voravuthikunchai, 2017) and a novel antibiotic mechanism of action has been documented for the compound (Saeloh et al., 2018). In addition, rhodomyrtone has demonstrated an anti-proliferative activity against human epidermal keratinocytes (HaCaT cells) (Chorachoo et al., 2016) and emiquimod-induced skin inflammation in mice (Chorachoo et al., 2018). R. tomentosa extract can be applied in cosmeceutical products including anti-acne (Chorachoo et al., 2013).

Rhodomyrtone is an extract from *Rhodomyrtus tomentosa*, which is mainly obtained from the leaves and is used in cosmetic products such as anti-acne (Chorachoo et al., 2013; Wunnoo et al., 2021), oral care products (Limsuwan et al., 2012; Limsuwan et al., 2014), food products (Voravuthikunchai et al., 2010; Odedina et al., 2015), immunomodulatory products (Srisuwan & Voravuthikunchai, 2017; Hmoteh et al., 2018), and antioxidant products (Lavanya et al., 2012). Potential applications as a biocontrol agent for bacterial infections in bovine mastitis (Mordmuang et al., 2019) and streptococcosis in Nile tilapia (Na-Phatthalung et al., 2017; Na-Phatthalung et al., 2018) have been reported. In addition, it is a popular ornamental plant in gardens in tropical and subtropical areas (Zhao et al., 2020). Versatile benefits from this plant species have led to a strong demand for this plant species from manufacturers of pharmaceutical and healthcare products for the treatment, prevention and control of drug-resistant microorganisms and immune-related diseases, as well as ornamental plants. The main concern from the commercial sectors is to maintain a continuous supply of raw material to meet market demands. At present, *R. tomentosa* is mainly found in nature on the east and west sides of the Thai Peninsula. Therefore, the cultivation and propagation of this plant species to concentrate the leaves to obtain the rhodomyrtone, which contributes to sustainable development, is essential.Therefore, WH compost is considered to be suitable for growing leafy plants like *R. tomentosa*. A large quantity of available water hyacinth native to tropical regions could provide enough compost to sustain the cultivation of *R. tomentosa* at a large industrial scale. The main objective of this research was to explore WH compost in the floriculture of *R. tomentosa* to give a high yield of rhodomyrtone for continuous industrial supply to meet the market demands.

2. Materials and methods

2.1. Water hyacinth compost

Water hyacinth (WH) compost was processed using an organic waste composter machine (Bio Axel Co., Ltd., Thailand).

The machine is equipped with a temperature and moisture control system and a shredder for mixing the composting materials.

WH was collected from natural water sources in Hat Yai, Songkhla, Thailand (e.g., irrigation canals and swamps), excluding sewage sources. The biomass was cut into 5–10 cm pieces and fed into the machine, where it was shredded and mixed with a microbial inoculum (superbacteria) formulated in rice bran (Bio Axel Co., Ltd., Thailand).

This inoculum primarily consists of mixed *Bacillus* spp. (*B. subtilis, B. licheniformis*, and other thermotolerant species), which are spore-forming, facultative aerobes capable of producing extracellular hydrolytic enzymes (cellulases, proteases, amylases, and lipases).

The inoculum was added at approximately 10% (w/w) of the total WH biomass, according to the manufacturer's recommendations, to accelerate microbial activity and enhance organic matter decomposition during composting. The composting temperature was maintained at 60 °C with a 50–60% moisture content for 24 h. Subsequently, the compost was stored uncovered until the pile temperature reached ambient conditions, approximately 5–7 days (Kumngen et al., 2023). Before further analyses, the WH compost was characterized following the Thai Agriculture Standards (TAS 9503-2014: Compost), assessing pH, electrical conductivity (EC), organic matter, total nitrogen, total phosphorus, total potassium, carbon-to-nitrogen (C:N) ratio, and heavy metals.

2.2. Effects of water hyacinth compost on Rhodomyrtus tomentosa growth

The experiment was conducted in Rattaphum, Songkhla, Southern Thailand.

