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Micro Propagation and Biochemical Profilling of Chlorophytum Borivilianum Plants of Vindhya Region, Madhya Pradesh

Guru Prasad Tiwari [1]#, Prof. Rajesh Singh [2], Prof. Santosh Kumar Agnihotri[1]
1. Department of Botany, Government Model Science College Rewa, (M.P.)
2. Department of Botany, Government VPG College Maihar, Satna (M.P.)
3. Department of Botany, Government Model Science College, Rewa (M.P.)

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ABSTRACT:
The purpose of this study was to analysis the phenolic metabolites and related therapeutic properties were affected by the presence of three various solvents: water, methanol, and ethyl acetate. Approach: Qualitative and quantitative methods were used to evaluate the study. Antioxidant activity was demonstrated using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assays. The data highlighted that methanol was the most potent solvent for polyphenol extraction. The IC50 values of DPPH about 52.83 g/mL and 68.96 g/mL, respectively, for DPPH and ABTS radical scavengers, the methanol extract of C. borivilianum showed the greatest antioxidant activity. In contrast, the extracts of ethyl acetate and aqueous showed the nethermost antioxidant potential. The Folin-Ciocalteu method indicated that the phenolic content of the methanol extract was 4.30 mg of equivalent Catechol (GAE)/g, which was greater than that of the aqueous extract, which had 5.50 GAE/g. The radical scavenging capacity, which is a measure of antioxidant activity, showed that the DPPH assay produced values in C. borivilianum leaves ranging from 2.1 to 3.1 TEAC in µg/ml equivalent to Trolox, and in tuber extracts from 3.36 to 3.8 TEAC in µg/ml equivalent to Trolox. This study's results suggest that C. borivilianum leaf methanolic extract has strong antioxidant properties, making it a promising candidate for use in functional food and supplement development.
Keywords: phenolic profile, antioxidant, extract, scavenging activity, Trolox.

I. INTRODUCTION:

Chlorophytum borivilianum is a valuable herb of medicine, which has been employed in practice since ancient times for its curative properties. It finds application in the system of traditional Indian medicine known as Ayurveda, increases general health and energy level (Kirtikar& Basu, 1975). The "Vedas," ancient Hindu scriptures, sing praises about the utility of its aphrodisiac effects and possible therapy for impotence (Thakur & Dixit, 2006). Rhizomes of C. Borivilianumhas been utilized in the Ayurvedic, Unani, and Allopathic medical sectors for a variety of medicinal uses. It is traditionally observed to reinforce male potency. However, researchers have recently shown that it can be used for the treatment of diabetes and arthritis too (Gayathri & Saroja, 2013). The plant is rich in bioactive compounds, including carbohydrates, proteins, fibers, and saponins. These members make it useful for medicinal purposes as well as nutrition (Kaushik, 2005). Among the members of Chlorophytum, C. borivilianum has recorded maximum root yield with excellent amount of saponin content, the main Phytochemical component (Aundhe& Deokule, 2001). C. borivilianum is an indigenous plant that can grow in a variety of climatic and soil conditions of India. It is grown in the states of Madhya Pradesh, Maharashtra, Punjab, the state of Andhra Pradesh, Bihar, India, the state of Orissa Uttar Pradesh, and the Indian state of Rajasthan Kerala, Karnataka, Tamil Nadu, and Gujarat. It is even taken as a leafy vegetable in some areas (Khanam, Singh et al., 2013). Since the crop has commercial importance, it is commercially cultivated. The crop harvested during October-November, which is kept for planting the following season is tubers. All these aspects considering climate, soil, types of propagation, nutrient management, weed and insect control, and intercropping must be taken into consideration for successful cultivation. Recently, C. borivilianum has been put in focus as a natural, safe aphrodisiac agent. The potential benefits have opened up new pathways for its utility and more is the requirement, but commercial utilization of this threatened species does not allow one to think about its conservation. Researchers and farmers are engaged in standardizing and popularizing the state-of-the-art micro-propagation techniques for the sustainable production of C. borivilianum (Khanam, Singh et al., 2013).

