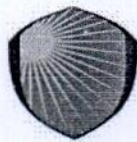


## प्रतिवेदन ;(Report)

“शिक्षक—शिक्षार्थियों की भावात्मक बुद्धि के संदर्भ में  
मानवाधिकारों के प्रति अभिवृत्ति का अध्ययन”

द्वारा प्रस्तुत



डॉ. मंजू गुप्ता

एसोसिएट प्रोफेसर

(शिक्षा विभाग)

जगन्नाथ विश्वविद्यालय, जयपुर

2019—20

जगन्नाथ विश्वविद्यालय, चाकसू, जयपुर—303901 (राजस्थान)





## प्रतिवेदन

“शिक्षक-शिक्षार्थियों की भावात्मक बुद्धि के संदर्भ में मानवाधिकारों के प्रति अभिवृत्ति का अध्ययन”

### परियोजना विवरण

क्र.सं.	क्षेत्र का नाम	विवरण
1.	परियोजना का नाम	शिक्षक-शिक्षार्थियों की भावात्मक बुद्धि के संदर्भ में मानवाधिकारों के प्रति अभिवृत्ति का अध्ययन
2.	कुल परियोजना लागत	रुपये 1,04,820/-
3.	परियोजना की अवधि और लागत का चरण	1 वर्ष (2019-20)
4.	चालू वर्ष के लिए प्रस्तावित लागत	रुपये 1,04,820/-
5.	क्षेत्र	शिक्षा
6.	कार्यान्वयन विभाग	शिक्षा विभाग जगन्नाथ विश्वविद्यालय, चाकसू, जयपुर-303901
7.	कार्यान्वयन एजेंसी	जगन्नाथ विश्वविद्यालय, चाकसू, जयपुर-303901
8.	परियोजना के संचालन का क्षेत्र (संपूर्ण राज्य, क्षेत्र या विशिष्ट जिले जैसा भी मामला हो	जयपुर जिला



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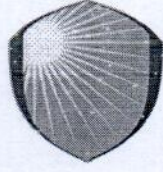


## भाग-1 : सामान्य जानकारी

1. परियोजना प्रस्ताव प्रस्तुत करने वाले संस्थान/संगठन का नाम : जगन्नाथ विश्वविद्यालय, चाकसू, जयपुर-303901
2. राज्य : राजस्थान
3. संस्थान की स्थिति : राज्य निजी विश्वविद्यालय
4. आवेदन अग्रेषित करने वाले संस्थान/विश्वविद्यालय के कार्यपालक प्राधिकारी का नाम व पदनाम : जगन्नाथ विश्वविद्यालय, चाकसू, जयपुर-303901 (राजस्थान)
5. परियोजना का शीर्षक : शिक्षक-शिक्षार्थियों की भावात्मक बुद्धि के संदर्भ में मानवाधिकारों के प्रति अभिवृत्ति का अध्ययन
6. परियोजना की श्रेणी : शिक्षा
7. समयावधि : एक वर्ष
8. कुल लागत : रूपये 1,04.820 लाख
9. प्रोजेक्ट सिंगल/इंस्टीट्यूशनल/मल्टीपल इंस्टीट्यूशनल : एकल संस्थागत
10. प्रभारी/पी.आई. का नाम : डॉ. मंजू गुप्ता  
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12. पत्राचार का पता : रजिस्ट्रार  
जगन्नाथ विश्वविद्यालय  
चाकसू, जिला-303901 (राजस्थान)  
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ई-मेल: info@jagannathuniversity.org







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## आभार प्रसून

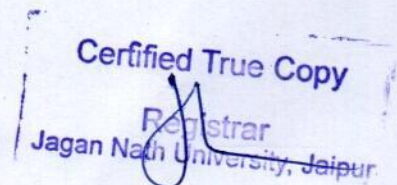
गुरुब्रह्म गुरुर्विष्णु, गुरुर्देवो महेश्वरः ।  
गुरु साक्षात्, तस्मै श्री गुरवै नमः ॥

इस परियोजना को सफलतापूर्वक पूरा करने में, बहुत से लोगों मेरी मदद की है। मैं उन सभी लोगों को धन्यवाद देने चाहूंगी जो इस परियोजना से संबंधित हैं। मुख्य रूप से, मैं इस परियोजना को सफलता के साथ पूरा करने में सक्षम होने के लिए भगवान को धन्यवाद दूंगी। फिर मैं जगन्नाथ विश्वविद्यालय के (डीन, शोध समन्वयक) डॉ. विवेक शर्मा को धन्यवाद दूंगी, जिनके मार्गदर्शन में मैंने इस परियोजना के बारे में बहुत कुछ सीखा। उनके सुझाव और निर्देशों ने इस परियोजना के पूरा होने में बहुत मदद की है।

फिर मैं अपने माता-पिता और दोस्तों को धन्यवाद देना चाहती हूँ जिन्होंने अपने मूल्यवान सुझावों और मार्गदर्शन के साथ मेरी मदद की है और परियोजना के पूरा होने के विभिन्न चरणों में बहुत मददगार रहे हैं।