The average annual rainfall in the area is 1781.7 mm (https://www.songkhla.tmd.go.th/site/rain/rattaphum) and the daily mean temperature ranges from 23°C at night to 33°C during the day. The mean sunshine is 5.6 h/day. Seedling preparation: Native 3-month-old *R. tomentosa* seedlings were transplanted from forest populations. The collected seedings were grown in nursery bags (3x7 inches) for two months prior to transplantation into 10-inch pots (volume 4500 mL) containing growing medium. Plants were grown with WH compost as a source of nutrients for plant growth. In order to study the effects of WH compost on the growth of *R. tomentosa* and rhodomyrtone yield, two types of cultivation systems were set up as follows.

In a pot cultivation, the control planting material was top soil mixed with coconut coir at a 70:30 ratio v/v. WH compost was mixed with potting soil at various ratios of soil:WH compost (part), ranged from 10:0 to 7:3 (Table 1). The experiment was set up in a completely randomized design (CRD) with three repetitions. Planting materials were mixed volumetrically using a measuring cup, where 1 part had a volume of 450 mL, giving a total volume of planting materials of 4500 mL. In a field cultivation method, plants were placed in holes 30 cm in diameter and 30 cm deep. Each plant was spaced 2 m apart and rows were spaced 1 m apart. Different amounts of WH compost, ranging from 1 to 3 parts were added to the soil (Table 2). The plants were grown for six months (March-September). They were watered every day. In both systems, WH compost was added once a month at the initial ratio.

Table 1. Experiment treatment of *Rhodomyrtus tomentosa* growth using water hyacinth (WH) compost in pots using water hyacinth compost added to the soil initially and every month for three month

Treatment	Planting materials	Soil:WH compost (part)
T1	Soil (70% v/v top soil and 30% v/v coconut coir)	10:0
T2	Soil: WH compost	9:1
T3	Soil: WH compost	8:2
T4	Soil: WH compost	7:3

Note: WH compost 1 part = 450 mL.

Table 2. Experiment treatment of *Rhodomyrtus tomentosa* grown in field using water hyacinth compost added to the soil initially and every month for three month

Treatment	Planting materials	WH compost added (part)
T5	Soil	-
T6	WH compost added	1
T7	WH compost added	2
T8	WH compost added	3

Note: WH compost 1 part = 450 mL.

2.3. Plant growth measurement

Vegetative growth parameters of *R. tomentosa*, including height, number of leaves and numbers of stems were recorded every month (Deepika & Mubarak Ali, 2020). Following the seedling plantation for a period of three months, the leaves were collected monthly (July, August, and September) for rhodomyrtone quantitation. At the same time, soil samples were collected for assessing vegetative growth parameters affecting plant growth, including pH, soil, EC, and nutrient contents (total nitrogen, total phophorus, and total potassium).

2.4. Plant extraction and analysis of rhodomyrtone

R. tomentosa leaves were extracted according to the method of Limsuwan et al. (2012). Briefly, leaves were collected, cleaned with water, and dried at 60°C. Dried leaves were ground to powder, soaked in 95% ethanol (RCI Labscan, Thailand) and kept in darkness for seven days.

The liquid was then filtered and evaporated by rotary vacuum evaporator (Heidolph, Germany). The crude extract was completely dried and dissolved in dimethylsulfoxide (DMSO, Merck, Germany) before analysis. Quantitative determination of rhodomyrtone was performed using high-performance liquid chromatography (HPLC, Agilent 1100, USA) earlier described by Ontong et al. (2023). In brief, aliquots of 20 µL of each sample solution were directly injected into HPLC system with an optimized mobile phase of acetonitrile and 0.1% phosphoric acid in water (70:30, v/v). The HPLC system was operated at a flow rate of 1.2 mL/min. The column temperature was 35°C, and the quantitative detection wavelength was set at 254 nm. The column was equilibrated for 6 min before each run and was saturated with the mobile phase for at least 3 h before each assay. Rhodomyrtone ≥ 95% purity (Sigma, USA) was used as the internal standard for the assay.

2.5. Statistical analysis

The results are shown as mean values with standard deviations.

Homogeneity of variance was assessed using the Levene test, and the normality of distributions using the Shapiro-Wilk test. Analysis of variance (ANOVA), combined with the Tukey honestly significant differences (HSD) test, was used to analyze parametric data, and the Kruskal-Wallis test, combined with the *post hoc* Dunn test, was used to analyze non-parametric data. The significance level was set at 5% ($p < 0.05$) for all tests. Statistical analyses were conducted using the R program version 4.10.

