



**COMPARATIVE PHYSICOCHEMICAL AND PHYTOCHEMICAL
EVALUATION FOR INSULIN PLANT-*COSTUS PICTUS* D.DON
ACCESSIONS**

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ABSTRACT:

Costus pictus D. Don commonly known as Insulin plant, as the Tribal people of Kerala and Tamilnadu consume 2-3 leaves of the plant twice a day, known to manage diabetes. The plant is known to possess many other pharmacological activities than antidiabetic property. It is grown as an ornamental plant in gardens of South India regions and is transported to the parts of India in various Nurseries. The objectives of this study were to compare the fifteen accessions collected from the different geographical regions of India, on the basis of a large number of morphological, physicochemical and phytochemical characteristics. From the obtained results, it should be confirmed that the fifteen accessions of *Costus pictus* collected from the different populations of South, West, North and Middle India are almost same when compared for morphology as well as physicochemical and phytochemical properties. As the plant has various medicinal properties, the findings obtained from this study will be useful to explore it as the important herbal source of antidiabetic as well as other possible pharmacological activities from any region of the India.

Keywords: *Costus pictus* D.Don, Accessions, Medicinal plant, Physicochemical, Phytochemical.

INTRODUCTION:

Medicinally important Insulin plant, *Costus pictus* D. Don belonging to the family Costaceae is less explored plant generally known as Spiral flag. This plant is commonly used by the tribal people of Kolli hills of Tamilnadu, to treat diabetes by consuming 2-3 leaves twice a day, hence the plant named as Insulin plant [1,2]. The Costaceae monocot family has seven genera and around 143 recognized species [3]. This plant is said to be native of tropical climates of Asia, Central America, South America and Africa. The plants is grown as the ornamental plant in south regions but nowadays gain the

popularity and medicinal interest due to its medicinal potential and shows various pharmacological properties such as diuretic effect, anti-oxidant, anti-cancers and putative activity other than antidiabetic property [4]. Though this plant is known to have various medicinal uses, few research and scientific reports are available on its physicochemical and phytochemical information all over the India. Morphological examination is a very important, easy and straight way to study diversity. It is helpful in indexing various genera and species for various accessions.

As per our knowledge and literature review, there is a lack of information on the morphological, physicochemical and phytochemical analysis of the different accessions of *C. pictus* collected from various geographical regions of India. The objective of this study was to evaluate morphology, physicochemical and preliminary phytochemical profiling of *Costus pictus* accessions that can make possible to identify the plant and that can assist and provide the base in the preparation of monograph of this plant.

MATERIALS AND METHOD:

Collection of plant material

C. pictus accessions consist of samples from Gujarat, Maharashtra, Karnataka, Tamilnadu, West Bengal, Goa, Madhya Pradesh, Telangana and Kerala. Authentications of the plants were done at Department of Bioscience, VNSGU, Surat. The voucher specimen (No.ABN/1) was deposited at CGBIT department, Maliba Campus, Bardoli, Gujarat. The plants were then planted as their wild counterpart (rhizome part-vegetative growth) and fresh leaves were collected.

Preparation of plant extracts: Weigh 10 g dried powdered leaves materials and use them extraction using 100 ml of different solvents (Methanol, aqueous, petroleum ether, acetone, benzene, chloroform and hexane) by using Soxhlet apparatus for 6-8 hr at a temperature not more than their respective boiling points. The extracts were filtered using Whatman No.1 filter paper and then under vacuum at 40°C concentrated by using a rotary evaporator. The residual extracts were stored 4°C further use.

Morphological, physicochemical and phytochemical study of different accessions:

The plant was macroscopically examined for shape, size, surface characteristics, texture, color, odor, taste, etc (Figure 1). Physicochemical parameters were determined as per guidelines of WHO and The Ayurvedic Pharmacopoeia of India [5,6]. Foreign material analysis, loss on drying, total ash value, water soluble ash, acid insoluble ash, solubility of the extract in different solvents, pH, heavy metal analysis, petroleum ether soluble extractive, alcohol soluble extractive, ethyl acetate soluble extract, and water soluble extractive values were determined. Leaf extracts of *C. pictus* were evaluated for identification of efficient solvent system. This screening identified the suitable solvent systems which have the highest yield of extracts. For the identification of secondary metabolites in plant extracts, qualitative analysis was performed [7,8].

