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Diversity of Functional Traits in Leaves of *Syzygium* Species in Lowland and Highland

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Adaptation; correlation; parameters; phenotypic plasticity

ABSTRACT

Syzygium is a genus of Myrtaceae with 1,236 species. The functional traits of each species vary. The purpose of this study was to determine the variation in the functional traits of *Syzygium* leaves found in the lowlands and highlands. In this study, *Syzygium* leaves were collected from the Bogor Botanical Garden (lowland) for 27 species, while from the Cibodas Botanical Garden (highland) for 35 species. Ten parameters were measured, including leaf Fresh Weight (FW), leaf Dry Weight (DW), Leaf Area s(LA), Specific Leaf Area (SLA), Leaf Dry Matter Content (LDMC), Specific Leaf Weight (SLW), Chlorophyll Content (CC), Stomatal Density (SD), Stomatal Length (SL), and Stomatal Width (SW). Based on the results of the study, a diversity of functional traits in *Syzygium* species was observed in the lowlands and highlands. The results also indicated that the elevation influences variations in functional traits. Most of the leaf traits were found to be higher in the lowland species. Phenotypic plasticity of parameters was observed within the species found in both lowland and highland locations.

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INTRODUCTION

Syzygium is one of Myrtaceae genera with a high species diversity (Aprillia et al., 2021). There are 1.236 species of *Syzygium* recorded worldwide (POWO, 2024). Those species are distributed from Africa, Asia, Australia to Pacific and New Zealand (POWO, 2024). The habitat range of *Syzygium* extends from lowlands to highlands, with an altitudes ranging from 5 meters to 1,700 meters above sea level (Mudiana, 2009). This genus can grow in shrub areas, forest edges, secondary forests, mountain forests, river banks, fields, and even yards. It can also grow in limestone hill forest areas (Mudiana, 2009).

Some species of *Syzygium* have important economic value and have been used as food, medicine, and building materials (Irawan et al., 2016). Those that are used as fruit crop include rose apple (*S. jambos*), water apple (*S. aqueum*), black plum (*S. cumini*). Those that are used as spices and traditional medicine include cloves (*S. aromaticum*), and bay leaves (*S. polyanthum*) (Uddin et al., 2022). Additionally, the wood the wood can be used as a building material and the bark can be used as a dye to produce a brown color (*S. cumini*) (Mudiana & Ariyanti, 2020). Apart from being used as culinary ingredients or cultivated for their fruit,, *Syzygium* species, such as *S. antisepticum*, *S. australe*, *S. luehmannii*, *S. myrtifolium*, and *S. zeylanicum* can be used in the horticultural industry in Australia, Indonesia, Malaysia, and Singapore. These species are used for hedges, natural fences, natural sound barriers, and privacy screens (Low et al., 2022). Most other species have no specific use but possess potential as a genetic donors as wild relatives of the related crops.

Morphological variations in the leaves can be used todistinguish species in the genus *Syzygium* (Mardiastuti et al., 2015). However, the functional traits of the leaves in this genus have been less extensively studied . These traits represent the plant's strategies for preserving its physiological processes and providing valuable insights into their ecological success (Pérez-Harguindeguy et al., 2013). Functional traits highlight the importance of traits that can predict the effects of species on key ecosystem traits (Pérez-Harguindeguy et al., 2013).

Based on the TRY plant trait database, some of *Syzygium* species still lack on their functional traits, such as chlorophyll content and stomatal characteristics (Kattge et al., 2020). Therefore, additional functional traits data are needed for various *Syzygium* species. This research aimed to determine the variation in functional traits of *Syzygium* leaves found in lowlands and highlands.

MATERIALS AND METHODS

Research Location

This research was conducted in two botanical gardens; Bogor Botanical Garden and Cibodas Botanical Garden (Figure 1). Located in the Bogor City, the Bogor Botanical Garden has an elevation of around 215 to 260 meters above sea level. It showcases a diverse range of plant species from tropical lowland rainforest (Sasmita et al., 2014). On the other hand, Cibodas Botanical Garden, located on the northern slopes of the Gede Pangrango mountains, has an elevation range of 1,211 to 1,437 meters above sea level.

MATERIALS AND METHODS

In this study, leaves from 27 species of *Syzygium* were collected from the Bogor Botanical Gardens, while 35 species were collected from the Cibodas Botanical Gardens. Observations were made on mature plants with a diameter greater than 10 cm. Mature and healthy leaves without stalks were selected, ensuring that the leaves were randomly collected from each tree sample.

