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Preference for *Molineria latifolia* var. megacarpa and *Rhodomyrtus tomentosa* as Native Urban Landscape Plants

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ABSTRACT

Factors influencing the perception of landscapes have been the subject of research in the last 40 years. Indigenous and native plants are commonly restricted to informal or naturalistic designed landscapes. This research project investigates the use of native plants as a formal landscape element. As the world is becoming more urbanized (United Nations, 2010), gardens are becoming an increasingly important contributor to people's health and well-being (Dunnett & Qasim, 2000). The research has highlighted some elements that tend to affect visual preferences. This paper discusses a study conducted to determine preferences of Malaysian landscape professionals and students in landscape architecture and horticulture on two native ornamental plants, *Molineria latifolia* var. megacarpa (Lemba) and *Rhodomyrtus tomentosa* (Kemunting), that are grown in soilless media with the potential for use in urban landscapes. Participants of this study comprised of landscape architects (20 respondents), architects (20), nursery owners (20), Bachelor of Horticulture students (80) (Faculty of Agriculture, UPM), and Bachelor of Landscape Architecture students (80 respondents) (Faculty of Design and Architecture, UPM), with a total of 220 respondents. Data collected were analyzed through descriptive analysis, Chi square and reliability test using SPSS. Results indicated that 88.2% of the respondents agreed that *Molineria latifolia* var. megacarpa (Lemba) could be a potential urban landscape plant, while 92.7% of them agreed that *Rhodomyrtus tomentosa* (Kemunting) could be domesticated, and is therefore a

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potential urban landscape plant. Majority of the respondents (49% to 55%) preferred the plants grown individually, while others (40% to 49%) preferred both plants in the form of mass planting. Meanwhile, using the Likert's Scale, about half (50% to 52%) of the amateurs and professionals of the landscape field rated 4 (Like) for both the plants, whereas 10% to 15% of them marked 5 (Extremely Like) to show their acceptance towards the two new native plants. This finding indicates bright future for the two undomesticated wild native plants to be used as urban landscape plants. Thus, it is concluded that *Molineria latifolia* var. megacarpa (Lemba) and *Rhodomyrtus tomentosa* (Kemunting) grown in soilless media have a high potential to become urban, native landscape plants.

Keywords: Landscape preferences, Native plants, Urban landscape plants

INTRODUCTION

The Council of Europe (2000) defines a landscape as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Article 1); in parts of the world dominated by humans, landscape design can have significant environmental effects. The aggregate effects of private landscapes can influence habitat and water quality, among other environmental attributes. Nassauer (1993) has found that yards incorporating native plants can be as attractive, or even more attractive, to homeowners as conventional yards that do not include native plants. Gardens are the cumulative result of many individual decisions about plant choice over time that combine to determine the social and biophysical benefits provided.

Factors influencing the perception of landscape have been the subject of a great deal of research during the past 40 years. The research has highlighted some elements that tend to affect visual preferences. In general, natural landscapes are preferred over urban ones (Kaplan & Kaplan, 1989) in the urban areas as natural elements improve landscape quality (Matsuoka & Kaplan, 2008). Lyons (1983) analyzed the landscape preferences of subjects of different ages (children, adolescents, and adults) and concluded that culture plays a very important role in the perception of landscape. The perception of landscape tends to differ on the basis of social group, job type, familiarity, age, and other factors (Herzog *et al*., 2000; Kaltenborn & Bjerke, 2002).

Native plants are commonly restricted to informal or naturalistic designed landscapes. However, this study investigated the use of native plants as a formal landscape element. The goal of this study was to determine preferences of Malaysian landscape professionals and students in landscape architecture and horticulture for two native test plants, *Molineria latifolia* var. megacarpa (Lemba) and *Rhodomyrtus tomentosa* (Kemunting) grown in soilless media. Currently, the two plant species are lesser known as landscape plants in the urban areas. The use of native plants is highly encouraged to create sustainable

urban landscapes. Positive preferences for these plants will add to the palette of existing native plants that are available to landscape designers in the tropical regions of the world.