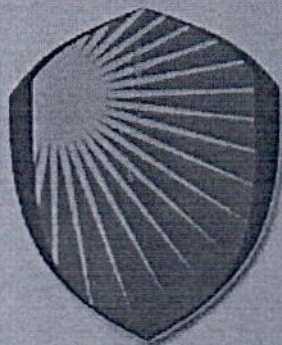
मैं अपने शिक्षा विभाग के सभी शिक्षकों के प्रति कृतज्ञता का विशेष धन्यवाद व्यक्त करना चाहती हूँ जिसने मुझे इस परियोजना को विषय पर करने का सुनहरा मौका दिया। इस परियोजना ने मुझे बहुत सारे शोध करने में भी मदद की और मुझे इतनी सारी नई चीजों के बारे में पता चला कि मैं वास्तव में उनके लिए आभारी हूँ।

दूसरा, मैं अपने माता-पिता और दोस्तों को भी धन्यवाद देना चाहूंगी जिन्होंने इस परियोजना को सीमित समय सीमा के भीतर अंतिम रूप देने में मेरी मदद की।





**PHYTOCHEMICAL STUDY OF ACACIA  
NILOTICA AND CASSIA FISTULA : PLANTS OF  
DESERT ECOSYSTEM**



**A  
PROJECT REPORT**  
*Submitted to the*  
**JAGAN NATH UNIVERSITY**

*Submitted by :*  
**Dr. ANIL KUMAR SHARMA**  
**Associate Professor**

**DEPARTMENT OF PHYSICAL SCIENCES,  
JAGAN NATH UNIVERSITY  
JAIPUR-303901, INDIA**

**2019**



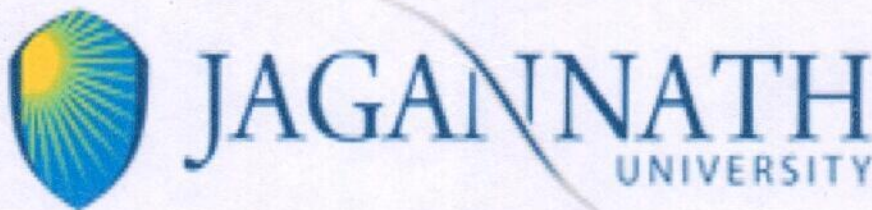
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A  
Project Report  
On  
Electric Car

Department of Mechanical Engineering  
JAGANNATH UNIVERSITY, JAIPUR



March, 2018



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## ACKNOWLEDGEMENT

*First and foremost I would like to thank almighty God, for his grace and blessings in completion of this work; I wish to express my profound sense of gratitude and inductors to Jagannath University Jaipur for providing financial assistance and necessary research facilities.*

*I am thankful to Professor VK Agarwal, President, Jagannath University, Mr. Tanmay Patnaik, Registrar, Jagannath University for their valuable guidance, affection, motivation and constant source of inspiration during research work.*

*I am grateful to entire technical and non technical staff of Jagannath University Jaipur for their kind cooperation.*

  
Mr. Avinash Nath Tiwari





## Preface

E-CAR is small, four wheeled vehicle which are used extensively in many Asian countries for transport of people and goods. The vehicles are small and narrow allowing for easy maneuverability in congested Asian metropolises. In India e-car is not used commonly. Despite the apparent advantage in the vehicle design, E-car presents a huge pollution problem in Indian cities. This is due to use of an inefficient engine, typically a 2 or 4 strokes, with almost no pollution control. This project present a transportation system based on E-CAR that operate in an environmentally friendly way. Existing vehicles are to be replaced by an all electric counterpart redesigned in a manner which improves the efficiency of the vehicle. In addition, a recharging infrastructure is proposed which will allow for the batteries to charged using renewable energy source such as solar power.



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## **Chapter 1**

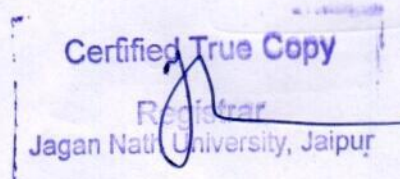
### **Introduction**

India is home to over 2.5 million cars and companies have come out with alternative models such as compressed natural gas and LPG to mitigate the pollution problem caused by traditional petrol and diesel models. Two main disadvantages that exist within corporation those technologies on the cars are:

1. Oil is still added to the chamber in the two stroke configuration, which adds to the pollution, and
2. LPG, CNG, PETROL and DIESEL are non -renewable energy sources.

The best way to redesign the car is to make the main power source renewable .One way to do this is to use an energy namely, electricity. Cars are an ideal candidate for the longest distance covered in a day. Therefore, we have set out to make e-car the example of environmental consciousness in India by replacing .the existing hydro carbon powered vehicle with electric car and recharge the batteries using mostly renewable energy sources.

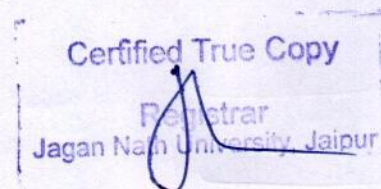
Electric vehicles have been identified as being a key technology in reducing future emissions and energy consumption in the mobility sector. The focus of this article is to review and assess the energy efficiency and the environmental impact of battery electric cars (BEV), which is the only technical alternative on the market





available today to vehicles with internal combustion engine (ICEV). Electricity onboard a car can be provided either by a battery or a fuel cell (FCV). The technical structure of BEV clarifies that it is relatively simple compared to ICEV. Following that, ICEV can be 'e-converted' by experienced personnel. Preliminary energy efficiency data of FCV are reviewed being only slightly lower compared to BEV. However, well-to-wheel efficiency suffers from 47% to 63% energy loss during hydrogen production. With respect to energy efficiency, BEVs are found to represent the only alternative to ICEV. This, however, is only true if the electricity is provided by very efficient power plants or better by renewable energy production. Literature data on energy consumption and greenhouse gas (GHG) emission by ICEV compared to BEV suffer from a 25% underestimation of ICEV-standardized driving cycle numbers in relation to street conditions so far. Literature data available for BEV, on the other hand, were mostly modeled and based on relatively heavy BEV as well as driving conditions, which do not represent the most useful field of BEV operation.