The parameters measure were Leaf Fresh Weight (FW), Leaf Dry Weight (DW), Leaf Area (LA), Specifit Leaf Area (SLA), Leaf Dry Matter Content (LDMC), Specific Leaf Weight (SLW), Chlorophyll content (CC), Stomatal Density (SD), Stomatal Length (SL), and Stomatal Width (SW). Measurement of variables were followed Cornelissen *et al.* (2003) and Pérez-Harguindeguy *et al.* (2013). SLA was the ratio between leaf area to dry leaf weight. Ten mature leaves were measured for their area and weight. Leaf area was measured by ImageJ from scanned fresh leaves. Dry leaf weight was measured from dried leaves after drying the leaves in the oven for 72 hours at 40^{o}C. LDMC is the ratio of leaf dry weight to fresh/wet weight. SLW is the ratio between leaf dry weight to leaf area. CC was measured using CCM-200 plus Chlorophyll Content Meter on 5 fresh leaf samples for each replication. Each leaf was measured 3 times, at the base, middle,

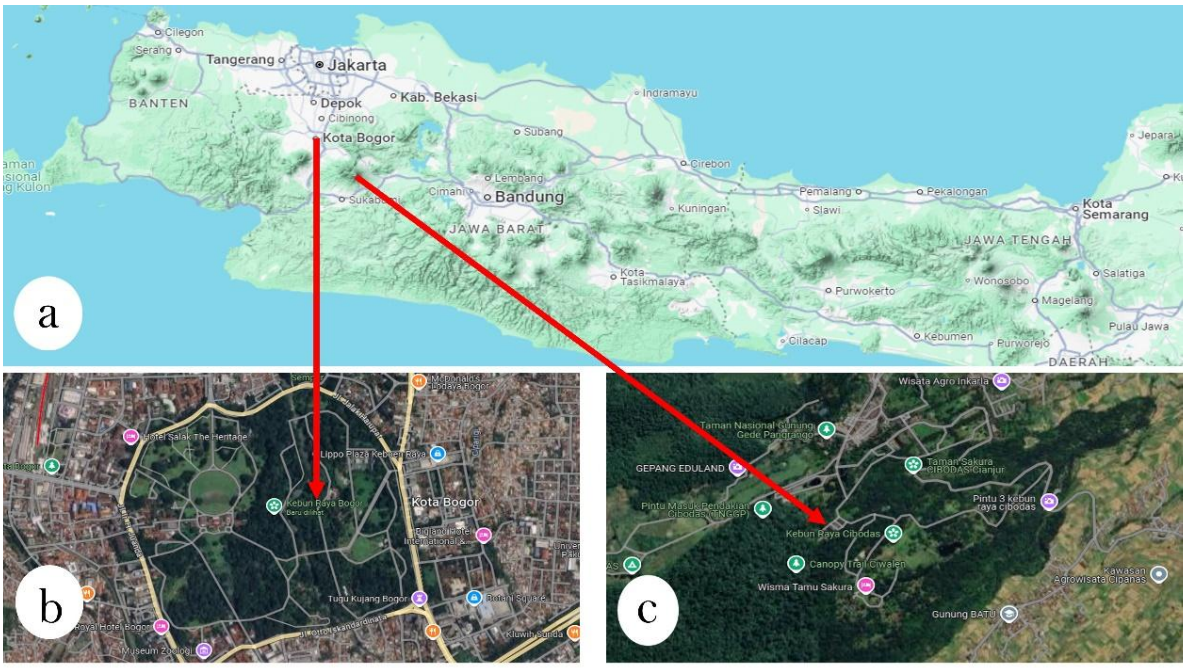

Figure 1. Map of Research Locations (a) Map of West Java Province, (b) Bogor Botanical Gardens, (c) Cibodas Botanical Gardens

and tip. Stomatal Density and Stomatal Size were measured at the abaxial surface of the leaf, near the leaf axis, by coating the leaf surface with dental resin. The dental resin was then peeled off once it was dry. Then, imprinted leaf surface mold on the dental resin was coated with transparent nail polish and aloowed to dry for approximately 30 minutes. The dried nail polish mold was then peeled off using tweezers and transferred to a glass object. The stomata were then observed under an Olympus CX22LED light microscope at 10× and 40× magnifications. The parameters observed included stomatal density, length, and width. Five images were taken in each field of view and then measured using Image Raster 3.0.

Statistic analyses

The statistical methods used for data analysis include the Pearson Correlation (Sugiyono, 2020) and a one-way analysis of variance (ANOVA), with Duncan's Multiple Range Test as a post hoc test. These methods were used to evaluate significant statistical differences between average values, with a probability level set at 5% (Sembiring et al., 2020).

RESULTS AND DISCUSSION

Correlation between the leaf functional traits

Based on the correlation analysis, not all the parameters had strong correlations (Figure 2). It was found that the FW, DW, and LA had strong relationships. FW and DW were significantly negatively correlated with LDMC. LA was negatively correlated with LDMC. SLA was significantly negatively correlated with SLW and LDMC. SLA had a low correlation with SL. SLA was not correlated with CC, SD, and SW.

LDMC was significantly correlated with SLW. LDMC had no correlation with CC, SD, SL, and SW. CC was not correlated with SD, SL, and SW. SD was negatively correlated with SL and SW. SL had a significant correlation with SW. Based on the results, a diversity of functional traits in *Syzygium* species was observed in the lowland (Bogor Botanical Garden) and highland (Cibodas Botanical Garden). The differences in functional traits diversity could be seen from each parameter measured. Among these parameters, three stood out the most: SLA, LDMC, and SLW. In the lowlands, *Syzygium* sp. Sumatra – Belitung had the highest SLA value, *S. vriescanum* had the highest LDMC value, And *S. palembanicum* had the highest SLW value. In the highlands, *S. uniflorum* had the highest SLA value, *S. rostratum* had the highest LDMC value, And *S. jambos* had the highest SLW value. In general, species from the lowland area had higher values for LA, SLA, and LDMC compared to those from the highland.