3. Results and discussion

3.1. Water hyacinth compost characteristics

All physiochemical parameters and heavy metal contents of WH compost met the specifications of the Thai Agricultural Standard (TAS 9503, 2014) for Compost (Table 3). The nutrient contents of the WH compost were 2.53% w/w, 1.40% w/w and 1.43% w/w for total nitrogen, total P_2O_5 and total K_2O, respectively. It was found that the WH compost contained the highest amount of nitrogen nutrients suitable for growing plant where foliage is the primary concern. However, heavy metal contentswere of most concerned t since WH can absorb heavy metals present in wastewater (Mashavira et al., 2015). The compost used in this study contained permissible levels of arsenic, cadmium, chromium, copper and lead, according to TAS 9503 (2014) Compost-and quality standards in European countries where compost regulations exist (Brinton, 2000). WH compost was therefore safe for use to increase crop yield without exposing consumers to heavy metal toxicity.

3.2. Physico-chemical properties of soil before and after treatments

Environmental parameters including pH, EC, and phytoavailbility of total nitrogen (N), total phosphorus (P_2O_5) and total potassium (K_2O) were determined from soil in both types of planting conditions before and after treatments. All soil nutrient values were higher in the pot cultivation method than the field cultivation method (Table 4).

In pot cultivation symtem, the nutrients in the WH compost remained in the pots. The population of microorganisms helped with decomposition and fixed the remaining nitrogen in the soil (Sun et al., 2020). On the other hand, in the field cultivation system, nutrients were dispersed over a large area after watering. WH compost was reported to increase physical, and biological nutrient retention and the cation exchange capacity of soil in rice fields and reduce the effects of over-fertilization by the slow release of nutrients (Khan & Sarwar, 2002). The slight increases in soil pH we observed in all WH compost treatments were due to the alkalinity of WH compost. However, the growing medium pH still remained at a level suitable for plant growth (Frohlich, 2012). Soil EC does not directly affect plant growth, but, it is an indirect indicator of nutrient availability for plant uptake and salinity levels. The soil or medium EC is one of the determinants of soil fertility and plant growth, as generally low EC of soil or irrigation water is always preferred (Ahmadi & Souri, 2021; Serri et al., 2021).

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Table 3. Physicochemical characteristics of water hyacinth compost

Parameter	Criteria of TAS 9503-2014 Compost*	Water hyacinth compost	Testing method
pH	Not configured standard	8.04	AOAC (2019), Method 973.04
Total nitrogen	≥ 1.0 %w/w	2.53	AOAC (2019), Method 955.04
Total P_2O_5	≥ 0.5 %w/w	1.40	AOAC (2019), Method 958.01
Total K_2O	≥ 0.5 %w/w	1.43	AOAC (2019), Method 983.02
Organic matter, OM	≥ 20 %w/w	66.31	AOAC (2019), Method 967.05
C/N Ratio	≤ 20:1	15:1	BS 7755 (1995)
Electrical Conductivity, EC	≤ 10 ds/m	3.42	BS EN 13038 (2000)
Particle size ≤ 12.5x12.5 mm.	100 %w/w	100	CATM 01 (2000)
Rock and Gravel, size ≥ 5 mm.	≤ 2 %w/w	Not detected	CATM 01 (2000)
Moisture content	≤ 30 %w/w	9.18	AOAC (2000), Method 950.01
Plastic, glass, sharp material and other materials	Not detected	Not detected	CATM 01 (2000)
Arsenic	≤ 50 mg/kg	6.211	AOAC (2019), Method 999.10
Cadmium	≤ 5 mg/kg	0.292	AOAC (2019), Method 999.10
Chromium	≤ 300 mg/kg	16.29	AOAC (2019), Method 999.10
Copper	≤ 500 mg/kg	9.087	AOAC (2019), Method 999.10
Lead	≤ 500 mg/kg	1.334	AOAC (2019), Method 999.10
Mercury	≤ 2 mg/kg	Not detected	AOAC (2019), Method 999.10

Table 4. Soil physicochemical properties before and after plantation of native three-month-old *Rhodomyrtus tomentosa* seedlings in pot and field cultivation systems