The first electric vehicle (EV) was built between 1832 and 1839; the exact year is not known, in Scotland by Robert Anderson, who created the first crude electric carriage. It was not until 1895, after A.L. Ryker built an electric tricycle and William Morrison built a six passenger wagon, that America paid attention to the electric vehicle. In 1902 Wood created the Electric Phaeton, which was more than an electrified horseless carriage and surrey. "The Phaeton had a range of 18 miles, a top speed of 14 mph. The decline in use and production of the electric vehicle occurred in the 1920s. Causes of the decline in production include: a better road system, reduced price of gasoline by the discovery of the Texas crude oil, invention of the electric starter, and the mass production of the internal combustion engine vehicles.





Electric cars are a more environmentally-friendly option than traditional cars because they produce no tailpipe emissions. However, they are not considered carbon neutral unless the electricity they run on is generated from a renewable source.

Electric cars are measured by the same safety standards as standard cars, and many have the highest 5-star ratings. There have been (very rare) reports of lithium ion batteries catching fire and exploding, but extra safety measures are installed to ensure this cannot happen. These include fuses and circuit breakers, plus coolant run through battery packs to keep them at a low temperature.

Fans of petrol cars argue that chemicals in an electric car battery will catch fire in the event of a crash. However, a tank full of petrol is about as flammable as you can get. This is why some people believe electric cars are in fact the safer option.



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### **Description of an Electric Vehicle**

The electric vehicle (EV) is propelled by an electric motor, powered by rechargeable battery packs, rather than a gasoline engine. From the outside, the vehicle does not appear to be electric. In most cases, electric cars are created by converting a gasoline-powered car. Often, the only thing that clues the vehicle is electric is the fact that it is nearly silent.

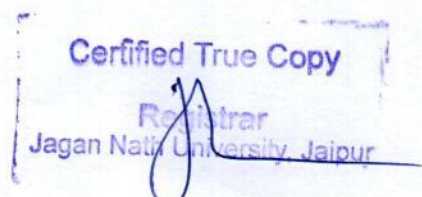
Under the hood, the electric car has:

- An electric motor.
- A controller.
- A rechargeable battery.

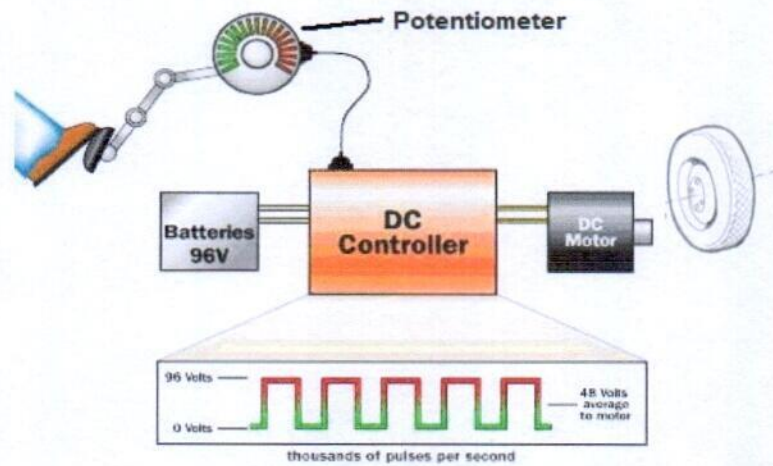
The electric motor gets its power from a controller and the controller gets its power from a rechargeable battery.

The electric vehicle operates on an electric/current principle. It uses a battery pack (batteries) to provide power for the electric motor. The motor then uses the power (voltage) received from the batteries to rotate a transmission and the transmission turns the wheels.

Four main parts make up the electric vehicle: the potentiometer, batteries, direct current (DC) controller, and motor.







### *Description of Parts and their Functions*

**Potentiometer:** It is circular in shape and it is hooked to the accelerator pedal. The potentiometer, also called the variable resistor, provides the signal that tells the controller how much power is it supposed to deliver.

**Batteries:** The batteries provide power for the controller. Three types of batteries: lead- acid, lithium ion, and nickel-metal hydride batteries. Batteries range in voltage (power).

**DC Controller:** The controller takes power from the batteries and delivers it to the motor. The controller can deliver zero power (when the car is stopped), full power (when the driver floors the accelerator pedal), or any power level in between. If the battery pack contains twelve 12-volt batteries, wired in series to create 144 volts,



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the controller takes in 144 volts direct current, and delivers it to the motor in a controlled way

The controller reads the setting of the accelerator pedal from the two potentiometers and regulates the power accordingly. If the accelerator pedal is 25 percent of the way down, the controller pulses the power so it is on 25 percent of the time and off 75 percent of the time. If the signals of both potentiometers are not equal, the controller will not operate

**Motor.** The motor receives power from the controller and turns a transmission. The transmission then turns the wheels, causing the vehicle to run.

### **Differential:-**

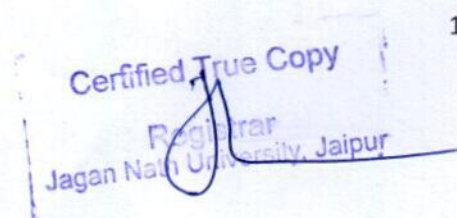
The main function of a differential are:

1. It permits a vehicle to take a turn without skidding.
2. It split the power /torque from the electric motor to the two drive wheels on the rear side of the vehicle.