Comparison of functional traits between in lowland and highland Species

All leaf functional traits parameters were significantly different between lowland and highland species (Figure 3). It was known that the parameters FW, DW, LA, SLA, LDMC, and CC were higher in lowland species. Meanwhile, the parameters SLW, SD, SL, and SW were higher in highland species.

One factor that contributed to the variation of functional traits is phenotypic plasticity. Phenotypic plasticity is the ability of a species to change its phenotype in response to environmental variations (Sommer, 2020). This allows the species to adapt to different environmental conditions. Phenotypic plasticity provides an early mechanism that allows organisms to explore various adaptation strategies. In the long term, beneficial phenotypes can strengthen the process of natural selection. Based on Joao et al (2023), plants found in the lowlands have high SLA values. In spesices such as, *S. polycephalum*, *S. formosum*, *S. syzygioides*, *S. claviflorum*, *S. racemosum*, *S. jambos*, *S. pycnanthum*, and *S. lineatum*, the value of SLA differed between the lowland and the highland, except for *S. cumini*. *S. cumini* showed no significant difference in SLA between the lowlands and the highlandThis suggests that the species is not plastic in response to elevation differences. High SLA values indicate that the leaves of the species are thinner and have a larger surface area per unit mass, which can increase photosynthetic efficiency. Conversely, low SLA values are likely the result of less supportive environmental conditions that can inhibit growth and nutrient absorption, thereby reducing SLA (Castaneto & Castaneto, 2015). These findings suggest that the place where *Syzygium* species grows induces phenotypic changes as a form of adaptation.

Leaf functional traits dimension among highland species

There were diverse leaf functional traits among *Syzygium* species in lowland (Appendix 1). *S. formosum* had the heaviest FW value, while *S. bankense* had the lowest. The range value of leaf FW for lowland *Syzygium* species was 0.02 – 8.46 g. *S. sexangulatum* had the heaviest DW value, while *S. bankense* had the lowest. The range value of leaf DW for lowland *Syzygium* species had 0.01 - 2.65 g. *S. sexangulatum* had the largest LA value, while *S. bankense* had the lowest. The range value of LA for lowland *Syzygium* species was 1.05 - 273.47 cm^2. *Syzygium* sp. Sumatra – Belitung had the highest SLA value, while *S. lineatum* was the lowest. The range value of SLA for lowland *Syzygium* species was 47.64 - 172.89. *S. vriescanum* had the highest LDMC value, while *Syzygium* sp. Sumatra – Belitung was the lowest. The range value of LDMC for lowland *Syzygium* species was 0.27 - 0.82. *S. palembanicum* had the highest SLW value, while *Syzygium* sp. Sumatra – Belitung was the lowest. The range value of SLW for lowland *Syzygium* species was 0.01 - 0.02. *S. clavatum* had the highest CC value, while *S. bankense* had the lowest. The range value of CC for lowland *Syzygium* species was 3.52 - 100.10 CCI. *Syzygium* sp. 2. W. Sumatera had the highest SD value, while *S. cumini* had the lowest. The range value of SD for lowland *Syzygium* species was 321.44 - 812.61. *S. cf. palembanicum* had the highest SL value, while *S. tetrapterum* had the lowest. The range value of SL for lowland *Syzygium* species was 14.24 - 23.22 µm. *S. cf. palembanicum* had the widest SW value, while *S. tetrapterum* had the lowest. The range value of SW for lowland *Syzygium* species was 11.19 - 18.43 µm.

Leaf Functional traits among species which found in both Lowland and Highland

Each species had differences functional traits in lowland and highland locations (Appendix 3). In *S. polycephalum*, all parameters were different between lowland and highland, except CC. In *S. formosum*, all parameters differed between lowland and highland, except LDMC and SL. In *S. syzygioides*, all parameters were different between lowland and highland, except LDMC and CC. In *S. claviflorum*, all parameters were different between lowland and highland. In *S. cumini*, all parameters were different between lowland and highland, except SLA and SLW. In *S. racemosum*, all parameters were different between lowland and highland, except FW and DW. In *S. jambos* and *S. lineatum*, all parameters were different between lowland and highland, except FW and CC. In *S. pycnanthum*, all parameters were not significantly different, except for LA, LDMC, SD, SL, and SW.

The diversity of functional traits in *Syzygium* leaves can be a factor for selecting parent plants for breeding cultivated *Syzygium* plants. For example, *S. aqueum* and *S. discophorum* have close functional traits, meaning that *S. discophorum* can be used as one of the species for plant breeding. This can be used as a guide in producing new varieties, but compatibility between species needs to be studied further, because there is a possibility that the number of chromosomes and genome size may differ, so that the genetic composition cannot be directly exchanged within the species.

