Qualitative Phytochemical Screening of Nyctanthes Arbor Tristis and Murrayakoenigii L. Leaf Leaves Extract.

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ABSTRACT
Plant extracts offer potential for drug discovery due to their chemical diversity and potential for treating complex diseases. They contain phenolic compounds, alkaloids, diterpenoid, steroid, and other compounds that inhibit microorganism development. Phytochemicals in plant extracts can act as reducing agents in the biosynthesis of metal nanoparticles. Medicinal plants, including seeds, root, leaf, fruit, bark, flowers, and whole plants, provide essential services for ecosystems and human health. A study on the phytochemical analysis of leaves of Nyctanthes arbor tristis L. Leaf and Murraya Koenigii L. Leaf revealed the presence of secondary metabolites such as saponins, flavonoids, tannins, carbohydrates, terpenoids, gums & mucilages, protein, leucoanthocyanin, glycoside, gum and mucilage, and coumarin and phlobatannins.

Key Words: Drug discovery, Phytochemicals, ecosystems,Plant

1- INTRODUCTION

The creation of herbal medication is an intriguing domain that integrates ancient wisdom with contemporary scientific techniques to investigate the therapeutic properties of plants. Indigenous communities have traditionally employed plants for therapeutic applications, and some contemporary pharmaceuticals can be attributed to ancient herbal treatments. The objective of herbal drug discovery is to methodically find, extract, and evaluate bioactive chemicals derived from plants, with the intention of potentially utilizing them in the treatment of diverse diseases and enhancing human health. [1,2] The discovery of herbal medications typically commences with ethnobotanical research, when investigators collect data from traditional healers and local populations regarding the conventional use of plants. These studies provide essential insights into the therapeutic potential of plants and assist researchers in determining which plants warrant further examination. [3,4,5]

After identifying promising therapeutic plants, scientists utilize several approaches to isolate and analyze the bioactive chemicals contained within these plants. This often entails the extraction, fractionation, and purification of materials to separate and isolate certain chemicals of interest. Subsequently, sophisticated analytical methods like chromatography, spectroscopy, and mass spectrometry are utilized to determine and clarify the chemical compositions of these substances. Following the identification of bioactive chemicals, researchers perform comprehensive pharmacological studies to assess their therapeutic efficacy. [6,7,8] This encompasses in vitro research to evaluate their impact on biological targets, including enzymes, receptors, and cellular pathways, alongside in vivo testing employing animal models to examine their efficacy and safety.

1.2 Nyctanthes arbor-tristis

Nyctanthes arbortristis, known as Night-flowering Jasmine or Parijat, is an intriguing flowering plant indigenous to Southeast Asia, namely located in India, Bangladesh, and Myanmar. This deciduous shrub or small tree is a member of the Oleaceae family and is distinguished by its distinctive traits and cultural importance.

1.2.1 Taxonomic Classification

Kingdom: Plantae
Clade: Tracheophyta
Clade: Angiospermae
Clade: Eudicots Clade: Asterids
Order: Lamiales
Family: Oleaceae
Genus: Nyctanthes
Species: N. arbor-tristis.

1.2.2 Physical Characteristics: • Leaves: The leaves of Nyctanthes arbortristis are dark green, oval, and exhibit an opposing arrangement along the branches.
The plant's most distinctive characteristic is its aromatic blossoms, which blossom at night and drop their petals before dawn. The flowers are little, tubular, and white with an orange-red core, producing a vivid contrast. The blossom is aesthetically pleasing and exudes a delightful aroma, rendering it a favored selection for gardens and patios.
The plant yields little, capsule-shaped fruits that encase seeds.

1.2.3 Cultural Importance:
• Religious Significance: Nyctanthes arbortristis possesses religious importance in Hinduism. The blossoms are frequently linked to numerous Hindu deities, and the plant is regarded as sacred. Parijat is referenced in Hindu mythology, and its blossoms are utilized in religious rituals and festivities.
• Medicinal Applications: In traditional medicine, many components of the plant, such as leaves and flowers, are employed for their therapeutic benefits. Parijat is thought to possess anti-inflammatory, analgesic, and anti-malarial effects. It is utilized in traditional Ayurvedic medicine for the treatment of ailments such as arthritis and fever. In addition to its aesthetic appeal, Nyctanthes arbortristis possesses multiple applications. The blossoms are utilized to produce fragrances and incense. The leaves and bark possess therapeutic characteristics utilized in the treatment of disorders such as fever, cough, and dermatological conditions. The wood is also employed in the fabrication of furniture and tools.
The plant represents beauty, fragility, and the ephemeral essence of life, as its flowers bloom briefly at night.