Cultivation system	pH		EC (dS/m)		Total Nitrogen (% w/w)		Total P_2O_5 (% w/w)		Total K_2O (% w/w)	
Pot	Before	After	Before	After	Before	After	Before	After	Before	After
T1	5.62 ±0.05	6.50 ±0.01	0.0074 ±0.001	0.0193 ±0.011	0.12 ±0.01	0.08 ±0.02	0.02 ±0.01	0.03 ±0.01	0.05 ±0.02	0.06 ±0.01
T2	6.26 ±0.01	6.68 ±0.01	0.0117 ±0.011	0.0496 ±0.021	0.14 ±0.02	0.22 ±0.01	0.03 ±0.01	0.10 ±0.02	0.10 ±0.02	0.08 ±0.01
T3	6.27 ±0.03	6.44 ±0.06	0.0177 ±0.009	0.0322 ±0.013	0.19 ±0.01	0.24 ±0.01	0.04 ±0.01	0.08 ±0.02	0.11 ±0.02	0.08 ±0.01
T4	6.71 ±0.02	6.65 ±0.01	0.0207 ±0.019	0.0316 ±0.017	0.22 ±0.01	0.26 ±0.03	0.06 ±0.02	0.11 ±0.03	0.16 ±0.03	0.07 ±0.01
Field	Before	After	Before	After	Before	After	Before	After	Before	After
T5	6.02 ±0.05	7.10 ±0.02	0.0758 ±0.010	0.0610 ±0.015	0.06 ±0.03	0.04 ±0.01	0.02 ±0.01	0.01 ±0.02	0.01 ±0.01	0.01 ±0.01
T6	6.05 ±0.04	6.78 ±0.04	0.0117 ±0.001	0.0109 ±0.022	0.08 ±0.01	0.08 ±0.02	0.02 ±0.01	0.03 ±0.02	0.01 ±0.01	0.01 ±0.01
T7	6.12 ±0.01	6.44 ±0.04	0.0197 ±0.009	0.0143 ±0.022	0.10 ±0.02	0.08 ±0.01	0.02 ±0.01	0.08 ±0.01	0.02 ±0.01	0.02 ±0.01
T8	6.42 ±0.08	6.18 ±0.01	0.0288 ±0.011	0.0253 ±0.017	0.05 ±0.01	0.14 ±0.02	0.02 ±0.01	0.06 ±0.02	0.03 ±0.01	0.01 ±0.01

Note: T1–T4 represent *R. tomentosa* planted under the pot cultivation system. The total substrate volume in each pot was 4500 mL. Treatments: T1 (control) = topsoil + coconut coir; T2 = soil:WH compost = 9:1; T3 = soil:WH compost = 8:2; and T4 = soil:WH compost = 7:3. T5–T8 represent *R. tomentosa* planted under the field cultivation system. Different volumes of water hyacinth (WH) compost were applied to the soil at planting and once every month thereafter. Treatments: T5 = soil only; T6 = soil + 1 part WH compost; T7 = soil + 2 parts WH compost; and T8 = soil + 3 parts WH compost (1 part = 450 mL).

A low EC can severely affect plant health and yields (Samarakoon et al., 2006). A high EC, on the other hand, can increase the osmotic pressure of the nutrient solution. As a result, nutrients are wasted and leach into the environment, causing pollution.

In this field study, EC values in all WH compost treatments remained much lower than 2 throughout the study period, indicating that the growing media were not salty and therefore the EC of each medium produced no effects on the growth of *R. tomentosa*.

3.3. Growth characteristics of *R. tomentosa*

After six months of cultivation, the growth characteristics of *Rhodomyrtus tomentosa* were evaluated in terms of plant height, number of stems, and number of leaves. The overall growth performance did not differ between pot and field cultivation systems (Figures 1 and 2), indicating that the native species can be successfully grown under both conditions. Statistical analysis revealed no significant differences in plant height and number of stems between the two cultivation methods ($p > 0.05$).

However, the plants treated with WH compost produced significantly more leaves compared to the plants grown without the addition of compost ($p < 0.05$) (Table 5).

These results are consistent with those of Ogbuehi & Ibe (2021), who demonstrated that soybean plants increased in both plant height and leaf number with increasing addition of WH compost.

The increased leaf production observed in the present study is likely related to nitrogen enrichment by WH compost.

