ISSN 0974-3618 (Print)
0974-360X (Online)

www.rjptonline.org

RESEARCH ARTICLE

Quick-identification of total phenolic and flavonoid content of *Mangifera foetida, Lagerstroemia speciosa* and *Impatiens balsamina* gathered from Riau, Sumatera

Erlia Anggrainy Sianipar, Sanjayadi, Beatrice Lin, Monika Arvia Chiara, Agustina D R Nurcahyanti*

Department of Pharmacy, School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia.
*Corresponding Author E-mail: **adr.nurcahyanti@atmajaya.ac.id**

ABSTRACT:

Introduction: Variance in a species and climate conditions often impact the phytochemical content and pharmacological properties of many medicinal plants. In this study, we used simple and quick methods to determine the total phenolic and flavonoid contents in ethanol extracts from three species of medicinal plants from Riau, Sumatera. Results obtained were then compared to existing literature. **Materials and Methods:** Several parts of plant were used, namely *Mangifera foetida* bark (MB), pericarp (MP), leaves (ML), *Lagerstreomia speciosa* bark (LB), flower (LFlo), leaves (LL), fruit (LFru), and *Impatiens balsamina* leaves (IL), root (IR), and flower (IFlo). Total phenolic content was estimated using Folin-Ciocalteau method, while flavonoid content was measured using common colorimetric method. **Results and Discussion:** Results obtained in this study indicate that LL has the highest flavonoid content (22.116 ± 0.409 mg QE/g) while MB contains the highest phenolic content (24.642 ± 11.087 mg GAE/g) amongst the different samples used in this study. **Conclusion:** When compared to existing literatures, results presented here indicate that plants from Riau, Sumatera are potential sources of pharmacologic ingredients as indicated by the presence of high flavonoid and phenolic content. Further pharmacological study on specific mechanisms of action from active substances isolated from LL, MB, and IL is required.

KEYWORDS: *Mangifera foetida*, *Lagerstroemia speciosa*, *Impatiens balsamina*, Phenolic content, Flavonoid content, Sumatera.

INTRODUCTION:

Indonesia possesses mega terrestrial biodiversity, whose secondary metabolites can be leveraged for therapeutic purposes. So far, the uses of plants, is, unfortunately, limited and pharmacological data/profiling is scarce. *Mangifera foetida*, *Lagerstroemia speciosa*, and *Impatiens balsamina* grows in some places in Indonesia, including Riau, Sumatera. It is known that the local population use these plants as traditional remedies for treating certain diseases.[1-5] Several well-known studies have shown that plants belonging to genus *Mangifera*, *Lagerstroemia*, and *Impatients* are well distributed around the world.[6-11]

Received on 28.01.2021 Modified on 08.03.2021
Accepted on 21.04.2021
Research J. Pharm. and Tech 2022; 15(1):311-314.
DOI: 10.52711/0974-360X.2022.00051

Testing phenolic and flavonoid content is important to identify the potency of plants growing in Indonesia compared to those growing in other areas across the world.[12-17] Results presented in this paper can serve as empirical data for further studies investigating mechanism of action of secondary metabolites found in these plants in treating different diseases.

MATERIALS AND METHODS:

Materials

Mangifera foetida [bark (MB), pericarp (MP), leaves (ML)], *Lagerstroemia speciosa* [bark (LB), flower (LFlo), leaves (LL), fruit (LFru)] and, *Impatiens balsamina* [leaves (IL), root (IR), and flower (IFlo)] obtained from Riau, Sumatera during May - July 2019. Gallic acid and quercetin were purchased from Sigma-Aldrich USA; Folin–Ciocalteu reagent was obtained from Merck, Germany; sodium carbonate, aluminum chloride hexahydrate, sodium hydroxide, ascorbic acid, ethanol, and distilled water were obtained as an analytical grade.

Preparation of sample and extraction:
Each part of the plant was dried using an oven at 40°C for 48 hours. Plant parts were individually dried and was grounded using a food processor and 100 g of the powder was macerated twice using 250 mL Ethanol 96%. Extract was collected and the remaining solvent was evaporated using a vacuum rotary evaporator at 50 °C to obtain a solid-liquid extract. The extract was stored in sealed vials at 4°C for further analysis.

Analysis of total phenolic content:
Total phenolic content from each extract was determined using the Folin-Ciocalteu method as described by Hye Young Kim, (2003).[18] Gallic acid was used as the standard. In brief, gallic acid was dissolved in DMSO to make stock solution of 10mg/ml which was serially diluted to 100, 80, 60, 40, 20 µg/mL. Plant extracts (100 µL) was mixed with 0.5 mL of Folin Ciocalteu's reagent and mixed thoroughly. The mixture was incubated for 3 mins followed with the addition of 10% sodium carbonate solution and was incubated at room temperature for 1 hour. Absorbance was measured using a spectrophotometer at 760 nm. Linear equation of standard curve prepared using gallic acid was used to determine the total phenolic content of the extract. Total phenolic content was expressed as mg/g of the extract of Gallic acid equivalent.

