International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 28-01-2022, Accepted: 12-02-2022, Published: 28-02-2022
Volume 7, Issue 2, 2022, Page No. 595-599

A comparative pharmacognostic and phytochemical evaluation of haustoria of three varieties of *Cocos nucifera* L

Manju Manoharan[1*], Laija S Nair[2], Bindu R Nair[3]
[1] Research Scholar, Department of Botany, University College, (Affiliated to University of Kerala), Thiruvananthapuram, Kerala, India
[2] Associate Professor, Department of Botany, University College, (Affiliated to University of Kerala), Thiruvananthapuram, Kerala, India
[3] Professor, Department of Botany, University of Kerala, Kariavattom, Thiruvananthapuram, Kerala, India

Abstract
The coconut palm is a monocot perennial member of the Arecaceae family. The present study was conducted to evaluate the pharmacognostic and phytochemical aspects of haustoria of three varieties of coconut: Chowghat orange dwarf (COD), Malayan green dwarf (MGD), and West coast tall (WCT). Phytochemical screening reveals that COD haustorium is enriched with a variety of phytochemicals such as alkaloids, phenols, terpenoids and saponins.

Keywords: coconut haustorium, phytochemical analysis, physico-chemical analysis

Introduction
Cocos nucifera L., commonly known as coconut palm belongs to the family Arecaceae also known as Palmae, is one of the most useful plants which is grown throughout tropical regions. A coconut palm can be mainly grouped into two major classes, the Tall and Dwarf based on certain characteristics like stature, growth characteristics of the tree, and precocious nature of flowering and nut characters. Tall varieties often have a life span of 70 years or more. The tall forms flower in about eight years. West Coast Tall (WCT) is the most common tall coconut variety cultivated commercially. The dwarf varieties often live for 30 years and flower about three to four years after planting. The important dwarf varieties cultivated are Chowghat Orange Dwarf (COD), Malayan Green Dwarf (MGD) etc. In Sanskrit, the coconut is called kalpa vriksha (a mythological tree supposed to grant desires) because of its versatile contribution to mankind. Different products obtained from the coconut tree include tender coconut water, coconut leaves, husk fibre, raw kernel, copra, coir pith, coconut oil, coconut cake, coconut toddy, coconut shell, and wood -based products[1]. One of the lesser utilized products of coconut palm is its haustorium. It is also known as a coconut apple. Coconut haustorium is a soft spongy mass of tissue formed inside the coconut fruit cavity during the process of its sprouting. Haustorium consists of two distinct parts; the outer yellow portion is oil rich and the inner white portion is carbohydrate rich. Previous studies have shown that coconut haustorium contains carbohydrates, proteins, minerals, alkaloids, polyphenols and growth promoting substances[2]. Though attempts have been made to assess the medicinal properties of coconut haustorium, a systematic study on the pharmacognostic and phytochemical aspects of haustorium is lacking. In view of this, the present study has been conducted to compare the physico-chemical and phytochemical parameters in the haustoria of three coconut varieties such as Chowghat Orange Dwarf (COD), Malayan Green Dwarf (MGD) and West Coast Tall (WCT).

Materials and Methods
Collection of samples
Three varieties of coconut such as Chowghat Orange Dwarf (COD), Malayan Green Dwarf (MGD) and West Coast Tall (WCT) were collected from a local plantation in Thiruvananthapuram, Kerala, India. Nuts of identical size and weight were selected and placed in horizontal rows, two-third of each nut covered with soil, and moisture was maintained by periodic watering.
The nuts were regularly monitored for germination. The appearance of the shoot tip on the surface of the perianth was noted as the initial day of germination. Sprouted nuts, 60 days after germination were selected for the study. Germinated nuts were dehusked and the nuts were broken carefully to remove the haustoria from the shell which was then sliced into thin pieces. The sliced samples were initially shade dried for 3-4 days and then oven- dried at 30^0C for 30 minutes. The dried samples were ground and powdered. The powders were stored in air-tight containers and used for the study.

Fig 1: Coconut haustorium

Organoleptic study

Organoleptic characters such as colour, odour, taste and nature of three varieties of coconut haustoria powder were evaluated according to standard methods of analysis[3,4].