Farag et al. (2013) emphasized that nitrogen is an essential macronutrient that accelerates leaf development, which in turn increases photosynthetic capacity.

Water hyacinth itself has been shown to be a rich source of nitrogen, containing up to 3.2% of its dry matter (Gunnarsson & Petersen, 2007) and generally having a favorable carbon-to-nitrogen ratio (C:N) of 8 to 15 (Khan & Sarwar, 2002; Gunnarsson & Petersen, 2007). Nitrogen availability is widely recognized as a limiting factor for plant growth and productivity in both natural and agricultural ecosystems.

Adequate nitrogen supply stimulates chlorophyll synthesis, leaf expansion, and biomass accumulation, which ultimately improves plant performance (Saghayesh et al., 2019; Souri et al., 2009).

The present results confirm that WH compost is a valuable source of nitrogen that leads to improved leaf production in *R. tomentosa*.

This not only supports sustainable cropping practices by recycling organic waste but also promotes the growth of a native species with ecological and pharmacological importance.

Figure 1. Growth characteristics of *Rhodomyrtus tomentosa* grown under the pot cultivation system

Native 3-month-old seedlings were initially raised in topsoil mixed with coconut coir at a 7:3 ratio (v/v).

Plants were subsequently cultivated in pots containing the same soil–coconut coir mixture (7:3, v/v) supplemented with one, two, or three parts of water hyacinth (WH) compost (1 part = 450 mL). The total substrate volume in each pot was 4500 mL. Treatments were as follows: T1 (control) = topsoil + coconut coir; T2 = soil:WH compost = 9:1; T3 = soil:WH compost = 8:2; and T4 = soil:WH compost = 7:3. The experiment was conducted for three months.

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Figure 2. Growth characteristics of *Rhodomyrtus tomentosa* grown under the field cultivation system
Native 3-month-old seedlings were initially raised in topsoil mixed with coconut coir at a 7:3(v/v) ratio.
Plants were then transplanted into field soil and cultivated for three months. Water hyacinth (WH) compost was applied at planting and subsequently once per month. Treatments were as follows: T5 = soil only; T6 = soil + 1 part WH compost; T7 = soil + 2 parts WH compost; and T8 = soil + 3 parts WH compost (1 part = 450 mL).

Table 5. Growth characteristics of *Rhodomyrtus tomentosa* after 3 months under pot and field cultivation systems

Cultivation system	Treatment	Plant height (cm)	Number of stems/branches	Number of leaves
Pot	T1	4.67 ± 0.67^{a}	0.72 ± 0.25^{a}	10.72 ± 5.36^{a}
	T2	6.56 ± 1.75^{a}	3.00 ± 0.58^{b}	33.33 ± 4.09^{b}
	T3	7.56 ± 0.76^{a}	4.33 ± 1.62^{b}	36.67 ± 4.62^{b}
	T4	5.56 ± 2.05^{a}	3.67 ± 1.21^{b}	43.00 ± 10.85^{b}
Field	T5	5.67 ± 1.44^{a}	1.17 ± 0.29^{a}	7.83 ± 2.34^{a}
	T6	3.83 ± 0.58^{a}	0.89 ± 0.10^{a}	11.22 ± 1.12^{a}
	T7	4.56 ± 1.39^{a}	2.06 ± 0.62^{ab}	11.72 ± 2.42^{a}
	T8	6.17 ± 1.35^{a}	1.67 ± 0.42^{ab}	9.67 ± 1.75^{a}

Values are presented as mean ± SD (n = 3). Different superscript letters within the same column indicate significant differences at $p < 0.05$ (Tukey's HSD test). Treatments: T1 (control) = topsoil + coconut coir; T2 = soil:WH compost = 9:1; T3 = soil:WH compost = 8:2; T4 = soil:WH compost = 7:3; T5 = soil only; T6 = soil + 1 part WH compost; T7 = soil + 2 parts WH compost; and T8 = soil + 3 parts WH compost (1 part = 450 mL). The experiment lasted for three months.