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The Vindhya region is unusual due to the diverse variety of flora and exotic ecosystems that create a natural habitat for Chlorophytum borivilianum, known as Safed Musli. A geographical survey demands mapping its occurrence across several different types of forests in the region. This study would be of vital importance for knowing their preferences regarding habitat, population density, and ecological factors influencing growth (Kumar M et al., 2018).

II. MATERIALS AND METHODS:

Plant extract collection and preparation: Flowers of C. borivilianum were gathered from different forests of Rewa (MP), Satna (MP), and Shidhi (MP), and authenticated by a botanist. Plants were collected from their natural habitat during the last week of September to the first week of October. The aerial parts of C. The tubers and leaves were mixed with borivilianum. They were then extracted after 72 hours of maceration at ambient temperature (30 °C) for petroleum-based ether and methanol, respectively.Through the filter paper, the product was filtered. The expected percentage yields of extracts from leaves and tubers were 10.5% w/v and 12.3%, respectively.

Screening for phytochemicals Using the methods outlined below (Dwivedi, Patel et al. 2017), air-dried and powdered plant materials were screened for the presence of various phytocompounds, including alkaloids, saponins, glycosides, steroids, tannins, and so on. More than 25 different types of sugars, including sucrose, fructose, glucose, mannose, galactose, and xylose, as well as carbohydrates, proteins, steroids, saponins, calcium, potassium, magnesium, phenol, herbs that are mucilage, and carbohydrates, are abundant in this plant. (Thakur, Bag et al. 2009). All experiments have been achieved in triplicate and as compared with control pattern from Jayanti Kunj as defined in proceeding observe (Tiwari, Singh et al.).

Phenolic compounds:

The presence of flavonoids is shown by the disappearance of the severe yellow colouration that became visible after adding dilute HCl to a portion of the methanolic extract that had been handled dropwise with NaOH in the NaOH test.The presence of flavonoids is indicated by a pinkish-reddish-brownish-crimson colour in a short amount of time, according to the Shinoda test (HCl test), which involves adding a few shards of Mg ribbon and a deposite of highly concentrated HCl to 1 ml of methanolic extract of the herbs.

Protein Content:

Biuret screening: After adding a few drops of 1% CuSO4 to one millilitre of extract, 1% NaOH was added. Proteins are indicated by a blueish pink or violetish colour.1 millilitre of test extract was combined with 1 millilitre of H2SO4, and then Millon's reagent was added drop by drop. As the mixture is heated, a white or yellow precipitate forms, which then transforms into a red one. This proves that proteins are present.

SDS page and Protein awareness estimation from extract

The dazzling leaves were ground in a mortar and pestle with 0.5 M Na-phosphate buffer (pH 7.0) to extract soluble proteins. These proteins were then measured using the BCA Protein Assay (Pierce™), which makes use of BSA. 50 mg dried extract powder of both leaves and tubers wash resuspended in 2 hundred µl of PBS and separately. Then 20 µl of suspended samples were mixed with 20 µl of 2X SDS loading buffer and heat the sample at 950C for 10 min. every pattern became centrifuged at13000 rpm for five min. Then 20 µl samples have been loaded on SDS web page gel. After electrophoresis the gel became stained with coomassie stain and destained with destaining buffer.Protein awareness estimation of extracts from each tuber and leaves have been achieved using Pierce™ BCA Protein Assay kit as described manually in the kit protocol.The rasin test consists of dissolving 1 milliliter of methanolic extract in 1 milliliter of acetone and then adding 1 milliliter of distilled water. There are rasins present when the solution is turbid.

To test for tannins, add 2 milliliters of 5% ferric chloride to 1 milliliter of extract; a dark blue or greenish-black hue indicates a positive tannin test.Adding the same volume of concentrated H2SO4 to 1 milliliter of methanol after dissolving 1 milliliter of the sample is the Salvoski assay procedure for steroids. When a chloroform layer forms, it will be bluish red to cherry in color, which is an indication of steroids.

Evaluation of Saponins using Foam: The development of foam indicates the presence of saponins when a little amount of extract is shaken with water. Check for Sodium Bicarbonate: Sodium bicarbonate has been added to at least one milliliter of plant extract with a few drops. It

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verifies the presence of saponins if a honeycomb-like structure develops.

