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Phytochemical properties of *Clitoria ternatea* L. (Fabaceae) – A distinct flower morphometric Plants Available in Sri Lanka

H.D.K Buddhika 1, R.M. Dharmadasa 2,*, L.D.A.Menuka Arawwawala2 and Kandiah Pakeerathan [1,*]

[1]Department of Agricultural Biology, Faculty of Agriculture, University of Jaffna, Sri Lanka
[2] Industrial Technology Institute, Bauddhaloka mawatha, Colombo-7, Sri Lanka
*Correspondence: pakeerathank@univ.jfn.ac.lk; Tel.: +94-077-696-9511

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INTRODUCTION

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- **Butterfly Pea (*Clitoria ternatea*) L. (Fabaceae)**
- **Asian Pigeon wing, is a perennial twinning medicinal plant**
- **widely used in traditional and Ayurveda systems of medicine in many parts of the world**
- **Butterfly Pea has pinnate leaves with 5 or 7 leaflets. Flowers auxiliary ,single or paired; colour range from white, dark blue to purple**

Root knot nematode, *Meloidogyne* spp.

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- **Phytochemicle profiles of different plant parts like, root,leaves,flower are vary**
- **Phytochemicals used to cure number of diseases, including asthma, burning sensation, ascites, inflation, leucoderma, leprosy, hemicranias, amentia, pulmonary tuberculosis, ophthalmology, insect bites snakebite, scorpion sting and skin diseases**

OBJECTIVES

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to investigate the variations in agronomic features and phytochemical contents in different morphotypes of *C. ternatea* plants available in Sri Lanka

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MATERIALS & METHODOLOGY

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- The experiment was conducted at the Herbal Technology Section laboratory of the Industrial Technology Institute (ITI) situated in Halbarawa Gardens, Malabe. Planting materials of different plant types were collected from the research plots that prepared in ITI Malabe for this research.

2.1 Sample collection and Preparation

- The fresh C. ternatea plants were separated according to different plant morphology and labeled as blue single petal, blue multi-petal (1A), white single-petal (1B), white single-petal (2A), white multi-petal (2B) and purple single-petal (3A). Roots, leaves, and flowers from labelled plants were separated. The plant parts were dried at room temperature without loss of volatile phytochemicals, and subjected to phytochemical analysis.

2.2 Phytochemical analysis

- Phytochemical screening of flavonoids, tannins, alkaloids, glycosides, steroids were carried out using standard protocols. In addition, Thin Layer Chromatography (TLC) fingerprints were developed. Total phenol content (TPC) and total antioxidant capacity (TAC) were measured using spectrophotometric analysis.

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2.3 Development of TLC fingerprint profiles and phytochemical screening

- From each sun dried sample 5 g was mixed with 50 ml of 99% methanol and kept in a mechanical shaker for overnight. The liquid part was filtered and filtrate was concentrated using a rotary evaporator. As the mobile phase mixture of dichloromethane, cyclohexane and ethyl acetate was used in a ratio of 2:3:0.5 (v/v). Phytochemical screening was carried out as described by Jayasinghe and co-workers [8].

2.4. Antioxidant activities

- Total phenolic content (TPC) [16], total flavonoid content (TFC) [5] and 1, 1-diphenyl-2-picryl-hydrazyl (DPPH) radical scavenging assay [13] were carried out to determine the antioxidant activities.

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Statistical Analysis

- The data were subjected to analysis of variance (ANOVA) using SAS 9.4 statistical package

- DMRT was performed to know the best treatment combination at P-value of 0.05

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RESULTS AND DISCUSSION

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Morphomatric variation in flowers of C. ternatea

- There were three different colour producing *C. ternatea* plants were observed and visual examination revels that the three different number of petal produced by *C. ternatea* observed and categorized as 1A: Blue colour more petals; 1B : Blue colour single petal; 2A: white colour more petals; 2B: white colour single petal, and 3A: purple colour single petal.