1.2.4 Cultivation:
Nyctanthes arbortristis is ideally adapted to tropical and subtropical climates, flourishing in well-drained soil with sufficient sunlight. Propagation often occurs by seeds, and the plant is recognized for its resilience and few maintenance requirements.

1.2.5 Description: Description Nyctanthes arbortristis can develop as a shrub or a little tree, with heights of up to 10 meters (33 ft). The tree possesses flaky grey bark and opposite, simple leaves measuring 6-12 cm in length and 2-6.5 cm in width.The flowers are, however, the highlight of the performance. They flourish in clusters of 2-7, each featuring a 5-8 lobed white corolla with a striking orange-red center. These aromatic flowers bloom exclusively at dark and wither by daybreak, consistent with the plant's moniker.The fruit is a bilobed, flat brown capsule around 2 cm in diameter, holding one seed in each lobe.
Nyctanthes arbortristis, renowned for its magnificent nocturnal blossoms and significant cultural heritage, serves as both a botanical wonder and a vital component of religious rituals and traditional medicine. Its importance beyond its aesthetic appeal, rendering it a valued plant in diverse cultural settings. The Night-flowering Jasmine is admired for its beauty and esteemed for its spiritual significance, captivating individuals and contributing significantly to the cultural fabric of its native regions.[9,10,11]

1.3 Murraya koenigii
Murraya koenigii, widely referred to as curry leaf, is a little tropical tree or shrub that belongs to the Rutaceae family. Indigenous to the Indian subcontinent, it is esteemed for its fragrant leaves, which are essential in South Asian and Southeast Asian culinary practices. Below are few essential characteristics of Murraya koenigii:
Kingdom: Plantae
Clade: Tracheophyta
Clade: Angiospermae
Clade: Eudicots
Clade: Rosids
Order: Sapindales
Family: Rutaceae
Genus: Bergera
Species: B. koenigii

1.9.2 Physical Characteristics: • Leaves: The most distinguishing characteristic of Murraya koenigii is its compound leaves, which are pinnate and lustrous. The leaves consist of several tiny leaflets organized in pairs along a central axis. They possess a dark green hue, have a fragrant scent, and exhibit a distinctive flavor.
The tree yields clusters of tiny, aromatic white blooms. Although the blossoms lack ostentation, they contribute to the plant's overall aesthetic appeal.
• Fruit: The shrub yields little, lustrous, black berries that are often not ingested.

1.3.3 Culinary Applications: • Flavoring Agent: The foliage of Murraya koenigii is essential in South Asian gastronomy, especially within Indian culinary traditions. They serve to impart a unique and fragrant flavor to a variety of foods, including as curries, dals, chutneys, and rice preparations.
• Aromatic Essence: The leaves possess a lemony, mildly bitter, and pungent flavor, imparting a distinctive smell to the foods. Curry leaves are typically used at the onset of cooking to impart their taste into the oil or ghee utilized for tempering.

Curry leaves have been utilized in Ayurvedic medicine for their purported health benefits, in addition to its culinary applications. They are thought to possess antioxidant, anti-inflammatory, and antibacterial effects.
•The curry tree is esteemed in traditional medicine traditions such as Ayurveda for its alleged therapeutic benefits. The leaves and bark are thought to exhibit anti-inflammatory, anti-diabetic, and potential anti-cancer qualities, however scientific investigation is ongoing. [12,13,14]