Physico-chemical analysis

Physico-chemical parameters such as loss on drying, total ash, acid insoluble ash, acid soluble ash, water soluble ash, water insoluble ash, sulphated ash, water soluble extractives, alcohol soluble extractives and pH were investigated as per standardized methods[5,6,7,8].

Phytochemical analysis

Serial extraction: 20 g of dried coconut haustoria powders were cold extracted with 200 ml of solvents such as petroleum ether, chloroform, ethyl acetate, methanol and distilled water. The extracts were maintained in a shaker for 2 days and then filtered. The extracts thus obtained were concentrated and the crude samples were used for further analysis.

Qualitative and quantitative analysis of phytochemicals such as alkaloids, phenols, flavonoids, terpenoids and saponins were conducted using standard protocols [9, 10, 11, 12, 13, 14, 15].

Results and Discussion

Organoleptic study

The term organoleptic means that 'impression on the organs'. It refers to the methods of analysis like colour, odour, taste, nature etc. Significant differences were found in the colour of the haustoria powder of the three coconut varieties. WCT varied in odour and taste from that of the other two varieties (Table 1).

Table 1: Organoleptic characters of haustoria of the three coconut varieties

Sl. No.	Characters	COD	MGD	WCT
1	Colour	Ecru beige	Deep amber	Cocoa brown
2	Odour	Sweet	Sweet	Toasted and nutty
3	Taste	Milky	Milky	Sour
4	Nature	Non-flowing	Non-flowing	Non-flowing

Physico-chemical analysis

The results of physico-chemical analysis of haustoria of the three coconut varieties are shown in Table 2.

Loss on drying was determined by heating the haustoria powder below its melting point and it includes all volatile matter including water content and solvents. It is therefore the measure of moisture content in the powder sample. The percent loss on drying was found to be less in the three haustoria powder in which COD had the highest loss of 7% followed by WCT and MGD of 6% loss each. Reduced moisture is used for convenience in packaging or shipping of a powdered food product to protect from microbes [16]. The total ash content of coconut haustorium varied among the three varieties. Total ash and acid soluble ash was found to be highest in COD and least in WCT. Total ash and acid-insoluble ash contents are important in evaluating the quality as well as purity of a food product since it represents the total mineral content [17]. Hence as per the ash content, COD was likely to contain more minerals. The total ash includes both physiological ashes derived from the plant tissue and non-physiological ash which is often from environmental contaminations such as sand and soil whereas acid-insoluble ash only contains silica materials. The water-soluble ash is used to determine the amount of inorganic compounds present in the material. COD (1%) had the highest content followed by WCT (0.4%) and MGD (0.3%). The sulphated ash denotes the content of inorganic impurities in an organic substance [18]. In that way, MGD (1.8%) had the highest impurities and COD (0.5%) was found to have the least amount of impurities.

Extractive values are indicative amounts of the active constituents in a plant material when extracted with a particular solvent. Water extractive values of WCT, MGD and COD were found to be 30%, 6% and 13% respectively and their alcohol extractive values were 19%, 20% and 20% respectively. All three varieties were found to have acidic pH in which WCT with the most acidic pH of 3.97 followed by COD (4.90) and MGD (4.97). Acidic food is more likeable to preserve, as the toxins formed by the deadly organism causing botulism are inhibited [19]. Hence it is clear that all the varieties have suitable pH for a preserved food item.

Table 2: Physico-chemical analysis of haustoria of the three coconut varieties

Sl. No.	Characters	COD	MGD	WCT
1	Loss on drying (%)	**7**	6	6
2	Total ash (%)	**7**	5	2
3	Acid-insoluble ash (%)	1.2	1.6	0.5
4	Acid-soluble ash (%)	5.8	3.4	1.5
5	Water-soluble ash (%)	1	0.3	0.4
6	Water-insoluble ash (%)	6	4.7	1.6
7	Sulphated ash (%)	0.5	1.8	1.1
8	Water soluble extractives (%)	13	6	30
9	Alcohol soluble extractives (%)	20	20	19
10	pH	4.90	4.97	3.97

Phytochemical studies

Phytochemicals are the bioactive compounds that are present naturally in plants. Nowadays these phytochemicals have become more popular due to their countless medicinal uses. Phytochemicals play a vital role against several diseases such as asthma, arthritis, cancer, etc. Extraction yield (Table 3) shows the percentage of yield of crude successive extracts (petroleum ether, chloroform, ethyl acetate, methanol and distilled water) of haustoria powders of three coconut varieties. Methanolic extracts of haustoria powders exhibited higher yield followed by distilled water. COD haustorium showed the highest yield percentage in all the solvents. The highest yield percentage was obtained in COD haustorium methanolic extract (26.95%) followed by its distilled water extract (23.55%).

