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Full Length Research Article

Quantitative Analysis of the Three Lianas, Ethnomedically Used for the Treatment of Diabetes

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Abstract

The phytochemical study of the plants reveals important information regarding the presence of a particular chemical compound and the quantity of the same present in the plant. Plans use their different parts like stems, roots, leaves, bark, fruits, seed etc. to deposit the primary as well as secondary metabolites. The primary metabolites are usually consumed in diets. The secondary metabolites are generally used for the treatment of various ailments. The alkaloids present in the plants are used for the treatment of diabetes, gastrointestinal problems, skin diseases, rheumatoid arthritis, inflammations etc. as documented through ethnomedicinal studies in the districts of Paschim and Purba Medinipur, West Bengal, India. In the present study, quantitative analysis of the three liana (woody vines) species namely *Tinospora cordifolia* (stem), *Coccinia grandis* (root) and *Gymnema sylvestre* (leaf) were done. These lianas were collected from three different localities. These three lianas were used in majority by the tribal and local people for the treatment of diabetes related issues. The results interpreted that the pant tissues of *Tinospora cordifolia* (stem) collected from the arid region of Digha, Purba Medinipur contain the highest level of alkaloid supporting the fact of higher production of secondary metabolites in response to stress condition. The alkaloid content was followed by *Gymnema sylvestre* (leaf) and *Coccinia grandis* (root). Another important interpretation was made that the alkaloid content of the plant species are at its highest peak in the rainy season irrespective of the species and the area of collection.

***Key words*:** Qualitative analysis, Liana, diabetes, Alkaloid, Ethnomedicine

Chemicals produced by plants that have been utilized as traditional medicines are known as phytochemicals (from the Greek phyto, which means "plant"). Due to the existence of a biologically active component, medicinal plants offer extraordinary therapeutic qualities. Plants have been used as traditional medicine for a very long time on the Indian subcontinent. It is crucial in both the prevention and treatment of human diseases. Because plants are a rich source of phytochemical components and have the capacity to defend against a variety of diseases, it is clear from study that they have the potential to have medicinal benefit [1]. Since ancient times, people have believed that certain biologically active compounds found in plants have therapeutic properties that can be used to treat a variety of illnesses, such as asthma, gastrointestinal issues, skin disorders, respiratory and urinary problems, hepatic and cardiovascular disease, etc.

Due to the chemical components of these plants' therapeutic value, which have a favourable physiological effect on the human body, there is a huge potential for the discovery and development of new pharmaceuticals [2]. The phytochemicals that are deposited in various plant components, such as the roots, stems, leaves, flowers, fruits, or seeds, are frequently visible as coloured molecules in the outer layer of plant tissue [3]. Due to the accumulation of bioactive phytochemicals in the plant tissue, which are referred to as primary and secondary metabolites, medicinally significant plants provide therapeutic advantages.

Primary metabolites are organic substances that help the plant body grow and develop. These substances include glucose, starch, polysaccharides, protein, lipids, and nucleic acids. Alkaloids, flavonoids, saponins, terpenoids, steroids, glycosides, tannins, volatile oils, and other secondary metabolites are produced by plants [4].

In addition to enhancing the plant's colour, flavour, and scent, secondary metabolites shield plants from harm and illness. Generally speaking, phytochemicals are the plant compounds that shield plant cells from environmental dangers such pollution, stress, drought, UV exposure, and pathogenic attack [5-7].

When their dietary intake is significant, it is now well established that they play a part in protecting human health. More than 4,000 phytochemicals have been identified [6] and categorized [8] based on their protective properties, physical traits, and chemical composition [7]. About 150

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phytochemicals have undergone in-depth research. Fruits, vegetables, legumes, whole grains, nuts, seeds, fungus, herbs, and spices all contain a variety of dietary phytochemicals [6]. Common sources include whole wheat bread, tomatoes, grapes, cherries, strawberries, raspberries, cabbage, onions, garlic, carrots, beans, legumes, and soy products [9].

Plant tissues such as the roots, stems, leaves, flowers, fruits, or seeds all acquire phytochemicals [10]. The outer layers of the various plant tissues frequently contain high concentrations of phytochemicals, especially colour compounds. According on the variety, processing, cooking, and growth conditions [11], levels differ from plant to plant. Supplemental versions of phytochemicals are also available, although there is little proof that they offer the same health advantages as dietary phytochemicals [6]. These substances have biological characteristics and are referred to as secondary plant metabolites. such as anticancer property, antibacterial effect, detoxification enzyme modulation, immune system stimulation, platelet aggregation reduction, antioxidant activity, and hormone metabolism regulation. There are about a thousand phytochemicals, both known and undiscovered.

Although recent studies have shown that several phytochemicals can help protect humans against disease [12], it is long known that plants create these compounds to defend themselves. Bioactive phytochemicals, often known as bio nutrients, are plentiful in medicinal plants. Studies conducted over the last two to three decades have demonstrated the critical role that these phytochemicals play in the prevention of chronic diseases like cancer, diabetes, and coronary heart disease. Dietary fibre, antioxidants, anticancer, detoxifying agents, immunity-potentiating agents, and neuropharmacological agents are the main types of phytochemicals with disease-preventing properties.

These functional agents are divided into several different chemical classes, each with a variety of potencies. Some of these phytochemicals serve many purposes. However, there is a lot of need for more, methodical research in identifying these phytochemicals in Indian medicinal plants and evaluating their potential to offer protection from a variety of diseases [13-14]. The three liana species that are utilized by locals and tribal peoples to cure diabetes were the subject of the current phytochemical analysis.

