ORIGINAL ARTICLE

Pharmacognostic characterization of *Carica papaya* L.

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Abstract

Background: Fruits and leaves of *Carica papaya* L. are widely used for various therapeutic purposes. This study aimed to establish some pharmacognostic parameters. **Materials and Methods:** For this propose, determination of total ash values, percentages of water matter, and percentages of total ethanol extractable matter, as well total polyphenol, tannins, and flavonoids were quantify using leaves from different seasons in different years. **Results:** The samples were cultivated under control. The values of percentage of water matter were: Collet (COL)1 = 5.5 ± 0.06, COL2 = 7.07 ± 0.18, COL3 = 9.03 ± 0.03, COL4 = 11.2 ± 0.46, and COL Mix = 11.5% ± 1.15%; values of percentage of total ethanol extractable matter were COL1 = 12.1 ± 1.4, COL2 = 13.5 ± 1.6, COL3 = 16.7 ± 1.2, COL4 = 11.1 ± 0.55, and COL Mix = 14.1% ± 1%. These values were not different between the samples. The total of flavonoids quantified were for COL1 = 835.6 ± 47.5, COL2 = 1202.9 ± 32, COL3 = 962.4 ± 11.3, COL4 = 708.9 ± 11.4, and COL Mix = 1273.8 ± 45.8. The polyphenol quantified were: COL1 = 11.8 ± 0.3, COL2 = 12.9 ± 0.1, COL3 = 27 ± 0.1, COL4 = 28.4±0.2, and COL Mix = 14.2 ± 0.5. Tannins quantified performed for COL1 = 1.7 ± 0.2, for COL2 = 2.1 ± 0.2, for COL3 = 25.6 ± 0.3, for COL4 = 27 ± 0.3, and for COL Mix = 4 ± 0.6. **Conclusions:** These results demonstrated that production of secondary metabolites by *C. papaya L.* is influenced by season conditions, soil and water viability.

Key words: *Carica papaya L.,* natural products, quality parameter

INTRODUCTION

Papaya, a juicy and tasty fruit, belonging to family Caricaceae is scientifically known as *Carica papaya* Linn. It is grown in various parts of the world including India, tropical America, and Europe. Papaya plant is laticiferous as they contain specialized cells known as laticifers. Laticifers secrete latex and dispersed throughout most plant tissues.[1] Papaya tree is basically short-lived Indian tree. In the historic times, it was considered as an exotic fruit because of its buttery taste and appearance. Papaya was the first genetically modified fruit consumed by human beings for its nutritional and medicinal properties.[2] *C. papaya* L., Caricaceae, contains a digestive enzyme-papain used to treat trauma, allergies, and sports injuries.[3] It has been evaluated for effect on cardiovascular system,[4] angiotensin converting enzyme inhibitors,[5] and antihypertensive compounds.[6] Its chemical composition described the presence of flavonoids, tannins, and alkaloids.[7] *C. papaya* secondary compounds production are dependent on soil quality, temperature, and humidity.[8] Pharmacognostic determination allows standardization of the vegetal by purity parameters.[9] Different parts of this *C. papaya* plant are used for several conditions pharmacological activities such as antihelminthic, antifertility, anti-implantation, abortifacient, purgative, antihypertensive, antibacterial, antioxidant, anti-inflammatory, ulcer healing, diuretic, and platelet count increasing activity.[10] *C. papaya* is well known that traditional herbal medicine existed before the

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application of modern scientific methods to healthcare, and even today majority of the world population depends on herbal healthcare practices. Exploring traditional herbal medicines in the perspective of modern science is the need for optimum and proper consumption of traditional plant drugs. In the last decade, the WHO, recognizing the importance of herbal medicines, has passed many resolutions *vis-a-vis* improving the quality and efficacy of the plant drug.[11] This work proposes to determine quality parameters for *C. papaya* collected in different seasons.

MATERIALS AND METHODS

Vegetal Material

C. papaya leaves, Rubi variety (Rubi INCAPER 511),[12] was collected at the experimental farm of Sooretama, Capixaba Research Institute, Technical Assistance and farm extension (INCAPER). The collet (COL)1 was realized in 2011 in a period of July (12.5 mm^3, 29° max and 16°C min; COL1), the COL2, in August (25 mm^3, 30° max and 16.1°C min.; COL 2). In 2012, COL3 was performed in May (0 mm^3, 29.5° max and 18.2 min., COL3), and COL4, in July (62.5 mm^3,29.1°C max and 15.7°C min; COL4), equal mix with the samples was prepared (COL Mix). The vegetal material was submitted to dry using ventilated oven, 40°C, for 48 h, followed by milling, using knife mill, the generated product was denominated vegetal drug.