MATERIALS AND METHOD

Test Plants

a. Rhodomyrtus tomentosa (Kemunting)

Rhodomyrtus tomentosa is a flowering plant from the family Myrtaceae, which is native to southern and south eastern Asia, east southern of China, Taiwan, the Philippines, as well as south Malaysia and Sulawesi. It grows in coastal areas, natural forests, riparian zones, wetlands, as well as moist and wet forests that are from sea level up to 2400 m elevation (Flora of China Editorial Committee, 2007).

Botanical Description

It is an evergreen shrub growing up to 4 m tall. The leaves are opposite, leathery, 5-7 cm long and 2-3.5 cm broad, three-veined from the base, oval, obtuse to sharp pointed at the tip, glossy green above, densely grey or rarely yellowish, hairy beneath, with wide petiole and entire margin. The flowers are solitary or in clusters of two or three, with about 2.5-3 cm in diameter and have five petals which are tinged white outside with purplish-pink or all pink. Fruit is a globose, few-seeded berry to 1.3 cm (0.5 in) across, dark purple and with sweet, aromatic flesh. Its edible fruit is about 10-15 mm in length, which is round and purple with three or four-celled and capped with persistent soft calyx lobes, with 40-45 seeds in a double row in each cell; seed dispersal is by frugivorous birds and mammals (Long & Lakela, 1971). Meanwhile, seed production and germination rates are high. It is a very showy shrub when in bloom and the prospects for its use as an ornamental plant are better than for its role as a fruit crop (Latiff, 1992).

b. Molineria latifolia var. megacarpa. (Lemba)

Botanical Description

Molineria latifolia var. megacarpa is from the Hypoxidaceae family. It is a herbaceous plant that grows in a relatively large group. It has simple leaves that are green, hard or strong, and oval. The shape of the leave is oblong and with 30 – 100 cm x 5cm in length and width. They have numerous parallel primary veins. The leafstalks are about one-third the length of its leaves, overlapping with one another at their bases to form a thick stem. The leaves are very tough, thin and broad (Keng, 1983). Inflorescence is ovoid to cylindrical, compact, 2-6 cm x 2-6 cm, bracts 1 - 6cm long, has green colour and white yellow or dark pink petals, fruit ovoid, and white to green tiny seeds and sweet (Shaari, 2005).

Cultivation and Management

This plant is cultivated through vegetative propagation. Cutting propagation utilizes a portion of the stem, root, or leaf that is cut from the parent or stock plant and induced to form roots and shoots by

chemical, mechanical, and environmental manipulation (Hudson, *et al.*, 2002).

Case Study Area

The study was conducted through a survey at nurseries located in the Klang Valley and Muar, Johor. Two nurseries chosen were Sungai Buloh, Selangor plant nurseries as well as Parit Jawa and Parit Sulung plant nurseries in Muar, Johor. Sungai Buloh was chosen because it has the most number of nurseries that are centralized in one area, i.e. in the Klang Valley. It is also a centre for plant-shopping to growers, garden-lovers and many home-owners around the Klang Valley, while nurseries in Muar area are selected due to their reputation as plant exporters to Singapore and they are also specializing in mass planting of landscape plants and are suppliers to many municipal councils and landscape companies throughout Malaysia.

The survey was conducted in architect and landscape architect firms in Petaling Jaya, Shah Alam, Subang Jaya and Kuala Lumpur. The two professions are considered as the professionals of their field, and thus, surveys were carried out to get their professional opinions on the two new, native and potential test plants.

The survey was also conducted with students of Bachelor of Horticulture Science at the Faculty of Agriculture and students of Bachelor of Landscape Architecture at the Faculty of Design and Architecture, Universiti Putra Malaysia, Serdang, Selangor as they have relevant background, exposure and knowledge on plant botanical perspectives and plant aesthetical values.