RESULTS AND DISCUSSION: Fifteen accessions were collected from different geographical regions of India for the variability studies. *C. pictus* is a perennial vigourously herbaceous monocot, rhizomatous, plant. The plant have the light green when immature and dark green when mature leaves with smooth large surface. It is a tropical evergreen plant, and lower surface is light purple colored. The largers leaves are at base and smaller leaves towards apex and are spirally assembled on stems. The leaf has pinnate parallel venation, its base is red and the sheathing is joined with margins, acuminate at apex. There is a characteriste mint-sour taste of the leaf and odor.



Figure 1 Germination of *Costus pictus* (Left) and young plant (Middle) in the plastic nursery bag and Flower bud (Right).

Flowers of are yellow colored with red linear stripes appear on cone like head sitted at the apex if the stem. Study of variability of quantitative morphological characters based on eleven parameters revealed minimum variability in the morphological parameters (Table 2). There were no such distinctive morphological variations among 15 populations. All the accessions of the *Costus pictus* D. Don are visibly almost same with minor variations in morphological parameters.

Results of pharmacognostic analysis showed percentage of foreign mater ranged 1.15-1.89%, loss on drying ranged 7.89-8.42%, total ash content ranged 15.11-15.84%, water soluble ash ranged 11.25-11.99%, acid soluble ash ranged 2.8-2.9%, water soluble extractive values ranged 10.09-10.77%, alcohol soluble extractive values ranged 2.28-2.82%, petroleum ether and ethyl acetate extractive values ranged 1.64-1.97% and 2.98-3.29%, respectively. All the accessions are free from heavy metal content, foreign materials and contaminations of microorganisms. Hence, they were found to be safe to use for further studies. These all values were in the proper range with reference to the Indian pharmacopeia and the Government of India Ministry of Health and Family

Welfare Department of Ayush (Table 3). The values found in these studies for all the acecions are nearly same and not significantly different from eachothers. In an earlier report [9,10] the morphological, anatomical and proximate features of this plant grown in a nursery at Vallam, Tamilnadu and accessions collected from different parts of Kerala have been briefly described.

Aqueous and methanolic leaf extracts of *C.pictus* were evaluated for exploration of efficient solvent system. This screening identified the efficient solvent systems which have the highest yield of extracts. The 8 extracts (Methanol, aqueous, petroleum ether, acetone, benzene, chloroform and hexane) yielded by Soxhlet extraction method have shown considerable differences. The extraction was done on the basis of polarity of the solvents. The maximum extract yield was obtained with methanol (4.05 g) > aqueous (3.15 g) > acetone (2.93 g) > benzene (1.82 g) > diethyl ether (1.31 g) > ethyl acetate (1.19 g) > chloroform (0.74 g) > hexane has the lowest yield (least polar solvent) (0.57 g). Methanol and aqueous extracts (CPME and CPAQ, respectively) found to be most efficient solvent systems with highest percentage yields and further used for further studies.

Preliminary phytochemical screening of CPAQ and CPME extracts confirmed the presence of major all phytochemicals like, alkaloids, cardiac glycosides, flavonoids, glycosides, phenols, saponins, steroids, tannins, and terpanoids compounds in both the extracts of all the accessions. Fifteen accessions collected from different geographical regions were analyzed for variability. Their qualitative traits are useful in characterization of accessions, as they show high heritability and stable morphological, physicochemical and phytochemical expressions. There was no significant divergence among those fifteen accessions. The samples of *Costus pictus* originally collected from fifteen different regions of India, when observed did not reveal any significant difference in their vegetative and reproductive characters.