1.3.4 Cultivation: • Climate: Murraya koenigii flourishes in tropical to subtropical regions. It is prevalently located in India, Sri Lanka, and several regions of Southeast Asia.
The plant can be cultivated in gardens or as a container plant. It favors well-drained soil, consistent irrigation, and a sunny environment. It is quite resilient and can endure various soil types.
• Propagation: Curry leaf plants may be reproduced from seeds or stem cuttings.
1.9.5 Cultural Significance: • Symbolism: In Indian tradition, curry leaves are deemed auspicious, and the tree is occasionally cultivated near residences for its symbolic and cultural importance.
• Folklore: In traditional medicine and folklore, curry leaves are reputed to confer numerous health benefits, such as enhancing hair growth and facilitating digestion.
Murraya koenigii, commonly known as curry leaf, is not merely a culinary herb but also a plant profoundly embedded in the cultural and gastronomic traditions of South Asia. The aromatic leaves, distinguished by their particular flavor, significantly influence the region's cuisine, while the plant possesses cultural importance and is esteemed for its possible health advantages. Murraya koenigii is a versatile and esteemed plant, utilized in culinary applications and valued for its cultural significance throughout various global populations.
Undoubtedly, the curry leaf is the tree's most prized feature. These lustrous, dark green leaves exude a lemony, peppery fragrance that invigorates the senses and enhances any cuisine. Their distinctive aroma and nuanced bitterness enhance the depth and complexity of cuisines worldwide, from moderating South Indian dals to enriching Thai curries. Fresh leaves are optimal, as desiccation reduces their efficacy.[12]

2-MATERIAL AND METHODS

2.1 Methods for Producing Leaf Extract

Murraya Koenigii and fresh Nyctanthes arbortristis leaves were procured from the Pharmacy Department of Veer Bahadur Singh Purvanchal University, formerly referred to as the Purvanchal University Garden, and meticulously cleansed using double-distilled water.[15] Extracted plant material was obtained from both specimens. It was combined with 150 ml of distilled water and 10g of powdered leaves. To extricate the leaf components, the solution was brought to 100°C for two minutes, chilled to room temperature, and then filtered through Whatman 1 filterpaper. The extracted solution was retained at 4 degrees Celsius.

2.2 Screening for Preliminary Phytochemicals

The phytochemical composition of the leaf extract of Murraya Koenigii leaves and Nyctanthes arbortristis were analyzed using the methodologies described as follow [16-20]

2.2.1 Tannins Examination

Twenty milliliters of water are added to one milliliter of boiled sample in a test vial. After that, the mélange was sieved. The test solution acquired a brownish green or blue-black hue subsequent to the introduction of minute quantities of 0.1% ferric chloride.

2.2.2 Test for Phlobatannins

One milliliter of Murraya Koenigii leaves and Nyctanthes arbortristis leaf extract is heated to 80%C with one percent aqueous hydrochloric acid; the formation of a red precipitate indicates the presence of the acid.

2.2.3 Saponin Evaluation

Twenty milliliters of distilled H2O are combined with two milliliters of Murraya Koenigii leaves and Nyctanthes arbortristis leaf extract in a water immersion before the solution is filtered. A volume of 10 mL of filtrate is combined with 5 mL of distilled H2O and vigorously agitated to produce a consistent, persistent froth. After vigorous shaking, the three droplets of olive oil combine with foaming and the formation of an emulsion is observed.

2.2.4 Flavonoids Evaluation

Two milliliters of the filtrate of Murraya Koenigii leaves and Nyctanthes arbortristis leaves extract were combined with five milliliters of diluted ammonia solution. The presence of flavonoids is indicated by the yellow hue that is observed in the extract subsequent to the addition of concentrated sulfuric acid to the sides of the test tubes. The yellow hue persisted while standing.

2.2.5 Steroid Examination

Add two milliliters of acetic anhydride, one milliliter of leaf extract, and two milliliters of H2SO4. The formation of a violet, blue, or green hue signifies the presence of steroids.

2.2.6 Terpenoids Evaluation

After combining five milliliters of leaf extract with two milliliters of chloroform, a layer is formed by adding three milliliters of concentrated H2SO4. The existence of terpenoids signifies the development of a reddish-brown hue at the interface.

2.2.7 Test for Triterpenoids
A volume of 1 ml of chloroform and 1 milliliter of acetic anhydride are combined with 1 ml of extract. An iridescent violet hue that results from the introduction of con. H_2SO_4 is indicative of the presence of triterpenoids.
2.2.8 Alkali Evaluation
Observe the formation of a pearly or white precipitate subsequent to adding a few droplets of Mayer's reagent and one milliliter of plant extract to the side of the test tube.
2.2.9 Test for Carbohydrates
Benedict's test: Combine five milliliters of Benedict's reagent with five milliliters of leaf extract in a simmering water bath for two minutes. A precipitate of a red hue indicates the presence of sugar.
2.2.10 Test for Anthraquinones
A 5 mL solution of leaf extract is hydrolyzed with concentrated H_2SO_4 and benzene is used to extract the substance. The formation of a rose-pink hue indicates the existence of anthraquinones subsequent to the introduction of diluted ammonia (1 mL).
2.2.11 Examine for Polyphenols
Murraya Koenigii leaves and Nyctanthes arbortristis extract (1 ml) is combined with four milliliters of ethanol and simmered in a water immersion for fifteen minutes. A freshly prepared solution of ferric cyanide was diluted with three droplets into the plant extract. The formation of a blue-green hue signifies the presence of polyphenols.
2.2.12 Test for cardiac glycosides
A five-milliliter extract of Murraya Koenigii leaves and Nyctanthes arbortristis leaves is treated with two milliliters of glacial acetic acid containing one drop of ferric chloride solution. Following the addition of 1 ml of concentrated H_2SO_4, the presence of glycosides may be indicated by the appearance of a violet ring beneath the brown ring.