Determination of Total Ash Value, Percentages of Water Matter, and Total Ethanol Extractable Matter

Total ash value, percentages of water matter, and total ethanol extractable matter determination were performed according to the World Health Organization and Brazilian Health Surveillance Agency.[13,14]

Determination of Total Polyphenol, Tannins, and Total Flavonoids

The quantification of total flavonoids, polyphenol, and tannins were realized according with colorimetric method.[15] A standardize quercetin curve (1-12 µg/mL) was plotted to quantify total of flavonoids. The absorbance was determined using a spectrophotometer (T80+ UV/VIS Spectrometer, PG Instruments Ltd., Leicester England) at 425 nm. The results are reported as quercetin equivalent (mg/g of dry mass). Every point was determined in triplicate. Folin–Ciocalteu method was used to quantify total polyphenol and tannins. An external pyrogallol calibration curve using concentration of 3.125-37.5 µg/mL was plotted. Absorbance was recorded at 715 nm using the same spectrometer as for flavonoids. The results are reported as pyrogallol equivalent (mg/g of dry mass). To analyses, 150 mg of vegetal drug was utilized.

Statistical Analysis

Statistical analysis was performed by one-way analysis of variance followed by Fischer's least significant difference *post-hoc* test using Software Package for the Social Science Software Package version 12.0. Results were expressed as mean ± standard deviation. $P < 0.05$ was considered significant.

RESULTS

In the present study, results revealed that the purity and integrity of the samples, which means percentages of water matter, percentage of total ethanol extractable matter, and total ash value [Table 1]. The analyses results did not indicate differences between the COLs for percentage of water matter, total ethanol extractable, and ash.

Determination of Total Polyphenols and Flavonoids

Table 2 represents the results for total polyphenols and flavonoids. Polyphenols compounds were different produced between the COL1 and COL2 compared to COL3 and COL4. The flavonoids did not represent a significant difference between the collets. COL Mix did not represent a significant difference between the averages of the samples. However, these compounds were quantified in higher quantity in this mix. Higher quantities for tannins were found in COL3 and COL4.

DISCUSSION

Plants secondary metabolites production are influenced by diverse factors as soil quality,[16] geographic localization,[17] harvest techniques, which can generate loss of the final content of these metabolites,[18] independently from the class of these compounds.[8] However, for some species, the relation between soil, climate, and geographic localization is not possible to be clearly established.[19,20] Indeed, the photosynthesis has a direct relation with water supply, what could lead to alteration in metabolism of the plants leading to the mobilization of reserve and modification of growth rate.[21] Rain precipitation rates have a direct relation with leaves loss of water-soluble compounds and roots by lixiviation.[22,23] On the other hand, temperature has a direct relation with altitude and seasonality, however, the influence of this isolated factor over metabolites production is hardly reported.[18] In fact, the chemical characterization of *C. papaya* performed by this work, no correlation between the rate of rain precipitation and temperature in the months of collection and content of flavonoids and total polyphenol could be established. The values of total polyphenols demonstrated the difference between the samples what could be used as a parameter

Table 1: Water matter percentages, total extractable in ethanol, total ash of *C. papaya* leaves

Sample	Water matter percentages	Total extractable in ethanol	Total ash
COL1	5.5±0.06*	12.1±1.4*,§,‖	11.6±0.5
COL2	7.07±0.18*,†	13.5±1.6*,†,‖	10.9±0.8
COL3	9.03±0.03†b,‡	16.7±1.2‡,‖	11.5±0.4
COL4	11.2±0.46‡,§,‖	11.1±0.55*,‡,§,‖	12.5±0.2
COL Mix	11.5±1.15§,‖	14.1±1*,†,‖	12±0.1

COL: Collection. Letters in the same column stand for a significant difference between the samples. Results were expressed as mean±SD for each COL. *P*<0.05 were considered significant. Where *,†,‡,§,‖Represents collects before they were added to the COL Mix. *C. papaya: Carica papaya,* SD: Standard deviation

Table 2: Spectrophotometric quantification of polyphenols and total flavonoids in leaves samples of *C. papaya*

Sample	Total flavonoids (mg. 100/g*)	Total polyphenols (g. 100/g**)	Total tannins (g. 100/g)
COL1	835.6±47.5*	11.8±0.3*	1.7±0.2*
COL2	1202.9±32.4†,‡	12.9±0.1*,†	2.1±0.2*,†
COL3	962.4±11.3*,†,‡	27±0.1‡,§	25.6±0.3‡
COL4	708.9±11.4*,‡,§	28.4±0.2‡,§	27±0.3‡,§
COL Mix	1273.8±45.8†,‖	14.2±0.5e,†	4±0.6*,†,‖

COL: Collection. Letters in the same column stand for a significant difference between the samples. Results were expressed as mean±SD for each COL. *P*<0.05 were considered significant Where *,†,‡,§,‖Represents collects before they were added to the COL Mix. *Results expressed in quercetin equivalent. **Results expressed in pyrogallol equivalent. *C. papaya: Carica papaya,* SD: Standard deviation

to qualify fruits. The different values found for the purity assays, demonstrated that environmental changes influence directly production of secondary metabolites by *C. papaya*. In addition, nutritional bioavailability, air pollution, UV radiation, pathogen attacks, altitude, circadian rhythm, and growth rate influences directly the quantities and qualities of secondary metabolites. The year of 2012, between June and July occurred rains but not abundantly, between March and May, rain was scarce, less than expected for these months. These facts could provoke hydric stress leading variation in quantification of secondary metabolites. In general, leaves collection occurred after fluorescence of *C. papaya*, L. It also influences the determination of secondary compounds.

CONCLUSION

The present study revealed that the results demonstrated that production of secondary metabolites by *C. papaya L.* is influenced by season conditions, soil and water viability.

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