Table 3: Extractive yield percentage of haustoria of three coconut varieties.

Sl No:	Solvents	COD	MGD	WCT
1	Petroleum ether	10.65	6.32	7.64
2	Chloroform	8.8	4.23	3.87
3	Ethyl Acetate	9.4	6.56	7.49
4	Methanol	26.95	19.34	20.65
5	Distilled water	23.55	17.13	19.26

Qualitative phytochemical screening (Table 4) revealed that flavonoid was absent in all the solvent extracts of three haustoria powders. Phytochemicals such as phenols, alkaloids, terpenoids and saponins were present in different solvent extracts of three haustoria varieties. More phytochemicals were detected in chloroform, methanol and distilled water.

Table 4: Qualitative Phytochemical Screening of three varieties of coconut haustoria

Sl No:	Solvents	Sample	Name of phytochemicals				
			Alkaloid	Flavonoid	Phenol	Saponin	Terpenoid
1	Petroleum ether	COD	+	_	_	_	_
		MGD	+	_	_	_	_
		WCT	+	_	_	_	_
2	Chloroform	COD	+	_	+	_	+
		MGD	+	_	+	_	+
		WCT	+	_	+	_	+
3	Ethyl acetate	COD	_	_	+	_	_
		MGD	_	_	+	_	_
		WCT	_	_	+	_	_
4	Methanol	COD	_	_	+	+	+
		MGD	_	_	+	+	+
		WCT	_	_	+	+	+
5	Distilled water	COD	+	_	+	+	_
		MGD	+	_	+	+	_
		WCT	+	_	+	+	_

From the quantitative phytochemical analysis, it was clear that chloroform extract contains the highest amount of alkaloid 115.5 µg Atropine equivalent/mg extract in COD haustorium (Table 5).
The concentration of phenol was found to be highest in the methanolic extract of COD haustorium (98.85 µg Gallic Acid equivalent/mg extract) (Table 6). Saponin content was higher in the COD variety (34.15 µg Diosgenin equivalent /mg extract) when distilled water was used the solvent (Table 7). Terpenoid content was found to be highest in chloroform extract of COD haustorium, (90.66 mg/g) (Table 8).

Table 5: Concentration of alkaloid in the coconut haustoria extracts

Sl No:	Solvents	Concentration of alkaloid (µg AE/mg extract)		
		COD	MGD	WCT
1	Petroleum ether	81.50	47.34	34.16
2	Chloroform	115.5	82.70	90.14
3	Distilled water	100.00	64.32	72.61

Table 6: Concentration of phenol in the coconut haustoria extracts

Sl No:	Solvents	Concentration of phenol (µg GAE/mg extract)		
		COD	MGD	WCT
1	Chloroform	36.71	19.63	21.78
2	Ethyl acetate	30.00	18.96	21.62
3	Methanol	98.85	63.27	72.68
4	Distilled water	83.42	77.64	79.21

Table 7: Concentration of saponin in the coconut haustoria extracts

Sl No:	Solvents	Concentration of saponin (µg DE/mg extract)		
		COD	MGD	WCT
1	Methanol	3.2	2.8	2.91
2	Distilled water	34.15	28.76	33.65

Table 8: Concentration of terpenoid in the coconut haustoria extracts

Sl No:	Solvents	Concentration of terpenoid(mg/g of extract)		
		COD	MGD	WCT
1	Chloroform	90.66	84.32	81.65
2	Methanol	84.51	74.12	76.82

Conclusion

According to the physico-chemical parameters analysed, total ash content, acid-soluble ash, water-soluble ash, water-insoluble ash and alcohol soluble extractives were found to be highest in the COD haustorium. The phytochemical studies revealed that coconut haustorium is rich in phytoconstituents such as alkaloids, phenols, saponins and terpenoids. Among the three haustoria samples, COD haustorium contained phytochemicals in higher quantities. Hence, from the study, it can be concluded that COD haustorium has potential in disease prevention and it must be considered as an important material in phytochemical research.