Betacyanins and anthocyanins: With the help of 1 milliliter of 2N NaOH, 1 milliliter of plant extract was mixed and heated. When betacyanin formed, a yellowish hue was visible, and when anthocyanin formed, a bluish-inexperienced color was visible.

For the starch-iodine test, mix 1 milliliter of iodine and 1 milliliter of potassium iodide solution with 1 milliliter of extract; a strong blue hue will form if starch is present in the mixture.

Terpenoids assay: 5 milliliters of plant extract, 2 milliliters of chloroform, and 3 milliliters of concentrated H2SO4 were combined to form a layer. There were terpenoids present because of the reddish brown interface.

Glycosides: 1 milliliter of ferric chloride (FeCl3), 1 milliliter of acetic acid, and a few drops of concentrated hydrochloric acid are added to 1 milliliter of plant extract. The existence of glycosides is indicated by their greenish-blue color.

Phenols: The presence of phenols can be confirmed by adding a few drops of FeCl3 solution to 1 milliliter of plant extract; this will cause the solution to turn blue, green, pink, or red in color.A phenol analysis was performed by heating 1 milliliter of plant extract with 1 milliliter of 1% hydrochloric acid. If the test pattern contains purple precipitate, it means that plobatannins are present.

Dwivedi, Tiwari, and colleagues (2018) used the Use the Folin-Ciocalteu reagent to find out how much polyphenol the plant's tuber and leaf extracts have in comparison to C. borivalium. After adding 25 µl of plant extract diluted with 125 µl of water, 150 µl of the reagent Folin- Ciocalteu (1N) and 25 µl of Na2CO3 (20p.cw/v) were added, and the mixture was cooked at 450C for 60 minutes. A UV-Vis spectrophotometer was utilized to detect the absorbance at 765 nm.

Experimental Procedure:

1. **DPPH Solution Preparation:** A 100 µM DPPH solution was used by dissolving 7.89 mg of DPPH in 100 ml of 99.5% ethanol and storing it in the light absence area for two hours.
2. **Trolox Standard Preparation:** A 1.00 mM Trolox stock solution was prepared by dissolving 2.5 mg of Trolox in a buffer and diluting it to 10.00 ml. Working solutions of varying concentrations (0.10, 0.08, 0.06, 0.04, and 0.02 mmol/L) were prepared by further diluting the stock solution.
3. **Sample Preparation:** The test samples were prepared at appropriate concentrations.
4. **DPPH Assay:** 1000 µl of DPPH solution was mixed with 800 µl of Tris-HCl buffer (pH 7.4) in a test tube. Then, 200 µl of the test sample solution was added and mixed thoroughly. The mix was incubated at room temperature for 30 minutes.
5. Absorbance Measurement: The solution's absorbance at 517 nm was measured using a spectrophotometer. A blank with ethanol and Tris-HCl buffer was also used as a control.
6. Inhibition Ratio Determination: The inhibition ratio (%) was determined as Inhibition ratio (%) = (A0 - A1) × 100 / A0, whereas A0 is the absorbance of the plain sample control and A1 the absorbance of the extract test sample.

IC50 Calculation:

The IC50 value is calculated as the absorption of the sample needed to inhibit 50% DPPH radicals. The inhibition ratios are plotted against the sample concentrations and a regression line drawn. From the obtained plot, IC50 value was determined by interpolation at the point where the inhibition ratio is 50%.

III. RESULTS AND DISCUSSION:

SDS PAGE and Protein Concentration estimation

Protein Profiling of the in vivo vegetation could be useful in characterizing the biochemical and Molecular aspects of boom and differentiation in both in vivo and in vitro plantlets. SDS page of Chlorophytum borivilianum leaves and tubers extract samples showing multiple Bands which indicate that each leaves and tubers of Chlorophytum borivilianum plant are rich in protein content material. The envisioned protein concentrations thru BCA approach are listed in table-1. Our locating suggests that C. borivilianum flowers have greater protein content material in tubers in assessment to leaves. Leaves and tuber extracts from Churhat wooded area of Shidhi district includes maximum amount of protein content in evaluation to Chitrakoot and Ateraila forest.

