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Estimation of physio-chemical properties of different plant parts of *Casuarina equisetifolia* L. and *Swietenia macrophylla* King

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Abstract
Physiochemical analysis of fresh leaf, dried leaf, bark and roots of *Casuarina equisetifolia* and *Swietenia macrophylla* was carried out to find the pH, EC, total phenols, total proteins and total carbohydrates. From the study it was found that pH was the highest in fresh leaf of both the tree species. The EC was recorded the highest in root and bark of *C. equisetifolia* and *S. macrophylla* respectively. As for the total phenols, the highest phenol content was recorded in the roots of both the tree species. Total proteins showed the highest in bark and dried leave of both the tree species. And for the total carbohydrates, the root and bark recorded the highest in *C. equisetifolia* and *S. macrophylla.* The results indicated that pH, EC, total carbohydrates and total proteins exhibited more in *S. macrophylla* when compared to *C. equisetifolia.* However, total phenols exhibited more in *C. equisetifolia* than *S. macrophylla*. *S. macrophylla* is more compatible as intercrop for agroforestry system for having high carbohydrates and protein with small amount of phenols which can hinder the growth of agricultural crops in future.

Keywords: *Casuarina equisetifolia*, *Swietenia macrophylla*, physicochemical properties, fresh leaf, dried leaf, bark, root

Introduction
Casuarina equisetifolia L. belongs to Casuarinaceae family is commonly known as casuarina, is a fast growing, medium sized evergreen tree that can grow up to 45 meters in height. The tree is often planted as a windbreak and also act as a useful species for reforestation of coastal areas and degraded lands. The tree is also valued for its source of fuel (Kumar, 2016) [9], tannins (Parrotta, 1993) [8], activated carbon from seed husk (El Nemr *et al*., 2007) [5], pharmacological activity *viz*., analgesic, anti-inflammatory, anti-histaminic and wound healing (Pawar *et al*., 2021) [16]. *C. equisetifolia* also known for its important in-house construction, furniture, poles and fences, stabilizing sand dunes. It is also a multipurpose nitrogen fixing tree species (Dommergues, 1990) [3].
Swietenia macropylla King. belongs to Meliaceae family and commonly known as big leave mahagony, is a large deciduous tree with an umbrella shape crown, and reaching the height of over 30 meters. The tree is among the three species of Swietenia that yield genuine mahagony timber, the other two species are *Swietenia mahagoni* and *Swietenia humilis*. It is suitable for large-scale timber production because of its excellent timber quality. The wood can be used for construction material, panelling, framing, flooring, cabinet making, plywood, interior of boat, bodies of musical instrument and other ornaments (Krisnawati *et al*., 2011) [10].
S. macrophylla also has potential for reforestation and afforestation. *S. macrophylla* is also medicinally important plant that has been widely use in folk medicines (Moghadamtousi *et al*., 2013; Eid *et al*., 2013; Telrandhe *et al*., 2022) [14, 4, 21]
Both trees are of paramount important in agroforestry, as well as raw material for wood-based industries. To avoid putting pressure on forest, the trees can be feature in farmer's field which will also increase the income of the farmers (Saravanan and Vijayaraghavan, 2014) [18] by intercropping with agricultural crops. The intercropping will lead to plant-plant interaction which is very important when it comes to agroforestry systems (Sharma *et al*., 1982) [19]. The reason being that of plant producing large number of chemical compounds that are vary in their composition and concentration and also affect the growth and development of another species or sometimes of its own species (Rice, 1984) [17].

Therefore, knowing the physiochemical properties of the plant parts like the pH, electrical conductivity, total protein, total phenol and total carbohydrates is important. Hence, the present study is mainly focus on finding the physiochemical properties of different plant parts of *Casuarina equisetifolia* and *Swietenia macrophylla*.

Materials and Methods

Collection of Sample: Different plant parts like fresh leaf, dried leaf, bark and root were collected from *C. equisetifolia* and *S. macrophylla* from Agroforestry Field and Precision Silviculture Field respectively at Forest College and Research Institute, Mettupalayam, Tamil Nadu.

Preparation of Leachate: Dried leaf, bark and root were dried at room temperature for 12 to 24 hours. With the help of Wiley Mill, they were crushed and sieve through 2 mm siever. Fresh leave was used freshly.