The project will include a differential which will be connected to the electric motor.

### **Shock Absorber:**

The main function of shock absorbers in an automotive vehicle is to absorb the shocks and vibration caused so that the vibration is not only felt by the passengers of the vehicle. The shock absorbers used are coil spring type shock absorber. The shock absorber will be optional and if used will be used in front wheels only. The rear wheels will be supported by a modified pipe which acts as suspension system





much like a circule plate connected on differential at one end and chassis on the other.

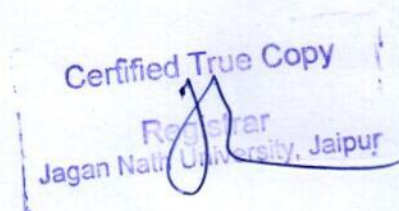
### **Brakes:**

The prototype uses an electric motor capable of generating 1000 -2700 rpm as a result the use of normal shoe brakes is out of question so the use of conventional drum brakes is taken into consideration. The drum brakes are a simple arrangement which consist of a drum made out of metal alloy and a pair of shoes connected to retractable spring and a tension wire made out of tensile steel. The brake will not be mounted on the handle but will be mounted on chassis (pedal, Brake) so on pressing the pedal the Brake engage stopping the rear wheel

### ***Theory of Operation for EV***

When the driver steps on the pedal the potentiometer activates and provides the signal that tells the controller how much power it is supposed to deliver. There are two potentiometers for safety. The controller reads the setting of the accelerator pedal from the potentiometers, regulates the power accordingly, takes the power from the batteries and delivers it to the motor. The motor receives the power (voltage) from the controller and uses this power to rotate the transmission. The transmission then turns the wheels and causes the car to move forward or backward.

If the driver floors the accelerator pedal, the controller delivers the full battery voltage to the motor. If the driver takes his/her foot off the accelerator, the controller delivers zero volts to the motor. For any setting in between, the controller chops the battery voltage, thousands of times per second to create an average voltage somewhere between 0 and full battery pack voltage.





**Working Principle :**

There are four wheel pulled by an electric motor ranging from 650 to 1400 watt. The E-car built on (mild steel ). Chassis which consist of four wheel with a diffrential mechanism at rear wheel. The motor is brushless dc motor. The electical system used in indian version is 48 volt. Some variants made in fiber are also popular because of their strength duribility resulting in low mantinance body designing varries from load carriers . It consist of controller units which are sold on the basis of voltage supplied and current out put also number of mosfet (metal oxied filled effect transistor ) used. The battery is mostly acid lithium ion battery with life of 6 to 12 month deep discharged /cycle batteries design for electric vehicles are mostly use .

The project involves the development of an electric car using product to minimum manufacturing cost the following point are taken into regards for the same :

1. Devloperment of self made diffrential system from scratch
2. Devolpement an electric motor attechment system with the .
3. Diffrential system for the raear wheel .
4. Testing the use of a simplwe step up transformer to increase battery
5. Voltage hence cost reduction
6. Development of refined chassis leading to maximum stablity, a maximum boot space, greater maneveraability a and passenger comfort.



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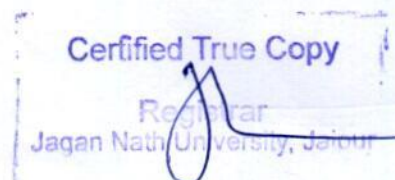
The approximate vehicle specifications are as follows:

Description	Dimensions
Overall length	2100 mm.
Overall width	1050 mm.
Overall height	840mm.
Rear track	960mm.
Ground clearance	135mm.
Wheel dia.	500mm.
Rim dia.	330mm.
Wheel shaft hole	60mm.
Differential length	970mm.
Brake shoe thickness	50mm.
Drum width	145mm.
Battery length	400mm.
Battery width	180mm.
Battery height	205mm.

### Methodology:-

The project involves the development of an electric car using product to minimum manufacturing cost the following point are taken into regards for the same :

1. Development of self made differential system from scratch.
2. Devolvement of an electric motor attachment system.





3. Differential system for the rear wheel.
4. Testing the use of a simple step up transformer to increase battery voltage hence cost reduction.
5. Development of refined chassis leading to maximum stability, a maximum boot space, greater maneuverability and passenger comfort.