Survey Design

Pictorial Stimuli

A photo-questionnaire with photographs of *Molineria latifolia* var. megacarpa (Lemba) and *Rhodomyrtus tomentosa* (Kemunting) was utilized in the survey. Over the last 20 years, there have been numerous developments in visualization tools, design processes and techniques that assess landscape preferences (Wherrett, 1999; Yamashita, 2002). In addition to other methods such as onsite surveys or slide projection, the use of photos in landscape preference studies has become generalized. The use of photos is extremely appealing as they show landscape in a holistic way (Hagerhall, 2001); photos also provide visual stimuli that closely assemble the real-life experience of the landscape. The use of photos is generally favoured because they enable larger samples of observers and judgments made based photo surveys are close (with a correlation of 80% or more) to those from on-site surveys (Natori & Chenoweth, 2008). Therefore, the assumption can be made that photos are capable of providing stimuli that enable the mind to associate sensory information with other knowledge and thus form opinions about what is perceived through intuitive recognition of an aesthetic quality (Bell, 2001).

Questionnaire

The questionnaire consisted of 13 items, in which the respondents were asked about their understanding of native plants and familiarity with the two plants, preferences for the different parts of the plants, as well as functional and economic values of the plants. In addition, the questionnaire also elicited the demographic information of the respondents such as age, gender and profession. Responses were either rated by using the Likert-like scale (1 = Extremely unlike to 5 = Extremely like) or by ticking the most appropriate answers.

Target Groups

The target groups in this survey are landscape architects (20 respondents), architects (20 respondents), nursery owners (20 respondents), horticulture students (80 respondents), landscape architecture students (80 respondents), making it a total of 220 respondents (n=220).

Survey Procedure

This survey method (pair-wise comparison) had previously been used to the study of relationships between landscape preferences and personal factors (Ruiz & Bernaldez, 1983; Abello & Bernaldez, 1986). According to the previous literature cited, this method presents three main advantages: the possibility of using a great number of photographs, simple and fast on-site application, and its methodological approach is based on the exploration of preference differences or contrasts among parts of the studied population. Presented with a collection of 50 mm x 60 mm photos of test plants in an album or power point presentation, the respondents were asked to complete the questionnaire based on the pictorial stimuli.

The survey was conducted in four months, i.e. from August to December 2012. Three methods were applied during the survey. First, emails consisting of the questionnaire and pictorial stimuli in Microsoft Presentation format were sent with the intention to make the survey process easier, faster and paperless. It is also technology savvy and pictorial stimuli materials can be viewed very clearly by the target groups. This method was applied to Architect and landscape architects.

The second method was to interview respondents in the target groups and to get them answer the questions based on the printed pictorial stimuli. The survey was done within one interview session with the nursery owners. As the nurseries are centralized, the process was done much faster and it was easier to achieve the maximum number of target groups. This method was mainly applied to nursery owners, with one session done in Sungai Buloh, Selangor and another session in Muar, Johor. All the nursery owners participated and responded positively to the questions forwarded to them and they were also willing to spare some of their time to partake in the survey.

The last method made use of survey that was done through answering session in a class where the target groups were gathered in a room and they were provided

with the questionnaires with pictorial stimuli projected on white screen. The respondents answered based on the pictures of the two native test plants *Molineria latifolia* var. megacarpa (Lemba) and *Rhodomyrtus tomentosa* (Kemunting). This survey was conducted in 4 different sessions of 4 different cohorts.

Session one was done with the first-year students of Bachelor of Horticulture Science, while the second session involved the third-year students of Bachelor of Horticulture Science from the Faculty of Agriculture. The third session was conducted with the first-year students of Bachelor of Landscape Architecture and the final session involved the final year students of Bachelor of Landscape Architecture from the Faculty of Design and Architecture, Universiti Putra Malaysia, Serdang, Selangor. The sessions were carried out on different days. The students involved indicated their willingness to participate in the survey and to answer the questionnaire with some help from their lecturers and tutors (see Fig.1 – Fig.9).

Data Analysis

Variables and Statistical Method

Results from the survey were analyzed using Reliability test, Descriptive analysis and Chi Square using SPSS Version 16 Equinox. Frequency and descriptive statistics were employed to describe the demographic characteristics of the respondents. Analysis of these data indicated that a wide cross section of the respondents responded to the questionnaire.