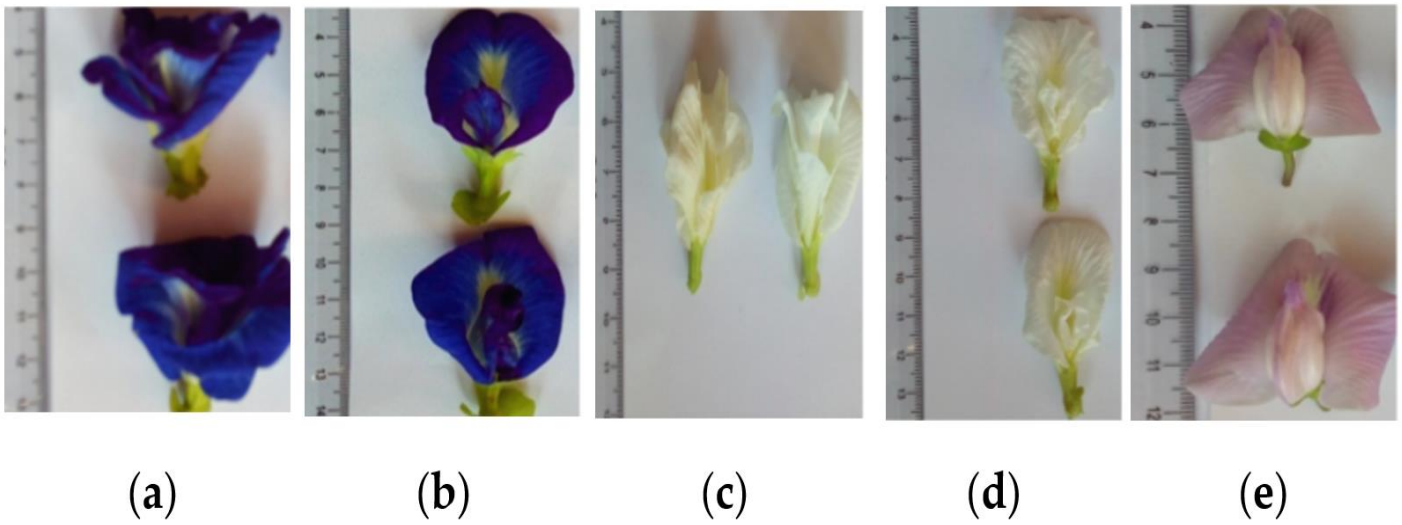

Figure 1: The different flower morphology of ***Clitoria ternatea***; a) 1A: Blue colour more petals; b) 1B : Blue colour single petal; c) 2A: white colour more petals; d) 2B: white colour single petal, and e) 3A: purple colour single petal

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Variation of phytochemicals in different plant parts of C. ternatea

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Table 1: Phytochemical variation in different *Clitoria ternatea* Plants parts TLC analysis

Sample	Plant part	Phenols	Flavanoids	Tannins	Alkaloids	Terpinoids	Cardiac	steroids
1A: Blue colour more petals	Roots	+	+	-	++	-	-	-
	Leaves	+	++	+	+	+	+	+
	Flowers	+	+++	+	+	+	+	+
1B : Blue colour single petal	Roots	+	+	+	+	-	-	-
	Leaves	+	++	+	+	+	+	-
	Flowers	+	++	+	+	+	+	+
2A: white colour more petals	Roots	+	+	+	++	+	-	+
	Leaves	+	+	+	+	+	-	-
	Flowers	_	+	+	-	-	+	+
2B: white colour single petal	Roots	+	+	-	+	+	+	-
	Leaves	+	+	+	+	+	-	+
	Flowers	-	++	+	-	-	+	+
3A: purple colour single petal	Roots	+	+	+	+	++	-	+
	Leaves	+	+	-	+	+	-	+
	Flowers	-	+++	+	-	-	+	+

"-":- Absent , "+ ":- Present (less) , "++": High, "+++" :- Very high concentration of phyto chemicals

Antioxidant activities

Table 2: TFC, TPC and Antioxidant capacity of different *Clitoria ternatea* Plants parts