**Electric Car Pics during & after Construction:**



Fig 1: Front wheel Alignment



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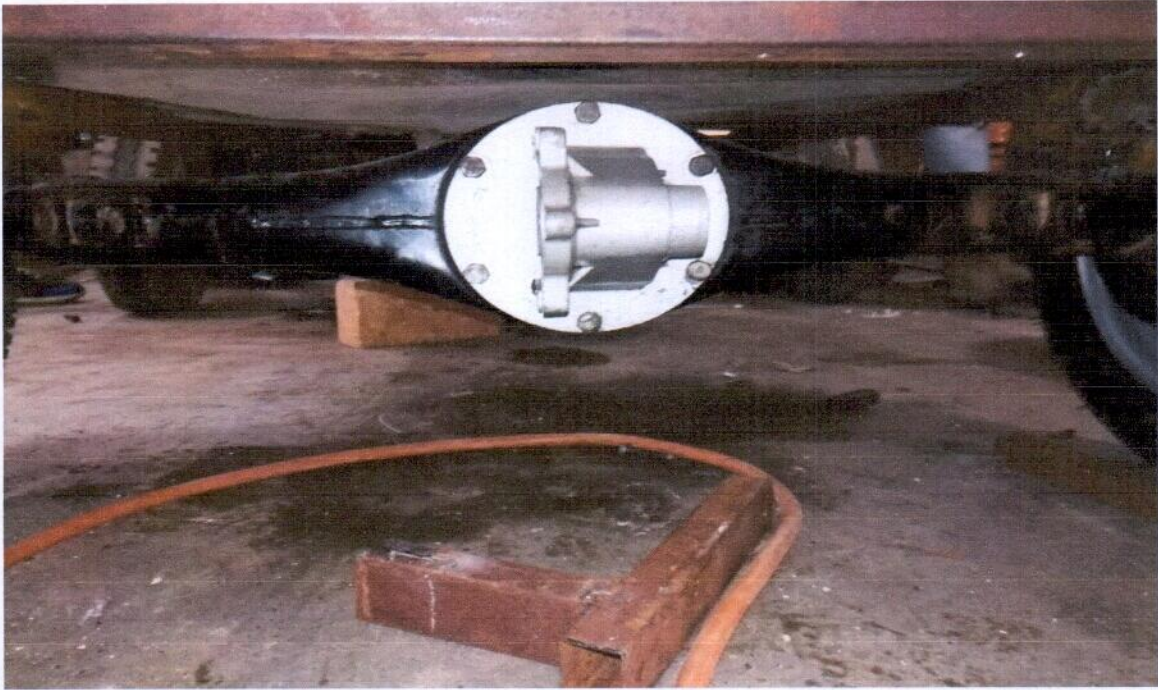


Fig2: Differential Setup



Fig3: Chassis Setup



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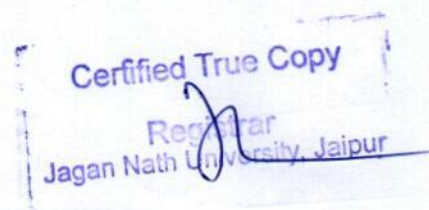




Fig4: Differential top view



Fig5: Overall Chassis





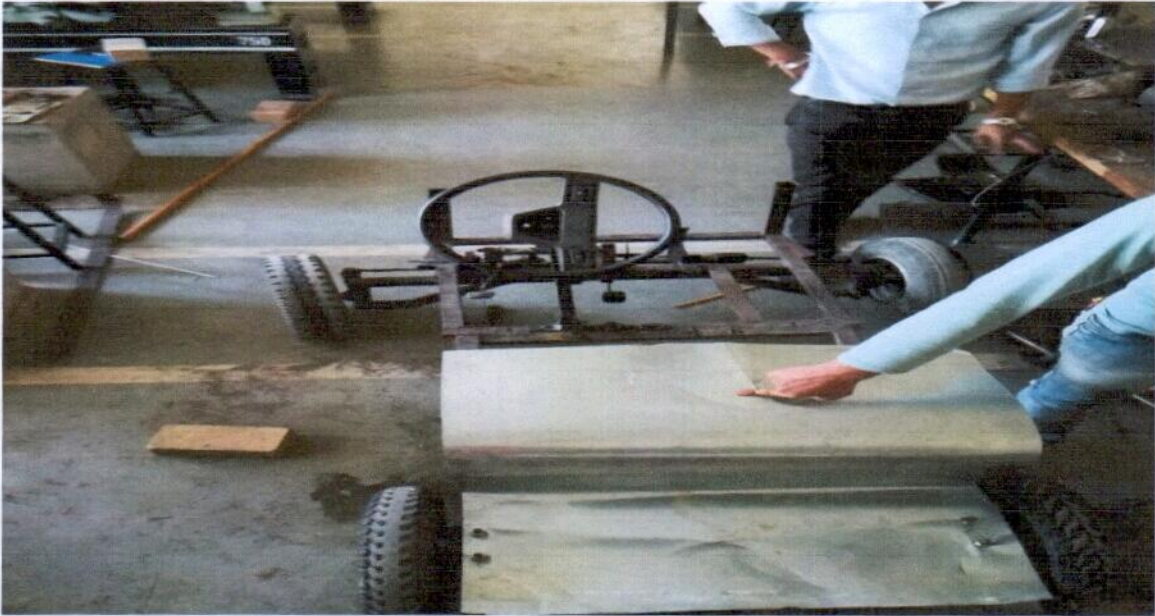


Fig6: Chassis Setup



Fig7: Welding Spots



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Fig8: Alignment of Various parts



Fig 9: Electric Car



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Fig10: Electric Car



Fig11: Production Team with Electric Car



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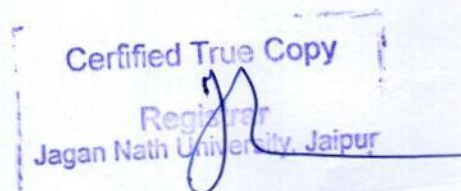


## Conclusion:

The project was initiated with an idea to make an environment friendly car model which has less emission of pollutant gases with lower noise index. The project developed is equipped with 48 Volt batteries with an average capacity of 45 km per full charge. The vehicle can reach a top speed of 35 Km per hour.

The overall impact of the electric vehicle ultimately benefits the people. Compared to gasoline powered vehicles, electric vehicles are considered to be ninety-seven percent cleaner, producing no tailpipe emissions that can place particulate matter into the air.