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Table-1 Protein concentration estimation through BCA method in Chlorophytum borivilianum plant leaves and tubers from different region.

S. No.	Chlorophytum borivilianum plant	Extract from leaves (milligrammes of protein per weight of plant-based material)	Protein milligrammes per weight of dried extracts from plants in tubers
1.	Chitrakoot, Satna	1.76 ± 0.002	2.3 4± 0.003
2.	Ateraila, Rewa	1.83 ± 0.003	2.66 ± 0.004
3.	Churhat, Shidhi	2.08 ± 0.008	2.70 ± 0.008
4.	Jayanti Kunj control	1.92 ± 0.003	2.45 ± 0.006

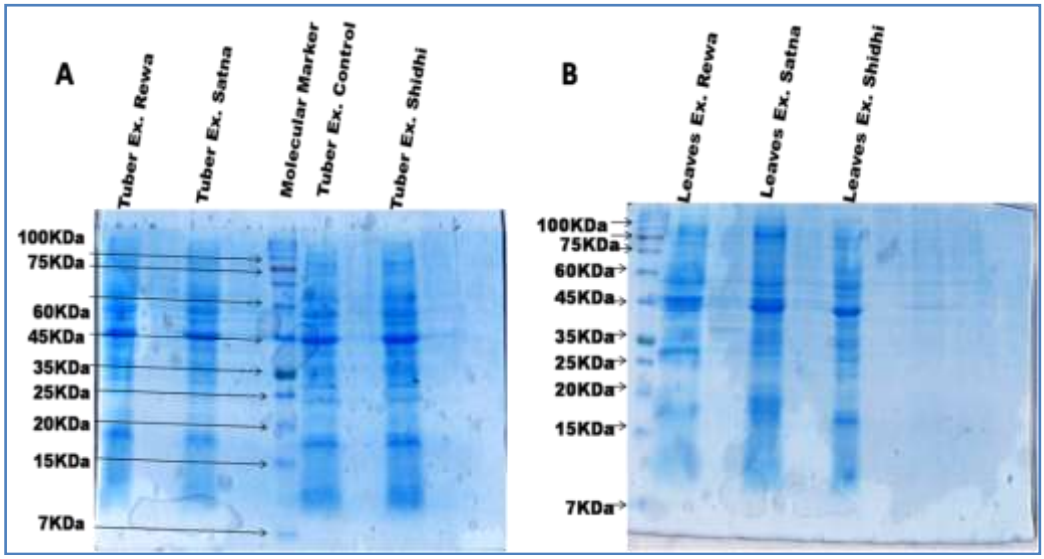

Figure 1 - SDS PAGE illustrating proteins of C. Borivilianum [A]. Tuber Extract from different districts on of Vindhya region (control was taken from Jayanti Kunj facility; Ex.- Extract) [B]

Leaves Extract from different districts on of Vindhya region

Phytochemicals Screening

According to phytochemical screening in Chlorophytum borivilianum, the plant's leaves and tubers contain a wide variety of organic compounds, including carbohydrates, the form of phenol flavonoids, all alkaline substances, saponins, rasins, tannins, and steroids, cellulose, glycosides and phlobatannins, and terpenoids.

The plant alkaloids are the massive and maximum diverse elegance of secondary metabolites, worried in numerous biosynthesis pathways and possess an array of structure, and pharmacological sports. Those are getting used as capsules, teas, poisons, etc for 4000 years. Alkaloids are present in water and absent in methanolic extract from Chitrakoot and Ateraila area whereas these compounds are found in each water and methanolic extract from Churhat area in both leaves and tubers.

Terpenoids or isoprenoids are the important class of phytocompounds, separated from the 5- carbon compound isoprene with extra useful corporations. Terpenoids are employed for growth and development of flowers and for the protection from biotic and abiotic strain. here we suggested that terpenoids had been gift within the extracts Chlorophytum borivilianum leaves and tubers from every vicinity.