Methodology: The various analytical methods used for physiochemical analysis of fresh leaf, dried leaf, bark and root which were collected from *C. equisetifolia* and *S. macrophylla* and are given in the table below:

Table 1: Analytical methods for different plant parts of *Casuarina equisetifolia* and *Swietenia macrophylla*

Sl. No.	Physio-chemical properties	Analytical methods	References
1	pH	1:2 Leachate water suspension	Jackson (1973) [7]
2	Electrical conductivity		
3	Total carbohydrates	Anthrone method	Hedge and Hofreiter (1962) [6]
4	Total proteins	Lowry's method	Lowry *et al*. (1951) [11]
5	Total phenols	Folin-ciocalteau reagent	Malick and Singh (1980) [13]

Result and Discussion

The fresh leaf leachate of the *Casuarina equisetifolia* was found to be the highest among the others with a recorded value of 7.41, followed by dried leaf with a value of 7.21, bark with a value of 5.94 while the lowest being that of root (5.86). At the same time, the fresh leaf of *Swietenia macrophylla* also showed the highest pH with 7.93 followed by dried leaf recorded 7.52, root with 6.81 pH value while the lowest was recorded 5.98 for the bark leachates. The results are conformity with the findings of Neenu (2014) [15] where the leaves of *S. macrophylla* recorded the highest pH through out the tested duration.

The electrical conductivity of *C. equisetifolia* was found to be the highest for the root leachates with a value of 1.71 dSm^{-1}, followed by fresh leave (1.48 dSm^{-1}), bark leachate (1.33 dSm^{-1}) whereas dried leaf leachates were recorded the lowest with a value of 1.24 dSm^{-1}. Whereas, the bark leachate of *S. macrophylla* recorded the highest value of 1.70 dSm^{-1}, followed by root with 1.62 dSm^{-1}, dried leaf which was 1.57 dSm^{-1} while the lowest value of 1.51 dSm^{-1} was recorded for the fresh leaf leachates.

The root leachate of *C. equisetifolia* showed the highest value for total carbohydrates of 53.89 mg/g which was followed by dried leave (46.31 mg/g), bark (29.45 mg/g) while the lowest total carbohydrates were 13.80 mg/g for fresh leaf leachate. Similar results were reported by Tripathi *et al*. (2000) [22] in root extract of *Dalbergia sissoo* which contains the highest amount of carbohydrates. However, the bark leachate of *S. macrophylla* also recorded the highest total carbohydrates value of 49.86 mg/g followed by root (44.53 mg/g), dried leaf (42.65 mg/g) while fresh leave leachate recorded the lowest value of 40.41 mg/g.

The bark leachate of *C. equisetifolia* showed the highest protein content with a recorded value of 1.04 mg/g followed by dried leaf with 0.68 mg/g, fresh leave with a content of 0.46 mg/g while the lowest recorded was showed by root leachate with a value of 0.04 mg/g. The findings are conformity with Bernardino-Nicanor *et al*. (2016) [1] who reported that tree bark of *Erythrina americana* contains higher protein content when compared to leaves, floral buds, young flowers and mature flowers. Whereas, in *S. macrophylla*, the dry leave recorded the highest protein content of 9.41 mg/g, followed by root with a value of 0.51 mg/g, bark with a content of 0.27 mg/g while the fresh leave recorded the lowest protein content of 0.25 mg/g. This was also reported by Makkar and Becker (1997) [12] in *Moringa oleifera* in which leaves recorded the highest crude protein (260 g kg^{-1}) followed by soft twigs (970 g kg^{-1}) and stem (60 g kg^{-1})

The root leachate of *C. equisetifolia* recorded the highest phenols content of 27.65 mg/g, followed by fresh leaf (27.18 mg/g), dried leaf (19.18 mg/g) while the lowest being recorded by bark of 9.79 mg/g. In *S. macrophylla*, the highest phenols content recorded for the root leachates with a value of 54.67 mg/g followed by fresh leaf (23.59 mg/g), dried leave (2.82 mg/g) while the lowest being recorded by bark with 0.40 mg/g. Leaf extract and root extract of *Dalbergia sissoo* showed appreciable amount of phenols as well as that of carbohydrates (Tripathi *et al*., 2000) [22]. Chellamuthu et al. (1997) [2] also reported in *Prosopis juliflora* that the root leachate recorded the highest phenol content when compared to other plant parts *viz*., dry stem powder, bark, dry leaves, fresh leaves and dry leaf powder. Higher total phenol content could be due to the release of secondary metabolites (Siqueira *et al*., 1981)

Table 2: Physiochemical properties of different plant parts of *Casuarina equisetifolia*

Plant parts	pH	Electrical Conductivity (dSm^{-1})	Total Carbohydrates (mg/g)	Total Proteins (mg/g)	Total Phenols (mg/g)
Fresh leaves	7.412	1.48	13.80	0.46	27.18
Dried Leaves	7.215	1.24	46.31	0.68	19.18
Bark	5.948	1.33	29.45	1.04	9.79
Roots	5.867	1.71	53.89	0.04	27.65

Table 3: Physiochemical properties of different plant parts of *Swietenia macrophylla*

Plant parts	pH	Electrical Conductivity (dSm^{-1})	Total Carbohydrates (mg/g)	Total Proteins (mg/g)	Total Phenols (mg/g)
Fresh leaves	7.935	1.51	40.41	0.25	23.59
Dry Leaves	7.521	1.57	42.65	9.41	2.82
Bark	5.983	1.70	49.86	0.27	0.40
Root	6.813	1.62	44.53	0.51	54.67