3.4. Effects of planting system on rhodomyrtone yield

In the pot cultivation system, the rhodomyrtone yield was significantly higher in leaves in treatment T4 (3 part WH compost by volume) sampling in August (0.99±0.19 mg/mL) and September (0.42±0.04 mg/mL) (Figure 3). In field cultivation system, the rhodomyrtone yield was significantly higher (P<0.05) in leaves in treatment T6 (1 part WH compost) sampled in August (0.86±0.16 mg/mL) (Figure 4). WH compost can increase leaf yield with increased rhodomyrtone content, as organic fertilizers can increase the number of leaves on a plant and increase the production of plant secondary metabolites (Weibel et al., 2000).

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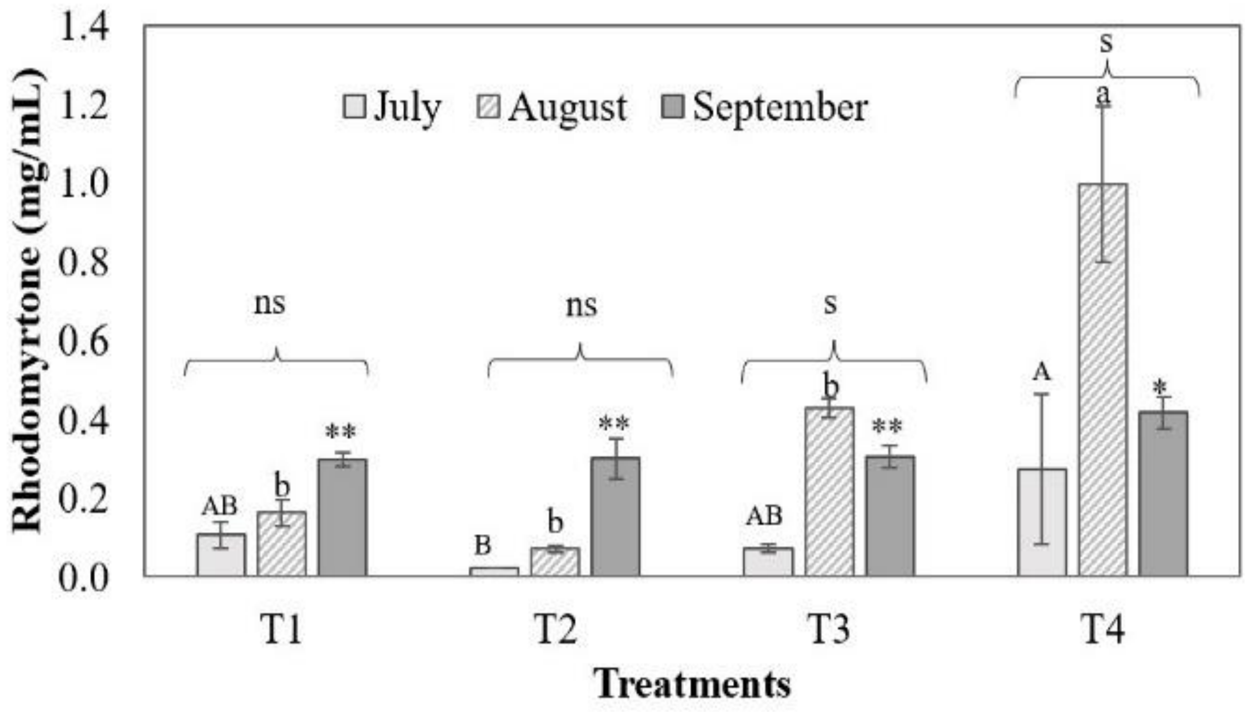

Figure 3. Quantitative analysis of rhodomyrtone in *Rhodomyrtus tomentosa* leaves collected in July, August, and September from plants grown under the pot cultivation system

Treatments: T1 (control) = topsoil + coconut coir; T2 = soil:WH compost = 9:1; T3 = soil:WH compost = 8:2; and T4 = soil:WH compost = 7:3. One part of WH compost = 450 mL.