Future electric vehicles will most likely carry lithium-ion phosphate (LiFePO<sub>4</sub>) batteries that are now becoming popular in other countries. The LiFePO<sub>4</sub> batteries are rechargeable and powerful and are being used in electric bikes and scooters. Electric vehicles will most likely adopt this technology in the future.





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**PHYTOCHEMICAL STUDY OF ACACIA  
NILOTICA AND CASSIA FISTULA : PLANTS OF  
DESERT ECOSYSTEM**



**A  
PROJECT REPORT**  
*Submitted to the*  
**JAGAN NATH UNIVERSITY**

*Submitted by :*  
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Dr. Anil Kumar Sharma



## *Preface*

Phytochemical examination of two important plants extracts has been presented in the report and organized the whole investigation into three chapters with brief summary in the end. The chemical constituents isolated from selected plants have been identified and summarized in the tables in each chapter. The structure elucidation of isolated compounds has been done on the basis of spectral studies viz., IR, MS,  $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR.

**Chapter 1 :** This chapter throws glow on the importance of medicinal plants used in various traditional medicinal systems and also in modern drug discovery approach. A number of phytochemicals isolated from plants have been mentioned with their action and structure.

**Chapter 2 :** This chapter describes the review of the work done on genus *Cassia* and chemical investigation of the stem bark of *Cassia fistula*. In this chapter isolation and characterization of eight compounds have been given out of which two are new compounds. The structure of these two new compounds was established on the basis of spectral data and is being reported for the first time.



**Chapter 3 :** This chapter deals with a brief review of the work done on genus *Acacia* along with the Phytochemical examination of stem bark of *Acacia nilotica*. The plant material extract with methanol afforded six compounds which were characterized on the basis of spectral analysis. One compound is reported first time from this plant.



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*Chapter-1*

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*Introduction*



### INTRODUCTION:

Since ages, medicinal plants are being used to cure a number of diseases. The knowledge of Ayurveda has led to the discovery of many potent bioactive agents in the history of modern drug development. Even today seventy five percent of the population in our country depends on the medicinal plants, as in the rural and remote areas mostly people adopts the traditional Indian system of medicine. This diversity offers the means for meeting the basic requirements of the Ayurvedic, Unani and Siddha system of medicines<sup>1-3</sup>.

In Ayurvedic system of medicine plant extracts and decoctions are used in the treatment. Old ma's decoctions are still popular in Indian families. The main principle of ayurvedic system of medicine is that it roots out the disease without causing any another trouble or side effects. A large percentage of world population, mainly in the developing countries depends on herbal system of remedy for the cure of different diseases. The uses of plants for cure are also discussed in Rig-Veda<sup>4</sup>. In the past, conventional people or early civilizations depend on local flora and fauna for their survival<sup>5</sup>. Hippocrates, Aristotle. Theophrastus, Pliny and Elder and Galen were familiar with many or the present day medicinal herbs. They described their healing properties and preparation of medicine from many plants species, which were useful for human and veterinary health care. World Health Organization (WHO) has listed more than 22,000 plants species used around the globe for therapeutic purpose<sup>4</sup>. In India, about 2500 plant species related to more than 1000 genera are being used in native systems of



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medicine. India is 10<sup>th</sup> among the plant rich countries of the world and 4<sup>th</sup> among the Asian countries. The herbs provide the foundation for drug development and discovery<sup>5</sup>. Think locally and act globally applies to the medicinal wealth, as it is limited to mankind all over the world.

Plants play an important role as a backbone in the healthy life style and provide health, food and phytotherapeutics. Nearly 8000 plants are recognized with medicinal values and are being used as medicine in India. It is well established that about 346 plants products have fungicidal properties, 92 have bactericidal and 90 have antiviral properties<sup>5</sup>. However, they are constantly under threat due to the growth of economic development, population explosion and new human settlements.

There is a call for the manufacturers of herbal and allopathic medicines to carry out systematic investigation on medicinal/herbal plants to save overseas exchange spend on their imports<sup>1</sup>. The knowledge of the traditional medicine of the Indian sub continent has been accumulated during 3000-5000 years back<sup>1</sup>. The efficacy and the therapeutic values of the plants described in Vedas are the result of systematic observations. This knowledge is documented in Samhita's, a compilation, which represent the science of ayurveda. Ayurveda collectively encompasses medicinal, psychological, cultural, religious and philosophical concepts. Today 70-80% of the people in India follow the Ayurvedic approach for the health treatment<sup>3</sup>.

The inquisitiveness of the modern chemist, scientist and pharmacologist to search active principles from the natural products i.e. marine or plants or other natural sources<sup>2</sup>. This has developed into a new



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branch of studies known as phytochemistry, which involves systematic and careful chemical analysis i.e. isolation, characterization and to establish the biological activity of the organic constituent or constituents in pure form. A systematic research of chemistry and biological properties of natural products is a key and main step in the growth of modern organic and medicinal chemistry<sup>4</sup>. The realization of the existence of bioactive principles in plants was a giant leap towards understanding the utilizations of plants as medicine in a better perspective. Still, plants or plant products prolong to retain their historical consequence as a main source of novel drugs and lead natural compounds for structural modification, optimization, specific biochemical and pharmacological probes. Medicinal properties of plants are due to the presence of bioactive molecules, mostly secondary metabolites<sup>6</sup>.