Lianas (woody vines) are a common and varied group of plants found in forests all over the world, but they are most prevalent in the tropics. Biologists and natural historians have always been interested in lianas due to their frequency and presumable significance in the dynamics of forests [15-16]. More recently, it was discovered that lianas play a significant role in many aspects of forest dynamics, including inhibiting tree regeneration, increasing tree mortality, providing an important source of food for animals, and physically connecting trees to allow arboreal animals access from canopy to canopy [17-18].They are likely to become more prevalent overall throughout the tropics as the rate of tropical forest disturbance rises, and their significance to numerous elements of forest dynamics will rise [19].

MATERIALS AND METHODS

Plant material

Stems of *Tinospora cordifolia*, a liana, is one of the plant materials of our present study. This plant was collected from three different localities namely Purba Medinipur, West Bengal; Paschim Medinipur West Bengal and Ranchi, Jharkhand. The plant samples were collected in three different seasons namely Summer, monsoon and rainy between the period 2021-2022. Other two lianas along with their used parts, namely *Coccinia* grandis (root) and *Gymnema sylvestre* (leaf) were collected from only one locality i.e., Bhadutala forest of Paschim Medinipur. The herbarium sheets of the plant samples were authenticated by Botanical Survey of India (BSI), Shibpur, Howrah, West Bengal, India.

Preparation of the plant extract

The stems of the plant were used for the phytochemical analysis. The stems of the plant were air dried in shade and then they were grinded to fine powder. The plant material was extracted in methanol, chloroform and aqueous solutions. The extraction was done using magnetic stirrer running for 24 hours.

Table 1 The OD values of the different plant species belonging to different localities and collected in different seasons were measured. The concentration of the different plant species were calculated from the linear regression equation. The obtained value in µg/µl was converted in to percentage and represented in the following table

Plant species	locality	Collecting season	Methanol (%)	Chloroform (%)	Aqueous (%)
Tinospora cordifolia	Purba Medinipur	Summer	9.05	6.24	6.32
		Winter	9.85	9.20	8.91
		Rainy	12.99	12.19	10.93
	Paschim Medinipur	Summer	9.06	7.90	6.44
		Winter	5.12	8.80	4.83
		Rainy	9.90	9.27	8.68
	Ranchi	Summer	8.96	7.87	6.18
		Winter	11.93	11.26	6.40
		Rainy	12.19	11.10	9.39
Coccinia grandis	Paschim Medinipur	Rainy	9.89	9.65	7.91
Gymnema sylvestre	Paschim Medinipur	Rainy	9.90	10.00	8.56

Qualitative test of the plant extract

2ml of Dragendorff's reagent was added to each of the 3ml extracts of the plant prepared in three different solvents. A reddish-brown precipitate at the bottom of the test tube confirmed the presence of alkaloid [20-21].

Quantitative test of the plant extract

For quantifying the amount of alkaloid in the different samples, Optical Density (OD) values of different concentration of standard was measured through UV-vis double beam spectrophotometer. Atropine was used as the standard for alkaloid. The concentration of the alkaloid present in various samples was calculated using the linear regression equation for alkaloid. The absorbance was measured at the wavelength of 470 nm.

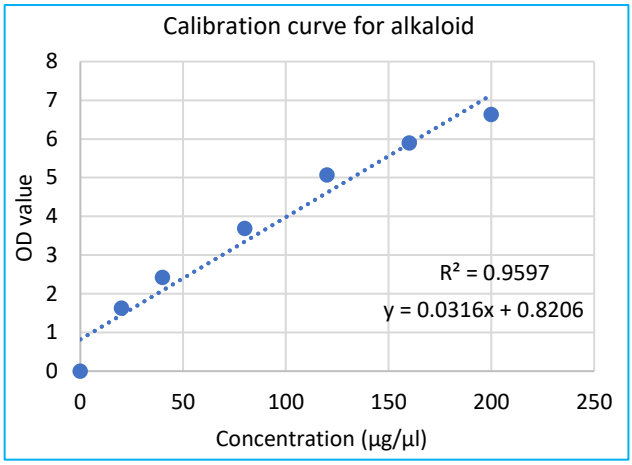

Fig 1 Calibration curve for alkaloids by plotting the gradient solutions

RESULTS AND DISCUSSION

The results interpret that the alkaloid content of *Tinospora cordifolia*, *Coccinia grandis* and *Gymnema sylvestre* show variations with respect to the season of collection of the plant material from different localities. *Tinospora cordifolia* has the highest quantity of the secondary metabolite, alkaloid which is 12.99% when compared to *Coccinia grandis* and *Gymnema sylvestre* which is 9.89% and 9.90% respectively. The plant samples collected in the rainy season showed higher concentration of alkaloid in all the three plant species irrespective of the different localities of collection. Hence it can be concluded that the lianas studied, produces more alkaloid in the rainy season. The alkaloid content of the plant can also be extracted in chloroform and aqueous solutions which shows fairly good concentration of alkaloid collected from three different localities and in different seasons.

CONCLUSION

From the results of the investigation, it could be concluded that the alkaloid content was followed by *Gymnema sylvestre* (leaf) and *Coccinia grandis* (root). Another important interpretation was made that the alkaloid content of the plant species are at its highest peak in the rainy season irrespective of the species and the area of collection.

Conflict of interest

The authors declare no conflict of interest in any form while fulfilling the objectives of this research work.

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