3-RESULTS
Natural products such as plant extracts provide unlimited opportunities for new drug discoveries because of unmatched availability of chemical diversity, either as pure compounds or as standardized extracts and recent evidences from the pharmaceutical companies shows that it still represents an extremely valuable source for the production of valuable chemical entities that can be used for the treatment of some complex diseases .These medicinal plants can be rich in phenolic compounds, alkaloids, diterpenoid, steroid and other compounds which inhibit the development of various microorganisms. Besides these, phytochemicals in the plant extracts can act as reducing and capping agent in the reduction of metal ions to metal nanoparticles and thus have found widespread use in the biosynthesis of metal nanoparticles.

3.1 Phytochemical analysis
Medicinal plants are presently in demand and their acceptance is increasing progressively. Undoubtedly, plants play an important role by providing essential services in ecosystems. Without plants, humans and other living organisms cannot live in a way living should be. The parts of medicinal plants that may be used are different types of seeds, root, leaf, fruit, bark, flowers or even the whole plant. The active compounds in most parts of the medicinal plants have direct or indirect therapeutic effects and are used as medicinal agents. In the body of these plants, certain materials are produced and stored that are referred to as active compounds (substances), which have physiological effects on the living organisms. Human is mainly dependent on raw plant materials in order to meet medical needs to maintain health and cure diseases Present study was conducted on phytochemical analysis of leaves of *Nyctanthes arbor tristis L. Leaf and MurrayaKoenigii L. Leaf.*

3.2-Phytochemical analysis of *Nyctanthes arbor tristis* leaves extract
3.2.1 Qualitative analysis
Phytochemicals are reported to have various biological and therapeutic properties. Pharmacists are interested in these compounds because of their therapeutic performance and low toxicity On the basis of therapeutic potential of secondary metabolites, the phytochemical characters of the ***Nyctanthes arbor tristis*** were investigated and represented in table Phytochemical studies show the presence of secondary metabolites such as saponins, flavonoids, tannins and carbohydrates whereas alkaloid, steroid, quinine, emodins, and anthocyanin are absent. Terpenoids and gums & mucilages are detected in water extraction of leaves and was absent in solvent (methanol) extraction. Protein, leucoanthocyanin and glycoside are detected in solvent extraction of leaves, but was absent in water extraction. Coumarin and phlobatannins may be present in plant.

Table.3.1: Qualitative phytochemical screening of *Nyctanthes arbor tristis*

Test	Water extraction	Solvent extraction
Saponin	+++	+++
Flavonoid	+	+
Tannin	+	+
Alkaloid	-	-
Protein	+/-	+/-
Carbohydrate	++	++
Steroid	+/-	-

Coumarin	+/-	-
Terpenoid	+	-
Quinine	-	-
Emodin	-	-
Phenol	-	-
Glycoside	-	+
Gum and mucilage	-	-
Phlobatanins	+/-	-

+ = indicates presence of phytochemicals, - = indicates absence of phytochemicals
+/- = phytochemicals may be present, +++ = shows high concentration of phytochemicals

Chemical substances present in plants have therapeutic esteem that plays a physiological activity on the human body. Diverse phytochemicals are found to have an extensive variety of activities, which may help in protection against intense ailments. For instance, alkaloids assume a noteworthy part to ensure against some chronic ailments. Saponins secure against hypercholesterolemia and anti-infection properties. Steroids have (analgesic) pain- relieving properties. The saponins and steroids are likewise in charge of focal sensory system (centralnervous system) activities. Phytochemical screening of water and solvent extract of *Nyctanthes arbor-tristis* leaves were utilized to study the presence of saponins, tannins, flavonoids, alkaloids and steroids and furthermore have different medicinal properties, for example, calming, against diabetic and pain- relieving activities and furthermore for focal sensory system activities.