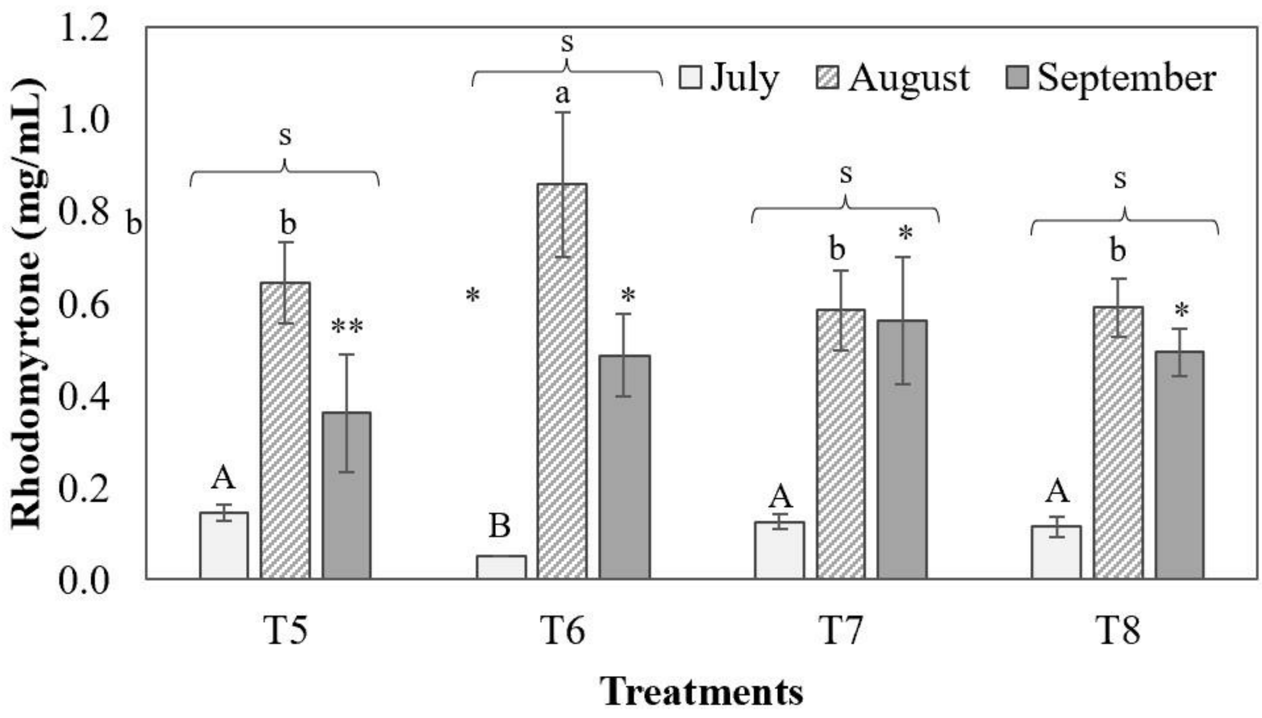

Figure 4. Quantitative analysis of rhodomyrtone in *Rhodomyrtus tomentosa* leaves collected in July, August, and September 2022 from plants grown under the field cultivation system

Water hyacinth (WH) compost was applied to the soil at planting and once every month thereafter. Treatments: T5 = soil only; T6 = soil + 1 part WH compost; T7 = soil + 2 parts WH compost; and T8 = soil + 3 parts WH compost (1 part = 450 mL).

4. Conclusion

The growth characteristics of *Rhodomyrtus tomentosa* plants cultivated in the pots and in the field did not differ, indicating that this native plant can be successfully grown in the pots.

Growing the plants with water hyacinth compost resulted in significant increases in the numbers of leaves and especially, rhodomyrtone content in both cultivation systems. In pot cultivation system, the highest rhodomyrtone yield (0.99 mg/mL) was obtained from *R. tomentosa* leaves from plants growing in a soil and coconut coir medium enriched with 30% WH compost by volume.

In the field cultivation system, the highest rhodomyrtone yield (0.86 mg/mL) was obtained from *R. tomentosa* leaf sampled from plants growing in soil with 10% WH compost added to the soil at planting and once every month.

Our findings provide useful information on the cultivation of *Rhodomyrtus tomentosa* with WH compost as a commercial and ornamental plant. Growing the plants with WH compost resulted in significant increases in leaf biomass and rhodomyrtone content in both cultivations.

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Authors Contribution

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by all authors. The first draft of the manuscript was written by J. Iewkittayakorn and S.P. Voravuthikunchai edited the manuscript. All authors read and approved the final draft.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Conflict of interests

The authors declare that they are no conflict of interest associated with this study.

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