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S. No.	Phytochemicals	Chlorophytum borivilianum leaves Control from Jayanti Kunj		Chlorophytum borivilianum leaves from Ateraila (Rewa)		Chlorophytum borivilianum leaves from Chitrakoot (Satna)		Chlorophytum borivilianum leaves from Churhat (Shidhi)	
		Water	Methanol	Water	Methanol	water	Methanol	Water	Methanol
1.	Carbohydrate	-	+	+	+	+	+	+	+
2.	Alkaloid	+	-	+	-	+	-	+	+
3.	Flavonoid	+	++	+	++	+	++	+	+
4.	Protein	+	+	+	+	+	+	+	+
5.	Resin	+	+	+	+	+	+	+	+
6.	Anthocyanin	-	-	-	-	-	-	-	-
7.	Saponins	+	++	+	++	+	++	+	+
8.	Steroid	-	-	+	-	+	-	-	-
9.	Tannin	-	-	-	-	-	-	-	-
10.	Starch	-	-	-	-	-	-	-	-
11.	Glycoside	+	+	+	+	+	++	+	++
12.	Phlobatannins	+	+	+	+	+	+	-	+

Table- 2 Comparison of qualitative phytochemicals analysis of C. borivilianum plant leaves extracts collected from Ateraila forest of Rewa district, Chitrakoot forest of Satna district and Churhat forest of Shidhi district of Vindhya region of Madhya Pradesh.

Steroids are the essential for everyday increase and improvement, however, some adverse results are also related to their lengthen use such as osteoporosis, immunosuppression, high blood pressure and metabolic disturbance. Here we located that steroids are present in water extract of each leaves and tubers from Chitrakoot and Ateraila area whereas absent in methanolic extract. Steroids are absent have been absent in both methanolic and water extracts of Chlorophytum borivilianum from Churhat, Shidhi location.

S. No.	Phytochemicals	*Chlorophytum borivilianum* Tubers Control from Jayanti Kunj		*Chlorophytum borivilianum* Tubers from Ateraila (Rewa)		*Chlorophytum borivilianum* Tubers from Chitrakoot (Satna)		*Chlorophytum borivilianum* tubers from Churhat (Shidhi)	
		Water	Methanol	Water	Methanol	water	Methanol	Water	Methanol
1.	Carbohydrate	-	+	+	+	+	+	+	+
2.	Alkaloid	+	-	+	-	+	-	+	+
3.	Flavonoid	+	++	+	++	+	++	+	+
4.	Protein	+	+	+	+	+	+	+	+
5.	Resin	+	+	+	+	+	+	+	+
6.	Anthocyanin	-	-	-	-	-	-	-	-
7.	Saponins	+	++	+	++	+	++	+	+
8.	Steroid	-	-	+	-	+	-	-	-
9.	Tannin	-	-	-	-	-	-	-	-
10.	Starch	-	-	-	-	-	-	+	-
11.	Glycoside	+	+	+	+	+	+	+	+
12.	Phlobatannins	+	+	+	+	+	+	-	+

Table- 3 Comparison of qualitative phytochemicals analysis of C. borivilianum plant tubers extracts collected from Ateraila forest of Rewa district, Chitrakoot forest of Satna district and Churhat forest of Shidhi district of Vindhya region of Madhya Pradesh.

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By combining a sugar molecule with a triterpene or steroid aglycon, saponins clearly undergo a process of increasing their molecular weight and becoming amphiphilic. Triterpene saponins and steroid saponins are two major types of saponins. Those chemical compounds guard healthy flowers from insect, fungal and bacterial pathogen. These are therapeutically essential because they have antiseptic and antioxidant pastime. Right here, we determined that saponins are gift at some stage in the plant frame (Leaves and tubers) in each aqueous and methanolic extract from each place. Here we also observed that quantities of saponins are extra in methanolic extract in assessment to aqueous extract from Chitrakoot and Ateraila vicinity while, it's far same in both extracts from Churhat place.

Tannins are polyhydroxy phenols of excessive molecular weight soluble in water and alcohol and acetone and may coagulate proteins. Tannins primarily based formulations are used to deal with diarrhea, leucorrhoea and rhinnorhoea. Here, we discovered that Tannins had been absent in Chlorophytum borivilianum leaves and tubers from every area.