3.3 Phytochemical analysis of *MurrayaKoenigii L. Leaf* leaves extract.

533.1 Qualitative analysis

Phytochemicals are reported to have various biological and therapeutic roperties. Pharmacists are interested in these compounds because of their therapeutic performance and low toxicity On the basis of therapeutic potential of secondary metabolites, the phytochemical characters of the ***MurrayaKoenigii L*** were investigated and represented in table Due to the vast differences in the nature of the phytochemical constituents found in a plant, there is no particular solvent that is known to extract all the compounds. Therefore in this study solvents like Methanol and waterare used for extraction to accommodate the range of polarities of the compounds present in Murraya Koenigii leaves. The results showed that the choice of these various solvents play a crucial role in the quantitative analysis of different phytochemicals extracted from the leaves of Murraya Koenigii. Quantification of compounds obtained from the extract varies greatly among the two solvents, which is an indication that solvents have different extracting capacity for phytochemicals.

Table.3.2: Qualitative phytochemical screening of *MurrayaKoenigii L*

Test	Water extraction	Methanol extraction
Phenolic compounds	++	++
Tannins	++	+++
Flavonols	++	+++
Flavonoids	++	+++
Proantho cyanidins	++	++
Carotenoids	++	++
Glycosides	++	++
Sugars	++	+
Aminoacid	++	++

+ = indicates presence of phytochemicals, - = indicates absence of phytochemicals
+/- = phytochemicals may be present, +++ = shows high concentration of

4-SUMARY AND CONCLUSION

Plant extracts offer numerous opportunities for drug discovery due to their chemical diversity and potential for treating complex diseases. These plants contain phenolic compounds, alkaloids, diterpenoid, steroid, and other compounds that inhibit the development of various microorganisms. Additionally, phytochemicals in plant extracts can act as reducing and capping agents in the reduction of metal ions to metal nanoparticles, making them widely used in the biosynthesis of metal nanoparticles.

Medicinal plants are essential for ecosystems and human health, providing essential services for living organisms. The parts of medicinal plants that can be used include seeds, root, leaf, fruit, bark, flowers, or even the whole plant. Active compounds in most parts of these plants have direct or indirect therapeutic effects and are used as medicinal agents. In the body of these plants, certain materials are produced and stored that are known as active compounds (substances), which have physiological effects on living organisms. Humans mainly depend on raw plant materials to meet medical needs to maintain health and cure diseases.

A study was conducted on the phytochemical analysis of leaves of Nyctanthes arbor tristis L. Leaf and MurrayaKoenigii L. Leaf. The phytochemicals of Nyctanthes arbor tristis were investigated based on their therapeutic potential and low

toxicity. The results showed the presence of secondary metabolites such as saponins, flavonoids, tannins, carbohydrates, terpenoids, gums & mucilages, protein, leucoanthocyanin, glycoside, gum and mucilage, and coumarin and phlobatannins. Phytochemicals present in plants have therapeutic properties that play a physiological activity on the human body. Different phytochemicals have an extensive variety of activities, such as protection against chronic ailments, hypercholesterolemia, anti-infection properties, and pain-relieving properties. The phytochemical screening of water and solvent extract of Nyctanthes arbor tristis leaves was utilized to study the presence of saponins, tannins, flavonoids, alkaloids, and steroids, and their different medicinal properties, such as calming, diabetic, and pain-relieving activities, and focal sensory system activities.

The choice of solvents like ethanol, water, acetone, and hexane is crucial in the quantitative analysis of different phytochemicals extracted from the leaves of Murraya Koenigii. The quantification of compounds obtained from the extract varies greatly among the four solvents, indicating that solvents have different extracting capacities for phytochemicals.