The responses were subsequently quantified and analyzed using the SPSS software package. Qualitative data coding was conducted in an inductive manner or with no predetermined categories but they were defined on the basis of the survey results, with key response themes identified

Fig.1: Whole plant of *Rhodomyrtus tomentosa* (a)

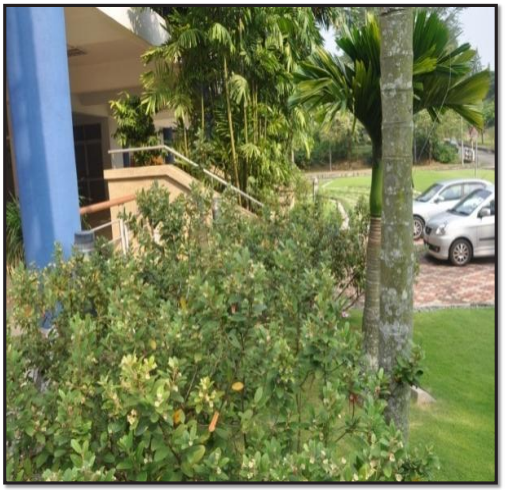

Fig.2: Whole plant of *Rhodomyrtus tomentosa* (b)

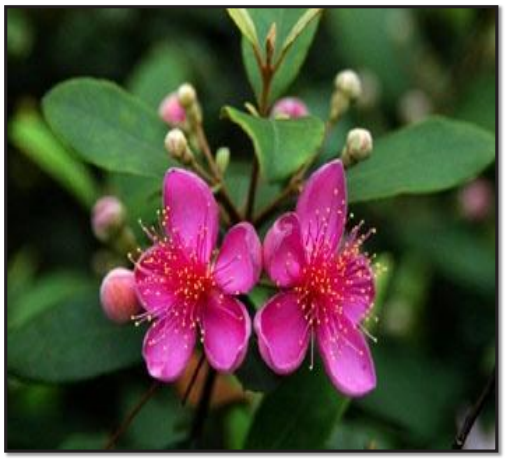

Fig.3: *Rhodomyrtus tomentosa* Flowers (a)

Fig.4: *Rhodomyrtus tomentosa* Flowers (b)

Fig.5: *Rhodomyrtus tomentosa* Buds (a)

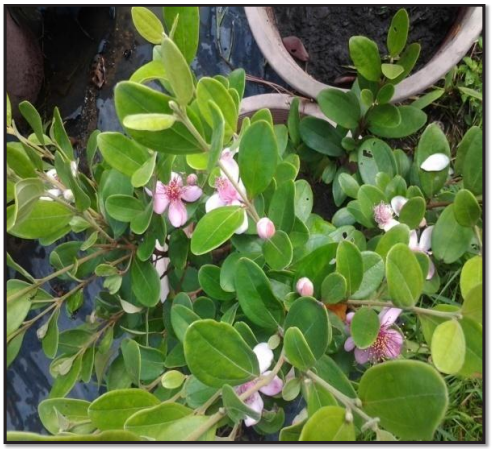

Fig.6: *Rhodomyrtus tomentosa* Buds (b)

Fig.7: *Rhodomyrtus tomentosa* Fruits (a)

Fig.8: *Rhodomyrtus tomentosa* Fruits (b)

Fig.9: *Rhodomyrtus tomentosa* Fruit (c)

from the open-ended descriptions given by respondents. Descriptive statistics revealed different trends depending on the parameters.

Reliability Test

Reliability test is an indicator of consistency which shows how stable a test score or data is across applications or time. In this study, the Cronbach's Alpha was used to measure how closely related a set of items are as a group. The lower the errors caused, the higher the reliability of the instrument would be (Kumar, 1999). Therefore, any Cronbach's Alpha value that is greater than 0.60 indicates consistency among the theories. The Cronbach's Alpha value for the respondents' opinion towards *Molineria latifolia* var. megacarpa was 0.708, and this means there is consistency among the model fit for this study (Table 1).

Table shows the reliability test for R*hodomyrtus tomentosa* (Kemunting). The Cronbach's Alpha value for the respondents' opinion towards R*hodomyrtus tomentosa* (Kemunting) is 0.714, indicating the consistency among the theories (Table 1).