Anthocyanins or anthocyans are water soluble pigments that, relying on their pH, provide blue, pink, purple, or black colors. Those are the participants of the flavonoid class synthesized thru polypropanoid pathway and are the maximum identified visible members of bioflavonoid phytochemicals. Anthocyanins have proven antioxidant effect for you to shield from DNA damage. Severalresearches have said that Anthocyanins can also improve the immune device and help fight from coronary heart sickness, infection, viral infections, and so on. Right here, Anthocyanins were absent in Chlorophytum borivilianum leaves and tubers from each vicinity.

Glycosides are Na+/okay+ pump inhibitors used to treat congestive heart failure and cardiac arrhythmia (Tiwari, Tripathi et al. 2014, Dwivedi, Tiwari et al. 2018). Here we mentioned that glycosides were gift inside the extracts of Chlorophytum borivilianum leaves and tubers from each area. Resins have been, present in each methanolic and water extract from every vicinity. Starch have been absent in Chlorophytum borivilianum in both extract of leaves and tubers from Chitrakoot and Ateraila whereas it's miles present in small amount in water extract of tubers from Churhat region. Phlobatannins have been present in, Chlorophytum borivilianum in Chitrakoot and Ateraila region while it's far absent from Churhat location in water extract of each leaves and tubers.

Quantitative analysis of total Polyphenolic Contents for plant extract

Compound of Polyphenolic are normally located in both suitable for eating and inedible vegetation, and reported for more than one organic effect, together with antioxidant interest. The antioxidant potential of compound of phenolic is required to their redox residences (Ramalakshmi, Kubra et al. 2008). It's been mentioned that phenolic compounds display antioxidant interest and play a vital role in stabilizing peroxidation of lipid (Dwivedi, Tiwari et al. 2018) and inhibiting diverse types of oxidizing enzymes. General polyphenolic content material of decided on a part of the plant were proven.

Table- 4 Concentration of polyphenolic contents in leaves and tubers of Chlorophytum borivilianum plants from different region.

S. No.	Chlorophytum borivilianum plant	Leaves (TPC in concentration µg/ml equivalent to Catechol)	Tubers (TPC in concentration µg/ml equivalent to Catechol)
1.	Chitrakoot, Satna	4.30 ± 0.002	5.36 ± 0.007
2.	Ateraila, Rewa	4.0 ± 0.003	6.05 ± 0.004
3.	Churhat, Shidhi	3.80 ± 0.008	5.80 ± 0.008
4.	Jayanti Kunj control	4.50 ± 0.003	5.50 ± 0.003

It was determined that alkaloids, phenols, flavonoids, tannin, saponins, and glycosides are among the medicinally active components found in the methanolic extract of Safed musli (C. borivilianum). The aim of this essay is given an overview of the potential applications of Chlorophytum borivilianum as an important herbal remedy. As an aphrodisiac, anti-inflammatory, immunomodulatory, anti-stress, and sedative, it is one of the rarest and most valuable medical herbs. To be able to validate its usefulness, more clinical trials need to be conducted because this plant holds

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a lot of potential as a versatile medicinal agent (Yadav M K et al., 2022).The root powder of Safed Musli showed the presence of alkaloids, flavonoids, phenols, tannin, saponins, and glycosides through phytochemical screening. Ahmad et al., 2014 and Sharma and Chandrul, 2017 have also reported similar results. Some conventional methods were utilized and concentration was measured by spectrophotometer to quantify the phytochemical screening. Additionally, Thakur et al., 2009 observed that the phytochemicals in Safed Musli contained abundant flavonoids, glycosides, and saponins. Both the analyses of Vijaya and Chavan (2009) were carried out phytochemicals like alkaloids, phenols, flavonoids, tannin, saponins, glycosides both quantitative and qualitative whereas Chakraborthy and Aeri (2010) were dealing with the quantitative and qualitative analysis of a number of phytochemicals. Bhat et al. (2018) further established through their phytochemical studies on this plant species the presence of several bioactive components, including saponins, glycoside, tannins, alkaloids, triterpenoids, flavonoids, phenolics, terpenenoids, and gallotannins. This species showed several properties, including aphrodisiac, antibacterial, antioxidant, hepatoprotective, galactogogue, antidiabetic, adaptogenic, and tonic properties, based on its pharmacological assessment.