5- RESULTS

1. Fatope MO, Al-Kindi SMZ, Abdulnour AO. Research trend: natural products as pest, microbial disease as tumour control agents. Sci Tech. 2000; 55–71.
2. Clark AM. Natural products as a resource for new drugs. Pharm Res.1996; 13:1133- 41.
2- Valeriote F, Corbett T, Baker L. Drug discovery: In Valeriote F, Corbett, TH, Baker LH. (eds),Cytotoxic Anticancer Drugs: Models and Concepts for Drug Discovery and Development.Kluwer Academic Publishers, Boston, 1990 pp. 1–9.
3- Corbett TH, Valeriote FA, Polin L, Panchapor C, Pugh S, White K, In: Valeriote, FA, CorbettTH, Baker LH. (eds), Cytotoxic AnticancerDrugs: Models and Concepts for Drug Discovery and Development. Kluwer Academic Publishers, Boston, p. 35–87.
3. Tyler VE, Brady LR, Robbers J. Pharmacognosy. 9th edition. Lea and Febiger, Philadelphia, USA, 1988.
4. Cragg MG, Newman DJ. Natural Product Drugs Discovery in Next Millennium, National CancerInstitute, Frederick, USA, 2002.
5. Alok Kumar Dash**,** Jhansee Mishra(2015) A comparative study on phytochemical investigation and pharmacological screening of *Platycladus orientalis* and *Ocimum canum* with review of literature. International Journal of Phytopharmacy Vol. 5 (6), pp.130-138, Nov-Dec 2015
6. Jhansee Mishra ,Alok Kumar Dash and Deepak Kumar Dash (2014).Hypoglycemic, Hypolipidemic and Antioxidant Potentials of Specially Formulate Polyherbal Formulation in Streptozotocin Induced diabetic rats, European Scientific Journal .10(6):340-351.
7. Swarnalatha, Y., Krishnan, D., and Rajasekar, S. P. V. (2013). Antibacterial activity of biogenic silver nanoparticles from Sphaeranthus amaranthoides. Int J Pharm Pharm Sci, 5(4), 594-596.
8. Gulshan B, Suri KA, Parul G. A Comprehensive review on Nyctanthes arbortristis. Int. J. Drug Dev. & Res. 2015; 7(1):183-193. 5.
9. Vajravijayan S, Udayakumar M, Brabakaran A, Thangaraju N. Anti–inflammatory, Antioxidant and Free Radical Scavenging Activities of Nyctanthes ArborTristis Linn. Seed Extract Under in-vitro. Scholars Academic Journal of Biosciences. 2013; 1(6):242-250 .
10. Wojdyło, A.; Oszmia ´nski, J.; Czemerys, R. Antioxidant activity and phenolic compounds in 32 selected herbs. Food Chem. 2007, 105, 140–149.
11. Ahluwalia, V.; Sisodia, R.; Walia, S.; Sati, O.P.; Kumar, J.; Kundu, A. Chemical analysis of essential oils of Eupatorium adenophorum and their antimicrobial, antioxidant and phytotoxic properties. J. Pest Sci. (2004) 2014, 87, 341–349.
12. Yankuzo, H.; Ahmed, Q.U.; Santosa, R.I.; Akter, S.F.U.; Talib, N.A. Beneficial effect of the leaves of Murraya koenigii (Linn.) Spreng (Rutaceae) on diabetes-induced renal damage in vivo. J. Ethnopharmacol. 2011, 135, 88–94.
13. M. Sathishkumar, K. Sneha, I.S. Kwak, J. Mao, S.J. Tripathy, Y.S. Yun, J. Hazard. Mater. 171, 400–404 (2009)
14. S. Chanda, & T. V. Ramachandra, "Phytochemical and pharmacologicalimportance of turmeric (Curcuma longa): A review", Research & Reviews: AJournal of Pharmacology, 2019, 9(1), pp. 16-23.
15. 2M. Arora, S. Singh, & P. Kaur, "Pharmacognostic & phytochemical evaluationof selected seeds of 'Cicer arietinum'Linn. seeds from Roopnagar Punab", Int. J.Pharm. Sci. Invent, 2013, 2(11), pp.18-29.
16. Jhansee Mishra, Alok Kumar Dash and Deepak Kumar Dash (2014 Pharmacognostical, physiochemical and phytochemical comparative study of the constituent of anantidiabetic polyherbal formulation International Journal of PhytopharmacyVol. 4 (1), pp.33-36, Jan-Feb 2014
17. S. K. Bhandary, V. S. Bhat, K. P. Sharmila, & M. P. Bekal, "Preliminary
18. phytochemical screening of various extracts of Punica granatum peel, whole fruitand seeds", Journal of Health and Allied Sciences NU, 2012, 2(04), pp. 34-38.
19. B. Dutta, "Study of secondary metabolite constituents and curcumin contents of
20. six different species of genus Curcuma", J. Med. Plants Stud, 2015, 3(5), pp.116-119