The present study revealed that the different accessions collected from geographical regions of India are studied as the representative of that particular area showed no significant variability which were here evaluated by morphology, physicochemical and phytochemical properties. Earlier study reported low genetic variability in accessions of *C. pictus* though accessions were collected from diverse geographical regions [11]. So, from this and our studies, it has been observed that different accessions of *C. pictus* have somehow same genetic pool and share nonsignificant characteristics.

CONCLUSION: A systematic approach is necessary in physicochemical and phytochemical study which helps in confirmation and determination of identity, purity and quality of crude drugs. Hopefully, the parameters which have been evaluated as per the standard norms and presented in this physicochemical and

phytochemical study of different fifteen *C. pictus* accessions will provide valuable information for future research work. From this and earlier studies, we can conclude that the plant collected from any geographical regions of India have almost the same genetic pool as well as their morphology, physicochemical and chemical constituents are same and they can be used to evaluate and explore their pharmacological activities.

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CONFLICT OF INTEREST STATEMENT: We declare that we have no conflict of interest.

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Table 1 *Costus pictus* accessions collected from different geographical locations

| Accessions | Place of collections | | Locality Geographical Coordinates | |
|------------|----------------------|----------------|-----------------------------------|--------------------|
| | City | State | Latitude(°N) | Longitude(°E) |
| CP1 | Howrah | West Bengal | 22°33'38.4"N | 88°17'20.1"E |
| CP2 | Bhopal | Madhya Pradesh | 23° 15' 35.7588" N | 77° 24' 45.414" E |
| CP3 | Panji | Goa | 15°29'07.4" N | N73°49'49.0" E |
| CP4 | Hydrabad | Telangana | 17° 23' 6.1584" N | 78° 29' 12.0156" E |
| CP5 | Navsari | Gujarat | 20° 56' 48.1272" N | 72° 57' 7.326" E |
| CP6 | Daang | Gujarat | 20° 49' 31.3608" N | 73° 42' 2.5524" E |
| CP7 | Vellore | Tamilnadu | 12°55'13.8" N | 79°07'32.3" E |
| CP8 | Thekkady | Kerala | 9° 36' 11.1924" N | 77° 9' 41.2488" E |
| CP9 | Banglore | Karnataka | 12° 58' 17.7564" N | 77° 35' 40.4268" E |
| CP10 | Nashik | Maharashtra | 19° 59' 50.8308" N | 73° 47' 23.2872" E |
| CP11 | Vansada | Gujarat | 20° 45' 28.5552" N | 73° 21' 50.5368" E |
| CP12 | Chennai | Tamilnadu | 13° 4' 57.648" N | 80° 16' 14.5848" E |
| CP13 | Palode | Kerala | 8° 43' 27.9624" N | 77° 1' 29.2116" E |
| CP14 | Dharwad | Karnataka | 15° 27' 32.1264" N | 77° 0' 0.0000" E |
| CP15 | Nagpur | Maharashtra | 21° 8' 44.88" N | 79° 5' 17.358" E |

Table 2 Morphological variations in quantitative characters of *Costus pictus* accessions

| Plant part | Characters | Mean | SEM | Range |
|------------|--------------------------|-------|------|-------------|
| Aerial | Plant height(cm) | 223 | 0.87 | 211-235 |
| | adventitious bud on stem | 14 | 0.17 | 11- 17 |
| | Total no of leaves/plant | 160.5 | 0.86 | 150-171 |
| | Leaf length (cm) | 18.73 | 0.14 | 17.25-20.22 |
| | Width of largest leaf | 7.44 | 0.25 | 5.9-8.99 |
| | No. of flowers/plant | 5 | 0.10 | 3-7 |
| | Flower size | 30.23 | 0.97 | 20.25-40.21 |
| Rhizome | Length (cm) | 34.73 | 0.22 | 30-39.47 |
| | Width | 3.49 | 0.78 | 2.1-4.89 |
| | Internode Length (cm) | 5 | 0.09 | 2-8 |
| | Diameter(cm) | 6.23 | 1.27 | 1.27-12.14 |