TABLE 1
Reliability Test for *Molineria latifolia* var. *megacarpa* (Lemba) and *Rhodomyrtus tomentosa* (Kemunting)

Test Plant	Cronbach's Alpha	N of Items
Molineria latifolia var. megacarpa (Lemba)	0.708	6
Rhodomyrtus tomentosa (Kemunting)	0.714	6

RESULTS AND DISCUSSION

Descriptive Analysis

Yu (1995) found living environment (urban or rural) and education level could significantly affect landscape preferences. Landscape preferences have also been found to differ with age (Balling & Falk, 1982; Lyons, 1983; Zube *et al*., 1983). In particular, it has been shown that the preferences of

children can vary significantly to that of adults. The above table shows the socio-demographic profile of the respondents in the target groups. There were 58.2% female respondents as compared to only 41.8% males for *Molineria latifolia* var. megacarpa (Lemba) and 33.6% male and 66.4% female respondents for the R*hodomyrtus tomentosa* (*K*emunting) survey. The ratio of the female respondents is slightly more compared to that of the male respondents. Age-wise, most of the respondents are between the age of 21-25 year old, with 34.5% and 40%, respectively.

This age category consists of Bachelor of Horticulture Science or Landscape Architecture students as the respondents. They were given pictorial stimuli to be evaluated based on their perception and preferences of the respective native test plants. Meanwhile, the other age groups (26 to 40 year old and above 40 years) comprised of students, nursery owners, architects and landscape architects. As mentioned before, the largest respondent group of this survey comprised of Bachelor of Horticulture or Landscape Architecture or Agriculture students of Universiti Putra Malaysia, with 49.1% for *Molineria latifolia* var. megacarpa (Lemba) and 45.4% for R*hodomyrtus tomentosa* (*K*emunting), followed by nursery owners in the Klang Valley area as well as in Muar, Johor, with 26.4% and 27.3% respectively (Table 2).

Ranking of Preferences

According to the ranking made by the respondents, the part of the plants that they found most attractive for *Molineria latifolia* var. megacarpa (Lemba) was the leaves (80.9%), while many others (88.2%) agreed that the flowers of R*hodomyrtus tomentosa* (Kemunting) were the most attractive part of the plant. This is quite obvious because

TABLE 2
Socio-demographic profile of the respondents (n=220)

	***Molineria latifolia* var. megacarpa (%)**	***Rhodomyrtus tomentosa* (%)**
Gender		
Male	41.8	33.6
Female	58.2	66.4
Age		
19-20	28.2	21.8
21-25	34.5	40.0
26-40	16.4	13.6
above 40	20.9	24.5
Category		
Landscape architect	14.5	18.2
Architect	10.0	9.1
Nursery owners	26.4	27.3
Landscape architecture /Horticulture student	49.1	45.4

the flowers of R*hodomyrtus tomentosa* (kemunting) are more attractive as opposed to those of the *Molineria latifolia* var. megacarpa (Lemba) which grew at the basal stem of the plant, making it harder to see them (see Fig.10 - Fig.14).

Most of the respondents (64.5%) agreed that *Molineria latifolia* var. megacarpa (Lemba) is mostly suitable as a potted plant, while the majority of the respondents (58.2%) agreed that R*hodomyrtus tomentosa* (Kemunting) is best planted as border planting plant. Meanwhile, 78%-88% of the respondents also agreed that both the plants have high aesthetic values, and 52%-62% others agreed that both plants have commercial values. These findings depicted that the two test plants are high in value and have the potential as landscape plants.

This research is based on Nassauer's past research (1992, 1993, 2004) on the cultural sustainability of ecological design. According to this theory, ecologically landscape designs that also are valued for their appearance are more likely to exist over the long term in a human-dominated landscape. Using digital simulations depicting residential landscapes with varying degrees of these characteristics, Nassauer (1993) found that "care," "neatness," and "naturalness" were significant predictors for the attractiveness of landscape designs, some of which included native plants in residential and urban yards (see Tables 3-5).