Natural products chemistry has been developed as a major field of scientific endeavor during the last few decades. The systematic work in phytochemistry began with the development of physical and biochemical methods. The discovery of chromatographic techniques e.g., column, thin layer, paper, HPLC, HPTLC has given a big impetus to the phytochemical methods. The phytochemists are provided with indispensable tool for the investigation of structure of compounds available even in small quantities with the discovery of modern spectroscopic techniques like UV, IR, <sup>1</sup>H NMR, <sup>13</sup>C NMR, 2-D NMR and MS.

The medicinal properties of the plants depend upon the presence of one or more physiologically active compounds. Some plant extracts may be toxic in higher doses, and might have medicinal properties in lower doses. Research in natural products contributes to the discovery of new drugs and drug development programme by



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providing important structural units to pharmaceutical chemists. The results of these investigations have not only enriched the academic outlook of organic chemist but have also equipped modern medicinal system with a wide range of therapeutic agents. Despite the various advancement made in the field of drug, synthesis, the use of plants for treatment is still invariably recommended.

Plant/sand products of plants are part of the vegetarian food and most of them display therapeutic characteristics and several Indian plants have been recognized and their preparations have been found to be useful in the treatment of different diseases<sup>2,3</sup>. Current reports suggested that there is an opposite association among the dietary intake of antioxidant rich foods and the occurrence of humandiseases<sup>4,5</sup>. Here are several findings which advise that natural occurring antioxidants work synergistically used in combination<sup>7</sup>. In current situation, customers are worried to utilize synthetic antioxidants and therefore food industries favor to use natural antioxidants in food stuffs. Thus, investigation of novel herbal antioxidants has become essential<sup>6,8</sup>. It has been found that molecules in their natural formulations are more active rather than isolated form<sup>9</sup>. An attempt has been made to review the antioxidant capacity of several plant extracts frequently used in Ayurvedic medicines<sup>10-18</sup>.

In spite of the fact that there has been tremendous development in organic chemistry. In this direction, the use of plant extracts/decoctions is still recommended variably. For example: plant polyphenols<sup>19</sup>, flavonoids stand for the major group. Their food intake through foodstuff has been allied with a lesser occurrence of cardiovascular disease<sup>20</sup>. It was observed that natural flavonoids which were used in foodstuffs



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may have valuable effects on "human being" health and also work as disease prevention agents, which are mostly recognized to their antioxidant and anticancer properties<sup>19,20</sup>. Usually occurring flavonols have received a lot attention as natural/herbal antioxidants and only a little studies have reported on the antioxidant effects of prenylated flavonoids, probably because of their low dietary eating compared to flavonols and anthocyanins<sup>21</sup>.

The root of *Rauwolfia serpentina* being known for ages to act as remarkable hypotensive agent, antidote to snake poison and febrifuge. The nature has provided the antidote in the form of plant extract but one should have to explore it. It has been observed that, when the *Rauwolfia serpentina* and the synthetic organic constituent of same structure used independently the active principle reserpine obtained synthetically was not active individually as like extract. The discovery of herbal remedies such as digitalis, quinine and ephedrine has provided a great impetus for the continuing isolation and characterization of plants and other secondary metabolites<sup>22-24</sup>.

Recent studies revealed that creation of free radicals participate a key role in the progression of a wide range of pathological disturbances such as cancer, brain dysfunction, cardiovascular disease and inflammation<sup>25,26</sup>. In food industries, free radicals are found to be accountable for lipid oxidation that is a main determinant in the deterioration of foods during processing and storage<sup>27-29</sup>. Due to these known facts significant emphasis has been made on the addition of antioxidants in food and biological systems to scavenge free radicals. So many natural compounds have been



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found to be antioxidants, including chlorophyll, carotenoids, vitamin E, phenolic acids and flavonoids<sup>30</sup>. Epigallocatechin (EGC) from tea leaves, polyphenols from grapes, rosmarinic acid, curcumin from turmeric are used as antioxidants for herbal preparations and cosmetics.

First effective antimalarial drug "Quinine" was identified from the bark of Cinchona tree (*Cinchona officinalis*) in 1820, which is still in use. Quinine was isolated from the *C. officinalis* plant and saved more lives than any other drug<sup>31</sup>. Another phytochemical "Aspirin", identified from the bark extract of "white willow tree" (*Salix alba*) is still in use to treat a large variety of ailments mostly as an anti-inflammatory, pain reliever and in heart problems, which affects blood clotting<sup>32</sup>. For the first time Schlittler et al. in 1952 isolated the main alkaloid reserpine from the roots of *Rauwolfia serpentina*<sup>33</sup>. Opium poppy (*Papaver somniferum*) still holds a unique place in medicinal world to relieve severe pain and act as preeminent analgesic. Thomas Sydenham, the English Hippocrates referred few would be willing to practice medicine without opium due to its medicinal property<sup>34</sup>. Settemer isolated the active component morphine for the first time from opium and the name morphine was given on the name of morpheus, the God of sleep<sup>35</sup>. It was William Gregory who isolated and made it commercially available in pure form for medicinal purpose, morphine still holds first place as a major pain relieving drug in the world<sup>36</sup>.

Natural product "Resveratrol" derived from "Grapes" was found to be antimutagenic, antioxidative, an inducer of phase II drug-metabolizing enzymes<sup>37</sup>. "Resveratrol" belongs to a class of chemical compounds called "Stilbenes" and are widely spread in nature<sup>38</sup>. Interest in the synthesis of "Stilbene" compounds similar to that of



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natural stilbenes is increasing due to their antioxidant, antifungal, ichthyotoxic and antileukemic properties<sup>38-40</sup>.