Antioxidant activities of C. borivilianum plant extracts using DPPH assay from different regions are shown in Figure. 5.

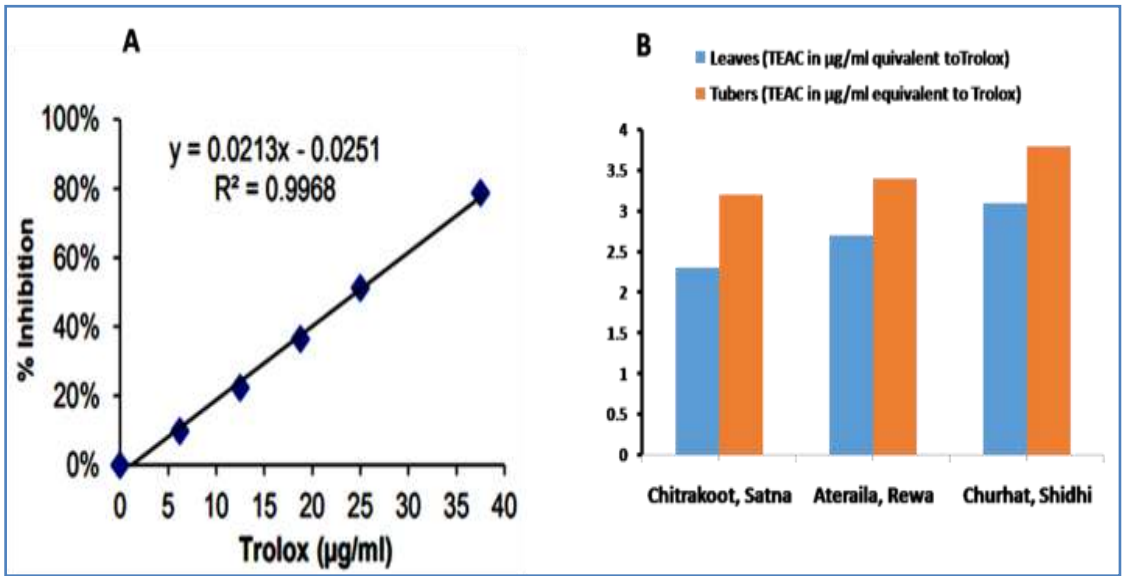

Figure- 5 DPPH assay for leaves and tubers of C. borivilianum plants; (A) Trolox Standard curve, (B) Free radicals scavenging activity of Leaves and tubers of C. borivilianum plants collected from different regions

Among those, antioxidant interest in terms of radical scavenging activity, the usage of DPPH assay ranged among 2.3 TEAC in µg/ml equal to Trolox to 3.1 TEAC in µg/ml equal to Trolox in C. borivilianum leaves and 3.36 TEAC in µg/ml equal to Trolox to 3.8 TEAC in µg/ml equal to Trolox in tubers extracts. The maximum antioxidant activity become determined in leaves extracts of Churhat (Shidhi) wooded area (three.1TEAC in µg/ml equivalent to Trolox) observed by means of Ateraila (Rewa)forest (2.7 TEAC in µg/ml equal to Trolox) and Chitrakoot (Satna)forest (2.three TEAC in µg/ml equivalent to Trolox),in addition tuber extract of Churhat forest indicates most antioxidant hobby (three.8 TEAC in µg/ml equal to Trolox) followed by Ateraila woodland (3.4 TEAC in µg/ml equal to Trolox) and Chitrakoot woodland (3.36TEAC in µg/ml equal to Trolox).

"Because of its strong antioxidant capacity and protective effects against inflammatory pathological processes, cancers, and mutagens (including scavenging free radicals)," Researchers are interested in a variety of phenolic chemicals that are present in plants, such as flavonoids, anthocyanins, phenolic acids, and simple phenolics (Shahidi F et al., 2018). Phenolic compounds can function as efficient hydrogen donors and metal

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chelators, reducing agents, and oxygen inhibitors because of their redox characteristics.