References

1. Deb Mandal M, Mandal S. Coconut (*Cocos nucifera* L.: Arecaceae): in health promotion and disease prevention. Asian Pacific journal of tropical medicine,2011:4(3):241-247.https://doi.org/10.1016/S1995-7645(11)60078-3
2. Manivannan A, Bhardwaj R, Padmanabhan S, Suneja P, Hebbar KB, Kanade SR. Biochemical and nutritional characterization of coconut (Cocos nucifera L.) haustorium.Food Chem. 238, 2018, 153-159.
3. Dravnieks A. Atlas of Odor Character Profiles. Philadelphia: ASTM Data Series ed. Instrumental- Sensory Relationships ASTM Committee E-18 on Sensory Evaluation of Materials and Products. Section E-18.04.12 on Odor Profiling, 1985.
4. *Munsell, Albert H. A Color Notation. Boston: G. H. Ellis Co.* Munsell's original description of his system. A Color Notation was published before he had established the irregular shape of a perceptual color solid, so it describes colors positioned in a sphere, 1905.
5. Indian Pharmacopoeia. The Indian Pharm. Commission Ghaziabad. Inst. of Medicine,2007:1:78-134.
6. WHO: World Health Organization. Sulfated Ash, 2012. Document QAS/11.401.
7. Indian Pharmacopoeia. The Indian Pharm. Commission Ghaziabad. Inst. of Med. 1. 1966.
8. Iqbal, J., Jilani, G., and Aslam, M. Growth Inhibiting Effects of plant extracts against the grain moth, Sitotroga cerealella (Oliv.) (Gelechiidae: Lepidoptera). Pakistan Journal of. Zoology,2010:42(5):597-601.

9. Sofowora, A. Screening plants for Bioactive Agents. In:Medicinal Plants and Traditional Medicinal in Africa. 2nd Ed.Spectrum Books Ltd, Sunshine House, Ibadan, Nigeria, 1993, 134-156.
10. Trease, G.E. and Evans, W.C. Pharmacognosy. 15th Ed. Saunders Publishers, London,2002:42-44:221-229,246-249,304-306, 331-332, 391-393.
11. Kancherla N, Dakshinamoothi A, Chitra K, Komaram RB. Preliminary Analysis of Phytoconstituents and Evaluation of Anthelminthic Property of *Cayratia auriculata* (*In Vitro*). Maedica,2019:14(4):350
12. Selvakumar S, Vimalanban S, Balakrishnan G. Quantitative determination of phytochemical constituents from Anisomeles malabarica. MOJ Bioequivalence and Bioavailability,2019:6(1):19-21.
13. Kamtekar S, Keer V, Patil V. Estimation of phenolic content, flavonoid content, antioxidant and alpha amylase inhibitory activity of marketed polyherbal formulation. Journal of applied pharmaceutical Science,2014:4(9):61.
14. Deepika J, Savita S. Estimation of Total Phenolic, Flavonoid and Saponin Content in Different Extracts of Butea monosperma Bark. International Journal of Engineering Technology Science and Research,2017:4(7):177-182.
15. Ferguson NA. Textbook of Pharmacognosy, Max Millam Company, 1956, 191.
16. Bradley RL. Jr. Moisture and Total Solids Analysis. In. S.S. Nielsen (Ed.), *Food Analysis*, Springer 4, 2010, 85-104.
17. Rao Y, Xiang B. Determination of Total Ash and Acid-insoluble Ash of Chinese Herbal Medicine Prunellae Spica by Near Infrared Spectroscopy. The Pharm. Soc. of Japan,2009:129(7):881-886.
18. WHO: World Health Organization. Sulfated Ash, 2012. Document QAS/11.401.
19. John ER. Acidified foods: Formulating dressings, sauces, and marinades Dept. of Food Sci, 1993, 99(21).