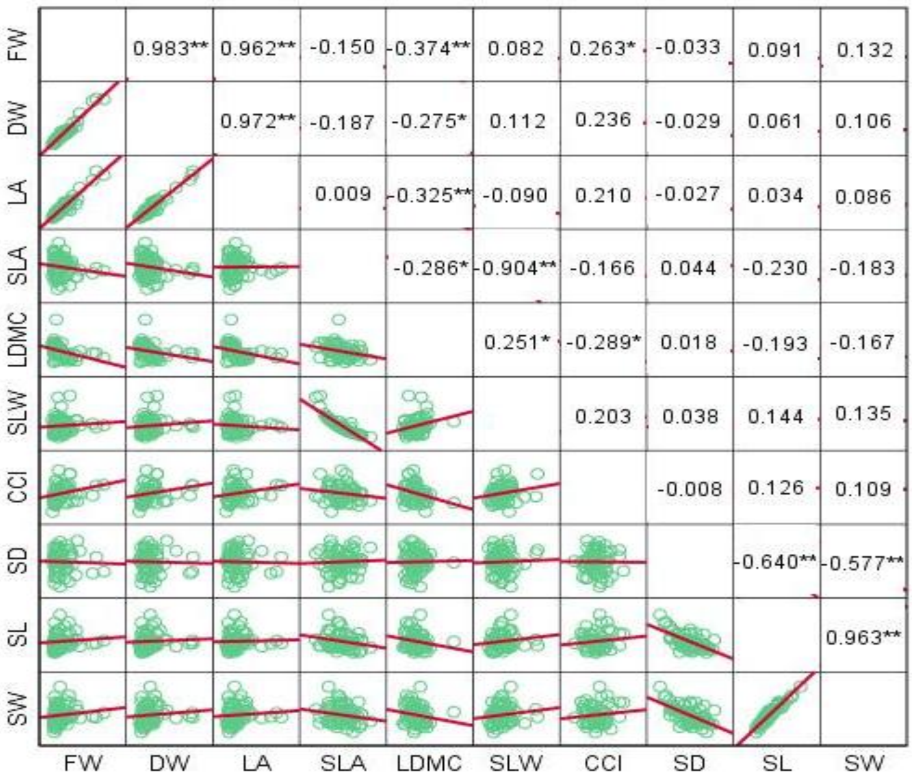

Figure 2. Correlation of variables among *Syzygium* species

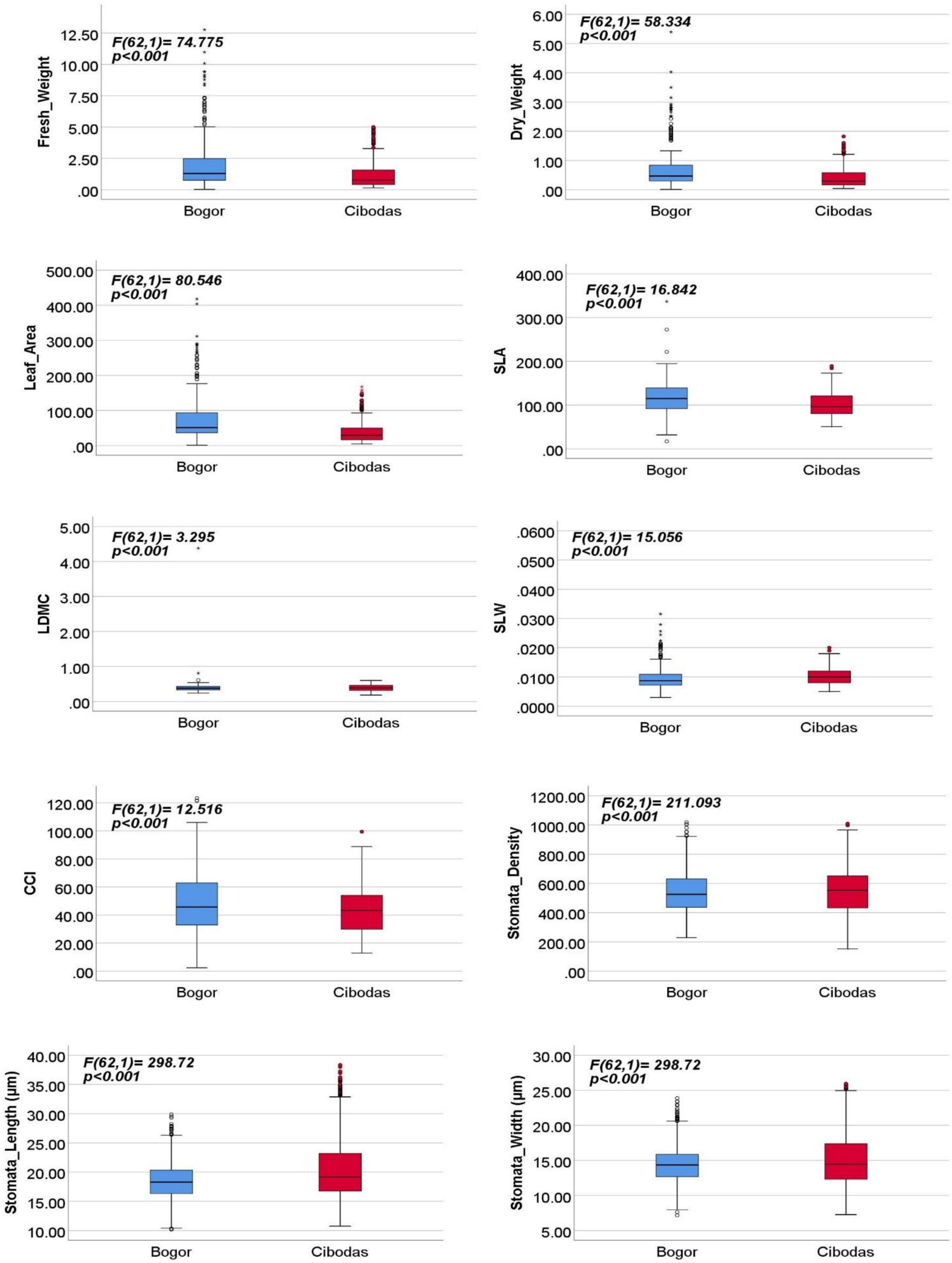

Figure 3. Boxplots of comparison of functional traits in various *Syzygium* species between Bogor Botanical Garden (Lowland) and Cibodas Botanical Garden (Highland). Boxplots with significantly different colors at the $p = 0.05$ level

Leaf functional traits dimension among highland species

There were diverse leaf functional traits among *Syzygium* species in highland (Appendix 2). *S. formosum* had the heaviest FW value, while *S. rosaceum* had the lowest. The range value of leaf FW for highland *Syzygium* species was 0.19 – 4.10 g. *S. formosum* had the heaviest DW value, while *S. smithii* had the lowest. The range value of leaf DW for highland *Syzygium* species was 0.06 - 1.36 g. *S. formosum* had the largest LA value, while *S. smithii* had the lowest. The range value of LA for highland *Syzygium* species was 6.57 - 110.31 cm^2. *S. uniflorum* had the highest SLA value, while *S. jambos* had the lowest. The range value of SLA for highland *Syzygium* species was 56.54 - 152.04. *S. rostratum* had the highest LDMC value, while *S. smithii* had the lowest. The range value of LDMC for highland *Syzygium* species was 0.24 - 0.55. *S. jambos* had the highest SLW value, while *S. uniflorum* had the lowest. The range value of SLW for highland *Syzygium* species was 0.006 - 0.017. *S. mycrocymum* had the highest CC value, while *S. cumini* had the lowest. The range value of CC for highland *Syzygium* species was 17.16 - 75.82 CCI. *S. formosum* had the highest SD value, while *S. claviflorum* had the lowest. The range value of SD for highland *Syzygium* species was 203.30 - 829.79. *S. claviflorum* had the highest SL value, while *S. acuminatissimum* had the lowest. The range value of SL for highland *Syzygium* species was 13.98 - 32.30 µm. *S. claviflorum* had the widest is SW value, while *S. acuminatissimum* had the lowest. The range value of SW for highland *Syzygium* species was 9.64 - 22.94 µm.

CONCLUSION