Analysis of total flavonoid content:
Total flavonoid content was determined using colorimetric method as described by Hye Young Kim (2003)[8]. The quercetin standard curve was obtained by serially diluting in DMSO to concentrations of 100, 80, 60, 40, and 20 µg/mL. Each plant extract (1 mL) was mixed with 1 mL of 2% AlCl3.6H2O (2g $AlCl_3.6H_2O$ mixed in 96% ethanol). The mixture was vigorously shaken and allowed to stand for 10 minutes at room temperature. The absorbance of this reaction mixture was read at 366 nm using UV spectrophotometer. Flavonoid content was expressed in milligrams of quercetin equivalent per gram of extract.

Statistical analysis:
Statistical analysis was done using *one-way Analysis of Variance* (ANOVA) following Duncan test to analyze significant difference using confidence interval of 95%. All experiments were performed, at least, in triplicates. All data is presented as mean ± standard deviation.

Results and Discussion:
Analysis of total phenolic (expressed as gallic acid equivalents) and flavonoid (expressed in quercetin equivalents) contents in the ethanol extract (Tabel 1) from Riau is shown in Table 2.

Table 1. Yield extract (%)

Name of Plant	Part of Plant	Abbreviation	Yield Ekstrak (%)
Mangifera foetida	Bark	MB	8,59
Mangifera foetida	Pericarp	MP	7,65
Mangifera foetida	Leaves	ML	13,74
Lagerstrpemia speciosa	Bark	LB	2,91
Lagerstreomia speciosa	Flower	LFlo	5,08
Lagerstreomia speciosa	Leaves	LL	11,29
Lagerstreomia speciosa	Fruit	LFru	1,29
Impatiens balsamina	Leaves	LL	12,14
Impatiens balsamina	Root	LR	1,70
Impatiens inai	Flower	LFlo	9,76

Total phenolic content in the different plants obtained from Riau, Sumatera ranged from 0.140 ± 0.393 to 24.642 ± 11.087 mg GAE/g. Highest amount of phenolic compounds was found in the bark of *M. foetida* (24.642 ± 11.087 mg GAE/g) and the lowest was found in leaves of *I. balsamina*. Abundance of total phenolic content in *M. foetida* in descending order is as follows: bark, pericarp, and leaves. This is in concordance with results presented in a recent study by Fitmawati et al where higher concentrations of phenolic content in ethanol extracts were seen in barks of some variants of *M. foetida* when compared to their corresponding leave extracts.[19] Núñez 2002, also reported that highest concentration of gallic acid is found in the bark of mango trees (~226.2 mg/100g of dry weight).[20] Another study also reported that mangiferin is the potential phenolic compound found in high concentrations in mango bark.[21]

On the other hand, results obtained in this study shows that total phenolic content in leaves, roots and flowers of *I. balsamina* are very low. Concentration of total phenolic content in different parts of *I. balasamina* in ascending order are as follows: leaves, roots, and flowers. In contrast, a study by Kang 2013 reported that total phenolic content from ethanol extract (70%) of *I.balsamina* leaves (79.55–103.94 mg CE/g extract) is higher than stem (12.92-18.95 mg CE/g extract). Another study mentioned that ethanol extract (80%) from *I.balsamina* (whole plant) is 16.17 ± 0.37 mg GAE/g.[22] Concentration of total phenolic content in different parts of *L. speciosa* in descending order are as follows: flower, bark, leaves, and fruit. This is different with results presented in Ajaib (2016) and Nasrin (2012) that reports that the highest total phenolic content in methanol extract from *L.speciosa* is in the leaves.[23,24]

Total flavonoid content present in the different plant samples ranged from 5.658 ± 0.273 to 19.824 ± 0.440 mg QE/g. Among the different samples used in this study the samples with the three highest flavonoid content (in decreasing order) is as follows: leaves of *L. speciosa*, leaves of *I. balsamina*, and bark *M. foetida*. Similar results were presented in Ajaib et al 2016, where

L. speciosa leaves were reported to contain highest concentration of flavonoid content.[13] Delgado-Rodriguez (2017) reported that ethanol (80%) extracted flavanoid content from *I. balsiama* (whole plant) is 4.98 ± 0.27 mg QE/g flavonoid. This is in line with results obtained in this study where flavanoid content in *I.balsamina* roots was 5.658 ± 0.273 mg QE/g.[22]