Fig.10 : *Molineria latifolia* var. *megacarpa* Whole plant (a)

Fig.11 : *Molineria latifolia* var. megacarpa Whole plant (b)

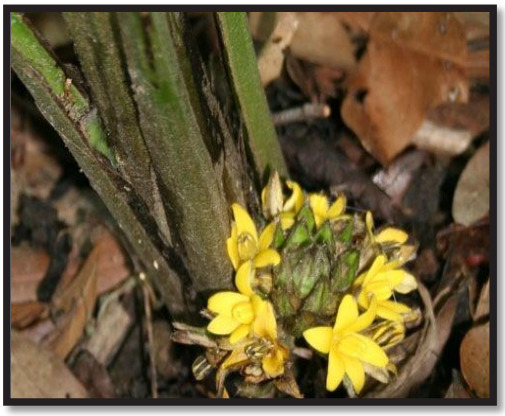

Fig.12 : *Molineria latifolia* var. megacarpa Flower (grown on basal stem) (a)

Fig13: *Molineria latifolia* var. megacarpa Flower (grown on basal stem) (b)

Fig.14: *Molineria latifolia* var. megacarpa Fruit

TABLE 3
Ranking of Preference - Which part of the plant you found most attractive?

	Molineria latifolia var. megacarpa (%)	*Rhodomyrtus tomentosa* (%)
Leaves	**80.9**	19.1
Flower	39.1	**88.2**
Stem	0.9	1.8
Fruits	6.4	14.5

TABLE 4
Ranking of Preference - In your opinion, this plant is most suitably planted as:

	Molineria latifolia var. megacarpa (%)	*Rhodomyrtus tomentosa* (%)
Potted plant	**64.5**	54.5
Ground cover plant	25.5	21.8
Indoor plant	55.5	13.6
Border planting plant	26.4	**58.2**
Other: The ground itself	0.9	0

TABLE 5
Ranking of Preference - What do you think are the prominent values of the plants?

	Molineria latifolia var. megacarpa (%)	*Rhodomyrtus tomentosa* (%)
Aesthetic values	**78.2**	**88.2**
Commercial values	61.8	52.7
Medicinal values	18.2	7.3
Edible values	20.0	24.5
Other	0	1.8

Chi Square Results

Hypothesis

Analysis of Chi Square was done using SPSS Equinox version 16.0 and the results depicted the relationship between respondents' demographic profile and a few variables with the following hypotheses:

H_o: There is no relationship between the public's perception on this plant and socio-demographic profiles of consumers such as gender, age and category.

H_1: There is relationship between the public's perception on this plant and socio-demographic profiles of consumers such as gender, age and category.

Landscape aesthetics is a complex issue, the basis of which can be found in human biological make-up and cultural experience (Appleton, 1975; Kaplan, 1987; Bourassa, 1990). The influence of individuals' personalities has been suggested as another important factor in understanding landscape aesthetics. The first analysis was the relationship between demographic profile and respondent's knowledge of *Molineria latifolia* var. megacarpa (Lemba) and *Rhodomyrtus tomentosa (*Kemunting). The only variable that failed to accept H_o was the profession variable of the respondents. This finding showed that the amateurs, i.e. degree students have less knowledge about the plants as compared to the professionals in the field.

Meanwhile, the relationship between demographic profile and respondents' perception towards both the plants also showed that the variable of profession had failed to accept H_o, and this was particularly due to the landscape architects' perception of the test plants. In more specific, the landscape architects were found to be rather sceptical about the ability of the test plants to be used as urban landscape plants. This is due to the growth of the plants or the probability of customers buying this new test plants or the issue of familiarity or knowledge of the plants which remains arguable.

However, the relationship between respondents' demographic profile and suitability of the plants as urban landscape plants provides different feedback for *Molineria latifolia* var. megacarpa (Lemba). two variables, namely gender and profession, failed to accept H_o. The female respondents showed lower percentage for using *Molineria latifolia* var. megacarpa (Lemba) as a landscape plant and this was most likely due to the lack of aesthetic value on the flowers as compared to the leaves as they are big. As for the profession category, nursery owners did not seem to agree that *Molineria latifolia* var. megacarpa (Lemba) had the potential to be used as urban landscape plant in the near future, with more or less the same reason, i.e. lacking commercial values as compared to *Rhodomyrtus tomentosa* (Kemunting). Based on this finding, it could be concluded that *Molineria latifolia* var. megacarpa (Lemba) is not popular amongst landscape

plant growers and nursery owners are also not interested in selling this particular plant. Thus, there is a lack of supply for this native test plant in the landscape plants market.