The species of *Syzygium* have wide distribution that enable adaptation to diverse environmental conditions, resulting in varied functional traits. This current result indicates significant differences in leaf functional traits between lowland and highland *Syzygium* species, with phenotypic plasticity playing a crucial role in their adaptation. This diversity in functional traits is valuable for selecting parent plants for breeding, although cross compatibility between species requires further study due to potential differences in chromosome numbers and genome sizes.

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Appendix 1. Differences in Average Functional Character Values of Syzygium Species in Bogor Botanical Gardens (Lowland). Numbers followed by the same letter in the same coloum are not significantly different at the $p = 0.05$

Species	FW	DW	LA	SLA	LDMC	SLW	CC	SD	SL	SW
Syzygium cf. Palembanicum V.C.67	2.88 gh	0.88 g	101.57 i	116.35 efghij	0.30 a	0.01 abcd	91.76 f	613.84 hi	23.22 n	18.43 m
Syzygium polycephalum V.A.187	4.51 i	1.819 i	177.18 k	99.30 cdefg	0.40 a	0.01 bcdef	45.46 cde	689.53 k	16.88 cd	13.74 e
Syzygium longipes V.A.180	1.69 def	0.67 efg	51.39 defg	75.98 bc	0.39 a	0.01 f	64.52 e	544.25 fg	16.73 c	12.73 d
Syzygium samarangense V.C.103	1.91 ef	0.61 defg	92.52 hi	152.46 kl	0.32 a	0.01 ab	47.36 cde	522.92 fg	20.24 kl	14.86 gh
Syzygium sp. 2. W. Sumatera V.C.141	1.23 cde	0.44 cdef	60.32 fg	137.38 jk	0.36 a	0.01 abc	51.58 de	812.61 n	15.19 b	11.94 b
Syzygium sp. Sumatra - Belitung V.C.135	1.03 cd	0.29 abcd	49.57 defg	172.89 l	0.28 a	0.01 a	29.14 bc	735.50 l	16.43 c	12.82 d
Syzygium sp. 2. Lombok V.C.147a	0.78 abc	0.32 abcd	43.79 cdef	134.20 ijk	0.41 a	0.01 abc	59.32 de	531.17 fg	15.10 b	11.67 ab
Syzygium formosum V.A.141	8.46 k	2.61 j	250.57 m	97.61 cdef	0.30 a	0.01 bcdef	65.94 e	408.70 bc	19.78 jk	15.30 hi
Syzygium syzygioides V.B.19	0.17 ab	0.06 ab	10.53 ab	151.41 kl	0.41 a	0.01 ab	28.92 bc	585.19 h	15.04 b	12.07 bc
Syzygium pseudoformosum V.A.145a	6.61 j	2.50 j	221.87 l	90.53 cde	0.37 a	0.01 cdef	41.08 bcd	386.19 b	18.13 fg	14.22 ef
Syzygium claviflorum V.A.196c	3.33 h	1.24 h	129.45 j	106.98 defghi	0.36 a	0.01 abcdef	27.62 bc	512.97 f	20.13 kl	14.99 gh
Syzygium cumini V.A.128a	1.03 cd	0.35 bcd	49.53 defg	142.39 jk	0.34 a	0.01 ab	29.42 bc	321.44 a	20.48 l	14.59 fg
Syzygium tetrapterum V.C.136	0.55 abc	0.26 abc	38.47 cdef	148.60 kl	0.46 a	0.006 ab	47.00 cde	430.41 cd	14.24 a	11.19 a
Syzygium phillyreifolium V.A.162	2.35 fg	0.84 g	94.78 hi	113.81 efghij	0.36 a	0.01 abcde	56.34 de	445.32 de	19.15 ij	15.94 jkl