Conclusion

The physiochemical properties *viz*., pH, electrical conductivity, total phenols, total carbohydrates and total proteins of the leachates present in different parts of selected tree species *viz*., *C. equisetifolia* and *S. macrophylla* were investigated. *S. macrophylla* exhibited more pH, EC, total carbohydrates and total proteins whereas *Casuarina equisetifolia* show more total phenols. Based on these findings, it is concluded that *S. macrophylla* is more compatible as intercrop for agroforestry system for having high carbohydrates and protein with small amount of phenols which can hinder the growth of agricultural crops in future.

References

1. Bernardino-Nicanor A, Montañéz-Soto JL, de los Ángeles Vivar-Vera M, Juárez-Goiz JM, Acosta-García G, González-Cruz L. Effect of drying on the antioxidant capacity and concentration of phenolic compounds in different parts of the *Erythrina americana* tree. Bio Resources. 2016;11(4):9741-9755.
2. Chellamuthu V, Balasusbramanian TN, Rajarajan A, Palaniappan SN. Allelopathic influence of Prosopis juliflora (Swartz) DC. On field crops. Allelopathy J. 1997;4(2):291-302.
3. Dommergues Y. *Casuarina equisetifolia*: an old-timber with a new future, 1990, 90-02.
4. Eid AMM, Elmarzugi NA, El-enshasy HA. A review on the phytopharmacological effect of *Swietenia macrophylla*. Seeds. 2013;3:5.
5. El Nemr A, El Sikaily A, Khaled, Abdelwahab O. Removal of toxic chromium (VI) from aqueous solution by activated carbon using *Casuarina equisetifolia*, Chemistry and Ecology. 2007;23(2):119-129.
6. Hedge JE, Hofreiter BT. Carbohydrate chemistry 17. Whistler, R.L. and Be Miller, J. N., Eds., Academic Press, New York, 1962.
7. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd., New Delhi, 1973, 498
8. John Parrotta. *Casuarina equisetifolia* L. ex. J. R. & G. Forst, 1993.
9. Kumar V. *Casuarina equisetifolia* L.: A potential tree; Tropical Forest Research Institute, Jabalpur, 2016, 3
10. Krisnawati H, Kallio M, Kanninen M. *Swietenia macrophylla* King: ecology, silviculture and productivity. CIFOR, Bogor, Indonesia, 2011.
11. Lowry OH, Rosebrough NJ, Farr AL, Randall RJ. Protein measurement with the Folin phenol reagent. Journal of Biological Chemistry. 1951;193(1):265-75
12. Makkar HPS, Becker K. Nutrients and antiquality factors in different morphological parts of the Moringa oleifera tree. The Journal of Agricultural Science. 1997;128(3):311-322.
13. Malick CP, Singh MB. Plant Enzymology and Histo Enzymology. Kalyani Publishers, New Delhi, 1980, p. 286.
14. Moghadamtousi SZ, Goh BH, Chan CK, Shabab T, Kadir HA. Biological activities and phytochemicals of *Swietenia macrophylla* King. Molecules. 2013;18(9):10465-83.
15. Neenu P. Autoallelopathy of selected multipurpose tree species and the effect of their leachates on agricultural test crop. M.Sc Thesis, Kerala Agricultural University, Thrissur, 2014.
16. Pawar AR, Rao PS, Vikhe DN. Pharmacognostic, phytochemical, physico-chemical standardization of *Casuarina equisetifolia* Stem-Inner bark. Research Journal of Science and Technology. 2021;13(3):193-199.
17. Rice EL. Allelopathy. USA Academic Press, 2nd edition, 1984.
18. Saravanan S, Vijayaraghavan A. *Casuarina equisetifolia* base agroforestry systems for higher economic returns for the farming communities in Tamil Nadu, India, 2014.
19. Sharma KD, Sidhana KL, Singhvi NR. Allelopathic effects of *Peganum harmala* L. on *Pennisetum typhoides*. Indian Journal of Botany. 1982;5:115-119.
20. Siqueira JO, Nair MG, Hammerschmidt R, Safir GR, Putnam AR. Significance of phenolic compounds in plant-soil-microbial systems. Critical Reviews in Plant Sciences. 1991;10(1):63-121.
21. Telrandhe UB, Kosalge SB, Parihar S, Sharma D, Hemalatha S. Collection and Cultivation of *Swietenia macrophylla* King. Sch Acad J Pharm. 2022;1:13-19.
22. Tripathi S, Tripathi A, Kori DC, Paroha S. Effect of *Dalbergia sissoo* extract, rhizobium and nitrogen on germination, growth and yield of *Vigna radiata*. Allelopathy Journal. 2000;7(2):255-264.