Samples	TPC (mg GAE/g of extract)	TFC (mg QE/g of extract)	DPPH (mg TE/g of extract)
1A: Blue colour more petals			
flower	46.97 (±4.4)^{d}	34.02 (±3.60)^{a}	2.61 (±1.2)^{b}
leaves	73.31 (±7.1)^{a}	40.02 (±4.00)^{a}	3.14 (±0.65)^{a}
roots	52.68 (±5.7)^{c}	18.40 (±2.86)^{bc}	3.40 ±0.54)^{a}
1B: Blue colour single petal			
flower	24.11 (±3.59)^{ef}	14.06 (±2.49)^{c}	1.95 (±0.64)^{c}
leaves	68.61 (±7.42)^{a}	39.37 (±2.39)^{a}	3.76 (±1.23)^{a}
roots	24.41 (±6.14)^{ef}	16.38 (±3.15)^{c}	2.64 (±0.43)^{b}

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Antioxidant activities

Table 2: TFC, TPC and Antioxidant capacity of different *Clitoria ternatea* Plants parts

Samples	TPC (mg GAE/g of extract)	TFC (mg QE/g of extract)	DPPH (mg TE/g of extract)
2A: white colour more petals			
flower	24.07 (±2.29)^{ef}	23.70 ± (6.04)^{b}	2.93 (±1.2)^{b}
leaves	65.89 (±2.43)^{b}	36.69 (±5.54)^{a}	2.19 (±1.2)^{bc}
roots	28.74 (±1.32)^{e}	15.56 (±2.44)^{c}	3.13 (±0.62)^{a}
2B: white colour single petal			
flower	30.77 (±2.17)^{e}	30.3 4 (±1.22)^{ab}	2.61 (±0.68)^{b}
leaves	63.75 (±2.22)^{b}	26.16 (±5.54)^{b}	1.90 (±0.76)^{c}
roots	20.69 (±0.56)^{f}	13.30 (±2.17)^{c}	1.23 (±0.38)^{c}
3A: purple colour single petals			
flower	53.62 (±2.78)^{c}	25.10 (±4.58)^{b}	0.61 (±0.21)^{d}
leaves	67.76 (±5.67)^{a}	14.08 (±1.52)^{c}	1.01 (±0.43)^{cd}
roots	42.08 (±6.34)^{d}	7.20 (±2.13)^{d}	1.23 (±0.42)^{c}

- It is evident from our findings that authentic part is very crucial for obtaining maximum pharmaceutical quality and avoiding any alternation of medicinal potency of C. ternatea.

- Raya et al. (2015) reported that the different phytochemicals are in different concentration in different plant parts highest initial phenolic content was found in young leaves of C. nutans [15]

- The TFC is attributed mainly in leaves and followed by flowers. Lakshan et al. (2020) reported that TFC range from 12.50 to 15.96 mg quercetin equivalents/g dry weight of flower, indicating that the TFC content is much higher in C. ternatea varieties grown in Sri Lanka [9].

- Study conducted by Attanayake et.al., (2016) showed that three C. ternatea varieties have higher TFC out of 11 selected medicinal plants and it has a higher potential for treating oxidative stress related chronic diseases in Sri Lanka [1]. These findings further validating the current research

- The DPPH activity is higher in roots and followed by leaves and flower. Havananda and Luengwilai (2019) studied 46 accessions of C. ternatea and reported that DPPH by varied between 4.5±6.0 to 67.7±25.0 mg trolox equivalents/g of flower [6].

- The current findings of DPPH is lower than the Havananda and Luengwilai (2019) results.

- This variation may be due to the variety differences or maturity differences. Rafat et al. (2009) also reported similar findings from their study with A. paniculata [12].

- Ghasemzadeh et al. (2014) on the other hand, recorded higher DPPH value in 1-year -old buds than in 6-month-old buds of C. nutans. Therefore, selection of plants to be utilized for commercial phytochemical extraction is important, which might result in changes in phytochemical content with course of time

CONCLUSIONS

- This report that phytochemical content of the C. ternatea plants, showing different flower morphology, varied greatly.

- The Flavanoids, Alkaloids, TPC and TPC is high in C. ternatea plants producing Blue colour more petals and Blue colour single petal.

- The finding concludes that C. ternatea plants producing Blue colour more petals and Blue colour single petal are highly suitable for commercial level medically important phytochemical extraction

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Acknowledgment

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Thank you

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