Species	FW	DW	LA	SLA	LDMC	SLW	CC	SD	SL	SW
Syzygium racemosum V.B.13	1.14 cde	0.44 cdef	56.23 fg	128.84 ghijk	0.38 a	0.01 abc	57.08 de	330.35 a	21.74 m	16.08 kl
Syzygium sexangulatum V.B.178	7.2 j	2.65 j	273.47 n	104.91 defghi	0.36 a	0.01 abcdef	64.60 e	607.95 hi	18.48 gh	13.99 e
Syzygium sp. 5 Sulawesi maros V.A.204	1.70 def	0.47 cdef	60.19 fg	125.64 fghijk	0.28 a	0.01 abc	39.52 bcd	618.67 i	19.37 ij	15.11 ghi
Syzygium sp. Sulawesi Kab. Luwu V.A.158	0.58 abc	0.28 abc	36.37 cdef	130.74 hijk	0.47 a	0.01 abc	41.72 bcd	471.62 e	18.77 ghi	15.44 hij
Syzygium boerlagei V.C.105	0.80 bc	0.35 bcd	42.10 cdef	117.92 efghij	0.44 a	0.01 abcd	41.12 bcd	548.93 g	17.68 ef	14.57 fg
Syzygium palembanicum V.C.148	2.88 gh	0.88 g	45.72 def	57.31 ab	0.30 a	0.02 g	91.76 f	703.66 k	17.40 de	14.10 ef
Syzygium bankense V.B.161	0.02 a	0.01 a	1.05 a	82.86 bcd	0.49 a	0.01 ef	3.52 a	553.84 g	18.47 gh	13.97 e
Syzygium clavatum V.B.92	1.02 cd	0.36 bcde	36.40 cdef	106.37 defghi	0.36 a	0.01 cdef	100.10 f	421.13 cd	23.15 n	18.28 m
Syzygium jambos V.B.56a	1.32 cde	0.52 cdef	52.93 efg	101.83 cdefgh	0.39 a	0.01 bcdef	50.22 de	452.34 de	16.63 c	12.71 d
Syzygium lineatum V.B.53a	0.89 bc	0.40 cdef	19.11 abc	47.64 a	0.45 a	0.02 g	38.94 bcd	657.11 j	20.25 kl	16.36 l
Syzygium pycnanthum V.C.4	2.10 f	0.70 fg	74.16 gh	128.06 ghijk	0.34 a	0.01 cdef	64.74 e	446.84 de	19.02 hi	15.11 ghi
Syzygium sp. Maluku - Seram VI.C.317	0.63 abc	0.26 abc	29.97 bcde	126.31 fghijk	0.42 a	0.01 abcdef	43.4 bcd	766.74 m	15.57 b	12.58 cd
Syzygium vriescanum V.B.179	0.64 abc	0.29 abcd	25.83 bcd	100.31 cdefg	0.82 b	0.01 def	24.42 b	531.14 fg	19.31 ij	15.58 ijk

Appendix 2. Average differences in functional character values of Syzygium species in Cibodas Botanical Gardens (Highland). Numbers followed by the same letter in the same coloum are not significantly different at the $p = 0.05$