Table 2. Total phenolic and flavonoid content in plants obtained from Riau, Sumatera

Plant part in abbreviation	Total flavonoid (mg QE/g)	Total phenolic (mg GAE/g)
MB	19.557 ± 1.065	24.642 ± 11.087
MP	12.057 ± 0.052	3.964 ± 0.673
ML	17.295 ± 1.014	1.092 ± 0.978
LB	10.807 ± 0.287	6.518 ± 0.360
LFlo	14.586 ± 0.136	9.909 ± 2.260
LL	22.116 ± 0.409	6.172 ± 0.513
LFru	9.646 ± 1.573	2.810 ± 2.288
IL	19.824 ± 0.440	0.140 ± 0.393
IR	5.658 ± 0.273	2.550 ± 3.796
IFlo	12.443 ± 0.186	4.411 ± 0.429

Based on the current study, bark of *M. foetida* from Riau were comparable to those obtained from different parts of the world.[20-21] Slight differences in total phenolic and flavonoid content from each part of *L. speciosa* and *I. balsamina* may be caused by different extraction method used. Methanol extract may extract higher total phenolic content in plants. In addition, plant age and various environmental conditions like geography, annual rainfall, temperature, soil type and available nutrition, cultural practice may potentially affect phytochemical properties of the plants used in this study.[12] Though bioactive metabolites usually share a similar structural backbone, the amount of metabolite produced may be affected by environmental conditions.

Based on previous phylogenetic study, we suggest that *M. foetida*, *L. speciosa*, and *I.balsamina* from Sumatera Riau are closely related to those found in other countries indicating that they have similar pharmacological activity.[9,25] Sharmin 2018 suggests that high phenolic and flavonoid content in *L. speciosa* such as corosolic acid, ellagic acid, gallic acid, and quercetin, have well know antioxidant activity.[26]

CONCLUSION:

Total phenolic and flavonoids are major indicators for a plants potential pharmacological activity. Based on this study, we recommend the use of *L. speciosa* leaves, *M. foetida* bark, and *I. balsamina* leaves rather than other parts of these plants. However further study on specific active metabolites and its pharmacological mechanism of action is required.

ACKNOWLEDGMENTS:

The author is grateful to the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia for the financial funding.

CONFLICT OF INTEREST:

The authors declare no conflict of interest.

REFERENCES:

1. Bincy R, John S, Rasheed A. Pharmacognostic and preliminary phytochemical screening of Ampelocissus indica including antioxidant activity. Research Journal of Pharmacognosy and Phytochemistry. 2020; 12(2): 80-82
2. Kavita G, Lal VK, Jha S. Total phenolic content flavonoid content and in vitro antioxidant activities of Flemingia species (*Flemingia chappar, Flemingia macrophylla, and Flemingia strobilifera*). Research Journal of Pharmacy and Technology 2013. 6(5): 516-523
3. Rachida ZA, Ridha OM, Eddine LS, et al. Screening of phenolic compounds from Abelmoschus esculentus L extract fruits and in vitro evaluation of antioxidant and antibacterial activities. Research Journal of Pharmacy and Technology 2017. 10(12): 4371-4376
4. Yadav SS, Sangwan P, Ganie SA, Gulia SS. Studies on free radical scavenging activity and total phenolic content of *Foeniculum vulgare* Mill. Research Journal of Pharmacy and Technology. 2020; 13(7): 3394-3398
5. Tangjitjaroenkun J, Tangchitcharoenkhul R. Antioxidant properties of the extract from culture filtrate of Schizophyllum commune. Research Journal of Pharmacy and Technology 2020. 13(7): 3365-3371
6. Ediweera MK, Tennekoon KH, Samarakoon SR. A review on ethnopharmacological applications, pharmacological activities, and bioactive compounds of *Mangifera indica* (Mango). Evidence-Based Complementary and Alternative Medicine. 2017; Article ID 6949835, 24 pages. https://doi.org/10.1155/2017/6949835
7. Jahnavi CH, Jyothsna K, Geetika DL, et al. Review on pharmacological activities of *Mangifera indica* and *Zingiber officinale*. Journal of Pharmacognosy and Phytochemistry. 2020; 9(3): 1166-1170
8. Stohs SJ, Miller H, Kaats GR. A review of the efficacy and safety of banaba (*Lagerstroemia speciosa* L.) and corosolic acid. Phytotherapy Research. 2012; 26(3):317-24. DOI: 10.1002/ptr.3664
9. Nurcahyanti ADR, Arieselia Z, Kurniawan SV, et al. Revisiting bungur (*Lagerstroemia speciosa*) from Indonesia as an antidiabetic agent, its mode of action, and phylogenetic position. Pharmacognosy Reviews. 2018; 12: 40-45
10. Chen XM, Qian SH, Feng F. Two new tetrahydronaphthalenes from the stem of *Impatiens balsamina* L. Chinese Chemical Letters. 2010; 21: 440-442
11. Imam MZ, Nahar N, Akter S, Rana MS. Antinociceptive activity of methanol extract of flowers of *Impatiens balsamina*. Journal of Ethnopharmacology. 2012; 142(3):804-10. DOI: 10.1016/j.jep.2012.06.004.
12. Scalzo RL, Picchi V, Migliori CA, Campanelli G, et al. Variations in the phytochemical contents and antioxidant capacity of organically and conventionally grown Italian cCauliflower (*Brassica oleracea* L. subsp. *botrytis*): Results from a Three-Year Field Study. Agricultural Food Chemistry. 2013; 61(43): 10335–10344.
13. Dubey R, Rajhans S, manked AU. Preliminary phytochemical screening, quantitative estimation of total phenolic and flavonoid content of Jatropha gossypiifolia (L). Research Journal of Pharmacognosy and Phytochemistry. 2020; 12(2): 83-86