All results were performed and analyzed in triplicates

Table 3 Pharmacognostic analysis for *Costus pictus* accessions

| Accessions | Foreign matter analysis (%) | Loss on drying (%) | Total ash (%) | Water soluble ash (%) | Acid insoluble ash (%) | Water soluble extractive (%) | Alcohol soluble extractive (%) | Petroleum ether soluble extractive (%) | Ethyl acetate soluble extractive (%) | pH | |
|------------|-----------------------------|--------------------|--------------------|-----------------------|------------------------|------------------------------|--------------------------------|--|--------------------------------------|-----------------|------------------|
| | *Not more than 2% | *Not more than 9% | *Not more than 20% | *Not more than 12% | *Not more than 5% | *Not more than 12% | *Not more than 3% | | | Aqueous extract | Methanol extract |
| CP1 | 1.35 | 8.29 | 15.25 | 11.79 | 3.5 | 10.11 | 2.81 | 1.87 | 3.21 | 7.84 | 3.55 |
| CP2 | 1.15 | 8.21 | 15.2 | 11.65 | 3.9 | 10.24 | 2.62 | 1.92 | 3.19 | 7.71 | 3.26 |
| CP3 | 1.22 | 8.11 | 15.35 | 11.84 | 3.2 | 10.14 | 2.75 | 1.64 | 3.25 | 7.25 | 3.27 |
| CP4 | 1.32 | 8.35 | 15.42 | 11.99 | 2.9 | 10.22 | 2.82 | 1.75 | 3.15 | 7.52 | 3.22 |
| CP5 | 1.65 | 8.31 | 15.19 | 11.59 | 2.8 | 10.17 | 2.66 | 1.91 | 3.05 | 7.55 | 3.45 |
| CP6 | 1.88 | 8.35 | 15.23 | 11.25 | 3.5 | 10.09 | 2.72 | 1.89 | 3.11 | 7.64 | 3.21 |
| CP7 | 1.25 | 8.17 | 15.11 | 11.91 | 3.2 | 10.77 | 2.81 | 1.78 | 2.98 | 7.12 | 3.26 |
| CP8 | 1.66 | 7.98 | 15.47 | 11.65 | 3.1 | 10.56 | 2.67 | 1.96 | 3.25 | 7.32 | 3.66 |
| CP9 | 1.24 | 8.42 | 15.39 | 11.75 | 3.7 | 10.64 | 2.28 | 1.9 | 3.14 | 7.25 | 3.24 |
| CP10 | 1.24 | 8.22 | 15.84 | 11.69 | 3.2 | 10.61 | 2.77 | 1.88 | 3.29 | 7.65 | 3.48 |
| CP11 | 1.25 | 7.98 | 15.22 | 11.61 | 3.1 | 10.25 | 2.75 | 1.87 | 3.15 | 7.54 | 3.51 |
| CP12 | 1.89 | 8.09 | 15.19 | 11.85 | 3.3 | 10.65 | 2.65 | 1.82 | 3.09 | 7.33 | 3.34 |
| CP13 | 1.34 | 8.11 | 15.51 | 11.57 | 3.4 | 10.62 | 2.78 | 1.86 | 3.21 | 7.27 | 3.33 |
| CP14 | 1.44 | 8.24 | 15.42 | 11.71 | 3.6 | 10.27 | 2.71 | 1.89 | 3.11 | 7.67 | 3.27 |
| CP15 | 1.52 | 8.14 | 15.76 | 11.45 | 3.8 | 10.45 | 2.62 | 1.97 | 3.21 | 7.25 | 3.23 |

All results were performed and analyzed in triplicates

* The Ayurvedic Pharmacopoeia of India Part- I Volume – V Government of India Ministry of Health and Family Welfare Department of Ayush Page No .89. *Costus speciosus* Rhizome