Species	FW	DW	LA	SLA	LDMC	SLW	CC	SD	SL	SW
Sizygium syzygioides XIX.C.18	0.71 bcdef	0.31 cd	22.66 bcde	72.17 bc	0.43 jk	0.01 n	51.54 hijk	387.79 e	22.95 l	16.30 l
Syzygium acuminatissimum XIX.C.6	0.30 abcd	0.11 ab	15.17 abc	133.54 mno	0.37 gh	0.01 abcd	44.38 fghi	741.09 r	13.98 a	9.64 a
Syzygium claviflorum IX.B.4	1.24 ghi	0.55 ef	41.78 ghi	76.81 bcd	0.44 jkl	0.01 mn	52.72 hijk	203.30 a	32.30 q	22.94 s
Syzygium filiforme XIX.C.19	0.66 abcdef	0.25 bc	29.68 cdefg	118.79 jkl	0.37 h	0.01 cdef	75.04 m	687.86 op	15.21 b	10.60 b
Syzygium formosum XIX.C.24	4.10 n	1.36 j	110.31 m	81.82 cd	0.33 def	0.01 klm	28.3 abcde	829.79 t	20.16 j	16.06 l
Syzygium insigne IX.B.131	0.90 efg	0.35 cd	47.17 hi	136.84 no	0.38 h	0.01 abc	43.4 fghi	562.22 jkl	18.71 hi	14.55 j
Syzygium lineatum XIX.C.25	0.82 defg	0.31 cd	39.41 fghi	128.66 lmn	0.37 h	0.01 bcd	45.64 fghi	534.32 hij	18.65 hi	13.31 h
Syzygium polycephalum XIX.C.30	0.70 abcdef	0.34 cd	25.23 bcdef	73.77 bc	0.49 mn	0.01 no	52.48 hijk	611.66 m	17.76 efg	12.85 gh
Syzygium racemosum XIX.C.5	0.92 efg	0.43 de	40.76 ghi	96.74 efgh	0.46 lm	0.01 hij	37.76 defgh	710.75 pq	22.77 l	17.46 n
Syzygium rosaceum XIX.C.42	0.19 a	0.09 ab	9.90 ab	102.28 ghi	0.49 n	0.01 gh	30.94 abcdef	577.68 l	16.35 c	12.19 de
Syzygium rostratum XIX.C.3	0.23 ab	0.13 ab	11.61 ab	89.57 defg	0.55 o	0.01 ijk	44.74 fghi	646.19 n	16.36 c	12.46 efg
Syzygium uniflorum TO.127	0.32 abcd	0.12 ab	18.39 abcd	152.04 p	0.38 h	0.01 a	43.7 fghi	565.05 kl	19.25 i	14.94 j
Syzyygium pseudomalaccense IX.B.1	2.70 l	0.77 gh	74.61 jk	98.90 fgh	0.28 bc	0.01 hi	67.88 lm	271.38 b	28.75 p	20.39 r
Syzygium ampliflorum XIX. C. 26	0.48 abcde	0.24 bc	21.55 abcde	87.76 def	0.50 n	0.01 jkl	41.74 efghi	615.59 m	18.44 gh	13.82 i
Syzygium anisatum VII.B.79	0.44 abcde	0.20 abc	20.15 abcde	97.89 fgh	0.46 lm	0.01 hi	20.98 ab	482.08 f	16.90 cd	12.25 def
Syzygium aqueum VII.C.83	2.15 k	0.65 fg	78.02 jk	120.74 kl	0.30cd	0.01 bcde	50.84 hijk	520.78 hi	17.66 ef	13.30 h
Syzygium australe XIX. C. 12	2.41 kl	0.63 fg	51.95 i	84.75 cde	0.26ab	0.01 klm	63.5 jklm	767.49 s	16.48 c	11.88 d
Syzygium discophorum VII. B. 90	2.07 k	0.65 fg	87.74 kl	134.01 mno	0.31 de	0.01 abcd	46.8 ghi	713.23 pq	18.13 fgh	13.95 i

Species	FW	DW	LA	SLA	LDMC	SLW	CC	SD	SL	SW
Syzygium jambos XIX. C. 38	1.45 hi	0.74 gh	41.85 ghi	56.54 a	0.51 n	0.01 p	37.26 cdefgh	512.39 gh	17.34 de	12.29 def
Syzygium magnoliifolium VII. C. 239	0.56 abcde	0.25 bc	28.90 cdefg	116.18 jkl	0.45 kl	0.01 cdef	44.02 fghi	632.17 mn	16.57 c	12.04 de
Syzygium malaccense VII.C.395	3.88 n	1.03 i	81.73 k	79.82 bcd	0.26 ab	0.01 lmn	44.92 fghi	360.32 d	24.69 mn	17.37 n
Syzygium nervosum VII. C. 31	1.09 fgh	0.42 de	32.09 defg	76.60 bcd	0.38 h	0.01 mn	69.9 lm	551.70 jkl	25.29 n	18.23 op
Syzygium paucipunctatum VII.C.32	2.02 jk	0.61 fg	65.09 j	106.28 hij	0.30 cd	0.01 fgh	26 abcd	316.24 c	26.89 o	19.04 q
Syzygium polyanthum XIX. C. 44	0.78 defg	0.32 cd	25.36 bcdef	78.98 bcd	0.41 ij	0.01 mn	50.58 hijk	734.37 qr	16.40 c	12.71 fg
Syzygium pycnanthum XIX.C. 2	1.62 ij	0.64 fg	51.16 i	80.66 bcd	0.39 hi	0.01 lmn	65.28 klm	678.83 o	18.31 fgh	12.81 gh
Syzygium versteegii VII.B.109	2.40 kl	0.85 h	95.26 l	116.76 jkl	0.35 fg	0.01 defg	22.54 abc	477.62 f	23.16 l	17.58 n
Syzygium hemilamprum IV.C.63	0.41 abcde	0.21 abc	14.42 abc	67.28 ab	0.52 n	0.01 o	24.6 abcd	479.37 f	20.30 j	15.57 k
Syzygium cf. *siphonanthum* VIII.B.287	0.36 abcd	0.12 ab	12.15 ab	101.97 ghi	0.33 ef	0.01 ghi	56.04 ijkl	252.78 b	28.50 p	19.95 r
Syzygium cumini VIII.B.235	0.46 abcde	0.12 b	17.55 abcd	145.56 op	0.26 ab	0.01 ab	17.16 a	547.38 ijk	23.34 l	18.50 p
Syzygium mycrocymum VIII.C.103	0.56 abcde	0.22 abc	17.19 abcd	79.88 bcd	0.38 h	0.01 lmn	75.82 m	342.52 cd	24.46 m	16.79 m
Syzygium antisepticum VIII.C.6	0.23 ab	0.11 ab	11.39 ab	95.79 efgh	0.51 n	0.01 hij	27.64 abcde	573.96 kl	14.30 a	11.08 c
Syzygium laxiflorum VIII.B.39	0.75 cdef	0.33 cd	33.76 efgh	102.50 ghi	0.43 jk	0.01 ghi	34.1 bcdefg	490.24 fg	22.97 l	17.79 no
Syzygium spp. Taman Obat IX A.32A	3.15 m	0.88 h	108.68 m	122.73 klm	0.28 bc	0.01 bcde	49.58 hij	649.81 n	18.02 fgh	14.07 i
Syzygium glabratum VII.C.131	0.35 abcd	0.13 ab	17.02 abcd	128.67 lmn	0.37 h	0.01 abcd	20.38 ab	331.47 c	21.26 k	16.40 lm
Syzygium smithii XII.B.	0.24 abc	0.06 a	6.57 a	114.57 ijk	0.24 a	0.01 efgh	30.62 abcdef	558.66 jkl	16.57 c	12.18 de