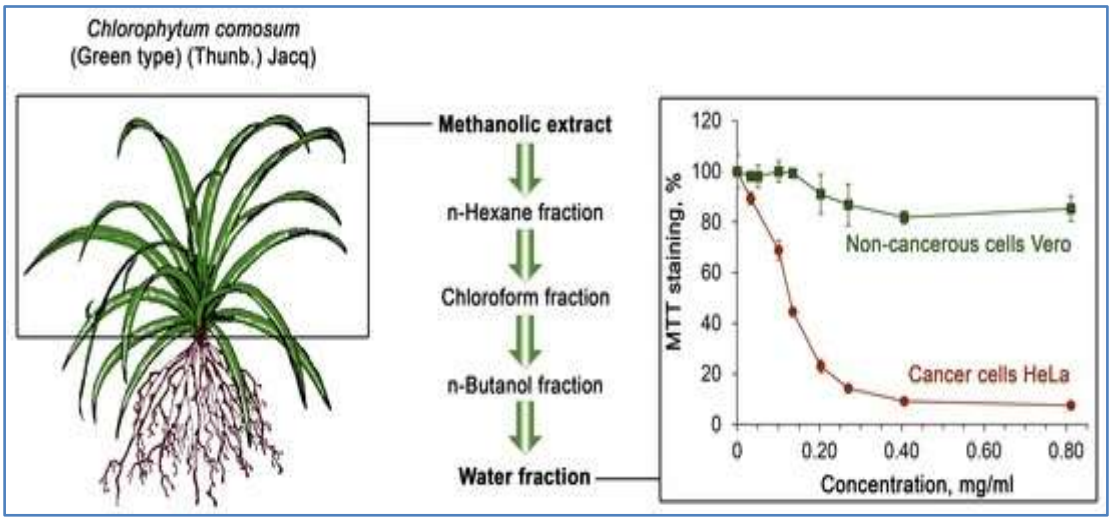

Figure: 6 Chlorophytum borivilianum plant extract of methanol (Green Type) (Thunb.) Jacq: Phytochemical Identification, Antioxidant Activities, and Cytotoxicity (Rzhepakovsky, I.V et al., 2022).

We present the most comprehensive chemical constituent study of this significant traditional medicinal plant to date by combining the results of two independent radical scavenging assays with the distinct chemical makeup of each extract, even though the effect of phenolic compounds on antioxidant capability has been extensively discussed. Furthermore, it is commonly known that a variety of parameters, including the phytochemical makeup, which is directly related to the extraction technique, can have a substantial impact on antioxidant activity (Karlowsky J et al., 2003).

We conducted experiments in order to learn how different extraction solvents affected the phytoconstituents profile and antioxidant capacity of C. borivilianum plant extract. In this instance, phytochemical heterogeneity as well as the antioxidant capability of the C. borivilianum extract can best be gained through extract of methanol. The antioxidants are the arylheptanoid substances, myricanone, catechin, quercetin, and p-coumaric acid, and more of these can be found in EE than in the other extracts. Flavonoids and phenolics are also found in higher concentrations in EE. Nordstrom L. et al. (2013) reported that the "effect of the solvents employed for extraction on the antioxidant potential of the pertinent extracts had been documented for these types". In addition, the extract composition of EE was remarkably different from those of NC and N which possessed antibacterial activity and higher content arylheptanoids and phenolics, respectively (Singh B et al., 2016).

IV. CONCLUSION:

This article concluded that leaf extracts of C. borivilianum, through high concentration of phytochemicals including flavonoids and phenolics, display interesting antioxidant properties. Measurement of TPC and TFC showed that the extraction solvent powerfully influences the amounts and content profile of bioactive chemicals in each of the extracts of C. borivilianum, namely EAE, EE, and AE. TFC and TPC were the highest in strain C. borivilianum EE. This study yielded new understanding of the possible mechanisms of antioxidant effects shown by C. borivilianum, particularly its free radical scavenging activity. There appears to be a substantial relationship connecting the biologic property of the various C. borivilianum extracts and their flavonoid and phenolic acid contents. Due to the excellent cancer-preventive effects attributed to the leaf extracts of C. borivilianum, their application should be widened. This plant could involve a paramount importance in the prevention of some disease conditions that arise from overproduction of free radicals, including cancers, cardiovascular problems, and premature aging. Potential preservatives for food and cosmetics require more study into isolating and characterizing bioactive components.

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