For *Rhodomyrtus tomentosa* (Kemunting), those who did not accept H_o involved those who are landscape architects. In particular, they did not agree that this plant is suitable for urban landscaping and the reason was most likely due to the probability of customers buying this new test plant or the issue of familiarity or knowledge of the new plants itself. In specific, 3 out of 20 respondents made a remark that the plant was hard to shape and did not look bushy enough.

Different respondents, who were grouped according to their activities, experiences, attitudes and behaviour, would have different preferences for landscaping. The differences were partly explained by varying levels of knowledge regarding the landscapes under examination. Darmstadt *et al*. (2006) also found that different groups of people (e.g., students and locals) would often have very different landscape preferences and argued that the differences underlined the need for care when interpreting indicator values (see Table 6-8).

CONCLUSION

Based on the descriptive analysis and Chi square results presented, it could be concluded that the two native test plants, namely *Molineria latifolia* var. megacarpa (Lemba) and *Rhodomyrtus tomentosa* (Kemunting), have high possibilities to be used as urban landscape plants. Amateurs and professionals in the landscape field both responded well to the test plants. Both the plants have good visual and aesthetical values and they may also have high commercial values. The plants are easy to propagate and have low maintenance, making them good and suitable candidates for urban landscape plants. The two native plants should be domesticated and widely propagated and popularized by nursery and landscape architect companies nationwide.

TABLE 6
Relationship between Demographic Profile and Respondent's Knowledge of (a) & (b)

a. *Molineria latifolia* var. megacarpa (Lemba)

Variables	Chi-square	Significant	Decision
Gender	2.277	0.131	Fail to Reject H_0
Age	4.005	0.261	Fail to Reject H_0
Category (Horticulture student)	9.305	0.097*	Reject H_0

b. *Rhodomyrtus tomentosa* (Kemunting)

Variables	Chi-square	Significant	Decision
Gender	0.125	0.723	Fail to Reject H_0
Age	3.748	0.290	Fail to Reject H_0
Category (Horticulture student)	19.760	0.001***	Reject H_0

***Statistically significant at 0.01 level, **at 0.05 level, and *at 0.10 level

TABLE 7
Relationship between Demographic Profile and Respondents' Perception on Test Plant (a)(b);

a. Molineria latifolia var. megacarpa (Lemba)

Variables	Chi-square	Significant	Decision
Gender	3.824	0.430	Fail to Reject H_0
Age	8.030	0.783	Fail to Reject H_0
Category (Landscape Architecture)	28.630	0.095*	Reject H_0

b. Rhodomyrtus tomentosa (Kemunting)

Variables	Chi-square	Significant	Decision
Gender	4.201	0.380	Fail to Reject H_0
Age	13.823	0.312	Fail to Reject H_0
Category (Landscape architect)	29.809	0.073*	Reject H_0

***Statistically significant at 0.01 level, **at 0.05 level and *at 0.10 level

TABLE 8
Relationship between Demographic Profile and Plant's Suitability as Urban Landscape Plant (a)(b);

a. Molineria latifolia var. megacarpa (Lemba)

Variables	Chi-square	Significant	Decision
Gender (Female)	4.234	0.040**	Reject H_0
Age	5.621	0.132	Fail to Reject H_0
Category (nursery owners)	9.760	0.082*	Reject H_0

b. Rhodomyrtus tomentosa (Kemunting)

Variables	Chi-square	Significant	Decision
Gender	1.727	0.189	Fail to Reject H_0
Age	4.672	0.197	Fail to Reject H_0
Category (Landscape architecture)	29.762	0.000***	Reject H_0

***Statistically significant at 0.01 level, **at 0.05 level and *at 0.10 level

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