14. Sheela D, Cheenickal M. Total phenolics and flavonoids among the selected species of *Syzygium*, Gaertn. Research Journal of Pharmacognosy and Phytochemistry. 2017; 9(2): 101-104
15. Hemmalakshmi S, Annapurani S, Devi SG. Comparative phytochemical screening and total phenolic content of different extract of Ficus racemosa, Morinda tinctoria, and Nerium indicum fresh leaves. Research Journal of Pharmacy and Technology 2016. 9(12): 2222-2227
16. Parimi R, Pravallika KE. Studies on phytochemical screening, total phenolic content and in vitro antioxidant activity of different extracts of Euphorbia thymifolia roots. Research Journal of Pharmacy and Technology. 2017; 10(2): 551-556
17. Abdeldjabbar M, Messaouda D, Zhour R, Cheyma B. Comparative analysis of total phenolic, flavonoid content and antioxidant profile of date palm (*Phoenix dactylifera* L) with different watering water from Oued Soufin Algeria. Asian Journal of Research in Chemistry. 2020; 13(1): 28 - 32
18. Kim HY, Kim K. Protein glycation inhibitory and antioxidative activities of some plant extracts in vitro. Journal of Agricultural and Food Chemistry. 2003; 51(6): 1586-91
19. Fitmawati, Resida E, Kholifah SN, et al. Phytochemical screening and antioxidant profiling of Sumatran wild mangoes (Mangifera spp.): a potential source for medicine antidegenerative effects [version 3; peer review: 2 approved] F1000Research 2020, 9:220 Last updated: 02 JUL 2020
20. Núñez SAJ, Vélez CHT, Agüero-Agüero J, et al. Isolation and quantitative analysis of phenolic antioxidants, free sugars, and polyols from mango (*Mangifera indica* L.) stem bark aqueous decoction used in Cuba as a nutritional supplement. Journal of Agricultural and Food Chemistry. 2002; 50(4): 762–766
21. Mohan CG, Deepak M, Viswanatha GL, et al. Anti-oxidant and anti-inflammatory activity of leaf extracts and fractions of *Mangifera indica*. Asian Pacific Journal of Tropical Medicine. 2013; 6(4): 311–314.
22. Delgado-Rodriguez FV, Hidalgo O, Loría-Gutiérrez A, Weng-Huang NT. In vitro antioxidant and antimicrobial activities of ethanolic extracts from whole plants of three *Impatiens* species (balsaminaceae). Ancient Sci Life [serial online] 2017 [cited 2020 Sep3];37:16-23. Available from: http://www.ancientscienceoflife.org/text.asp?2017/37/1/16/236543
23. Ajaib M, Arooj T, Khan K M, et al. Phytochemical, antimicrobial and antioxidant screening of fruits, bark and leaves *Lagerstroemia indica*. Journal of the Chemical Society of Pakistan. 2016; 38(3): 538-545
24. Nasrin F, Ahmad S, Kamrunnahar. Evaluation of antimicrobial, antioxidant and cytotoxic activities of methanolic extracts of *Lagerstroemia speciosa* leaves and barks. Journal of Applied Pharmaceutical Science. 2012; 2(10): 142-147. DOI: 10.7324/JAPS.2012.21028
25. Nurcahyanti ADR. Mangifera and Impatiens from Sumatra: Phylogenetic positions and their modes of action as anticancer agents. Pharmacognosy Review. 2019; 13: 16-23.
26. Sharmin T, Rahman M S, Mohammadi H. Investigation of biological activities of the flowers of *Lagerstroemia speciosa*, the Jarul flower of Bangladesh. BMC Complementary and Alternative Medicine. 2018; 18: 231