Appendix 3. Differences in the average functional character values of Syzygium species found in both locations, namely the Bogor Botanical Gardens (B) and the Cibodas Botanical Gardens (C)

Spesies	Lokasi	Mean FW	Mean DW	Mean LA	Mean SLA	Mean LDMC	Mean SLW	Mean CC	Mean SD	Mean SL	Mean SW
S. polycephalum	B	4.52	1.82	177.18	99.30	0.40	0.010	45.46	689.54	16.88	13.74
	C	0.70	0.35	25.24	73.78	0.49	0.014	52.48	611.67	17.77	12.85
	statistic	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p>0.05	p<0.01	p<0.05	p<0.05
S. formosum	B	8.47	2.62	250.57	97.61	0.31	0.011	65.94	408.70	19.78	15.30
	C	4.10	1.36	110.32	81.83	0.33	0.012	28.3	829.79	20.16	16.06
	statistic	p<0.01	p<0.01	p<0.01	p<0.01	p>0.05	p<0.05	p<0.01	p <0.01	p>0.05	p<0.01
S. syzygioides	B	0.17	0.07	10.53	151.42	0.41	0.007	28.92	585.20	15.04	12.08
	C	0.72	0.31	22.66	72.18	0.44	0.014	51.54	387.80	22.95	16.30
	statistic	p<0.01	p<0.01	p<0.01	p<0.01	p>0.05	p<0.01	p>0.05	p<0.01	p<0.01	p<0.01
S. claviflorum	B	3.34	1.24	129.46	106.98	0.37	0.009	27.62	512.97	20.14	14.99
	C	1.25	0.55	41.78	76.81	0.44	0.013	52.72	203.31	32.30	22.94
	statistic	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01
S. cumini	B	1.04	0.35	49.53	142.39	0.34	0.007	29.42	321.45	20.48	14.59
	C	0.47	0.13	17.55	145.56	0.27	0.007	17.16	547.39	23.35	18.51
	statistic	p<0.01	p<0.01	p<0.01	p>0.05	p<0.01	p>0.05	p<0.01	p<0.01	p<0.01	p<0.01
S. racemosum	B	1.15	0.45	56.24	128.85	0.39	0.008	57.08	330.36	21.75	16.09
	C	0.93	0.43	40.77	96.75	0.47	0.010	37.76	710.75	22.78	17.47
	statistic	p>0.05	p>0.05	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01
S. jambos	B	1.33	0.52	52.94	101.84	0.39	0.010	50.22	452.35	16.64	12.71
	C	1.46	0.75	41.86	56.55	0.51	0.018	37.26	512.40	17.34	12.30
	statistic	p>0.05	p<0.01	p<0.05	p<0.01	p<0.01	p<0.01	p>0.05	p<0.01	p<0.01	p<0.01
S. lineatum	B	0.89	0.41	19.12	47.65	0.46	0.021	38.94	657.11	20.25	16.37
	C	0.82	0.31	39.42	128.66	0.38	0.008	45.64	534.32	18.65	13.31
	statistic	p>0.05	p<0.01	p<0.01	p<0.01	p<0.01	p<0.01	p>0.05	p<0.01	p<0.01	p<0.01
S. pycnanthum	B	2.10	0.71	74.17	128.06	0.34	0.011	64.74	446.85	19.02	15.11
	C	1.62	0.64	51.17	80.66	0.40	0.013	65.28	678.84	18.32	12.81
	statistic	p>0.05	p>0.05	p<0.05	p>0.05	p<0.01	p>0.05	p>0.05	p<0.01	p<0.05	p<0.01