The development of phytochemistry depends on the systematic studies of the constituents isolated from natural products, e.g. fatty acids, lipids, steroids, terpenoids, alkaloids, essential oils, hormones, vitamins, anthocyanins, flavones, quinones etc.

Since communities are mainly anxious to know the safety and the quality of their foodstuff. Only preferred food additives are added for protecting them from off-flavor. Antioxidants are frequently used in oils and fatty foods to retard their oxidation. The synthetic antioxidants that were broadly used, are now avoided due to their possible toxic side effects<sup>41</sup> and emphasis is made on the use of natural antioxidants<sup>42,43</sup>. In Indian Medicine System, herbs and spices are a major resource of natural occurring antioxidants. Approximately 700 herb species have been screened for natural antioxidants and among them, 64 have been found to possess significant antioxidant behavior and 24 showed strong antioxidant activities<sup>44-46</sup>.

It is known that, food spoils by oxidation reaction due to the existence of atmospheric oxygen. Thus, the food which contains rich amount of antioxidant spoils later. Benzoic acid and ascorbic acid are also good example of antioxidant molecules<sup>46</sup>. Vegetables and fruits hold a lot of phytochemicals having antioxidant character.

Thus, the natural food antioxidants have anticancer properties or they protect against cancer. Some of the examples of antioxidants are being given below.



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1	$\beta$ -Carotene	Pigment in carrots
2	Catechins	Oak tree (stem bark)
3	Flavonoids	Tea leaves
4	Lycopene	Red colour of tomatoes
5	Pro anthocyanidins	Colouring matter of many fruits
6	Quercetin	Red onions apples
7	Resveratrol	Red wine pigment

Current studies showed that antioxidants are useful in decreasing the incidence of cardio-vascular diseases and are good as anticancer agents<sup>40</sup>. They also prevent aging and are used to prevent and treat atherosclerosis and coronary artery diseases. Antioxidants are beneficial for better living and thus average human life extent would be extended to more active years.

The list of some medicinally important plants which are source of important drugs and their activity are being summarized in table-1.1.



Table-1.1

S.No	Plant Name	Clinical use/ Activity	Active Principle	Ref.
1	<i>Acacia catechu</i>	Diarrhea, Sore throats, Astringents	Catechin (I), quercetin (II)	47
2	<i>Adhatoda vasica</i>	Cerebral stimulant	Vasicine (peganine) (III)	48--50
3	<i>Adonis vernalis</i>	Cardiotonic	Adonaside (IV)	51, 52
4	<i>Aerva ionatal</i>	Immuno modulatory activity	10-Methoxycanthin-6-one (V)	53
5	<i>Aesculus hippocastanum</i>	Anti-inflammatory	Aescin (VI)	54-56
6	<i>Agriiimonia eupatoria</i>	Anthelmintic	Agrimophol (VII)	57,58
7	<i>Arruni majus</i>	Leukoderma	Xanthotoxin (VIII)	59,60
8	<i>Ammi visage</i>	Bronchodilator	Khellin (IX)	61,62
9	<i>Anabasis sphylla</i>	Skeletal muscle relaxant	Ana besine (X)	48-50
10	<i>Anadenanthera macrocarpa</i>	Respiratory tract infections	Thiobarbituric acid (XI)	63
11	<i>Anamirta cocculus</i>	Analeptic	Picrotoxin (XII)	64
12	<i>Anonacn comosus</i>	Anti-inflammatory, Proteolytic	Bromelain (XIII)	65,66
13	<i>Anchrographis paniculata</i>	Bacillary dysentery	Andrographolide (XIV), neoandrographolide	67,68



14	<i>Angelica dahurica</i>	Anti-inflammatory, Lexitaline, Sedative	9-Hydroxy-4-methoxy psorlen (XV), alloisoperatorin (XVI)	69
15	<i>Anisodus tonguiticus</i>	Anticholinergic	Aniodamine (XVII), anisodine	70
16	<i>Anogeissus latifolia</i>	Analgesic, Bitter, Astringent	Gallic acid (XVIII)	47,71
17	<i>Ardisia japonica</i>	Antitussive	Bergenin (XIX)	72
18	<i>Asparagus racemosus</i>	Anti-inflammatory, Antiulcer, Antioxidant	Ascorbic acid (XX)	73
19	<i>Astroithun urundeuva</i>	Anti-inflammatory, Antiulcer	Thiobarbituric acid (XXI)	63
20	<i>Baccharis grisebachii</i>	Anticancer, Cytotoxic, Antiseptic	5,7,4'Trihydroxy-6- methoxy flavones (XXII), quercetrin	74
21	<i>Ballota acetabulosa</i>	Genetic disorder, Antioxidant	a-Tochopherol (XXIII)	74
22	<i>Ballota pseudodicamms</i>	Anti-inflammatory, Antimicrobial	a - Tochopherol (XXIV)	74
23	<i>Bauhinia forticate</i>	Skin diseases, ulcers, Lebroso	Kempferol-3,7-O-dirhamnoside (XXV)	75
24	<i>Berberis speciosi</i>	Anti-inflammatory, anti-cancer, antioxidative, anti-inflammatory, anti- microbial inhibits osteoclast and in gastric treatment	Berberine (XXVI)	76,77
25	<i>Berberis vulgarisi</i>	Bacillary dysentery	Berberine (XXVI)	78,79
26	<i>Betula alba</i>	Anticancerous	Betulinic acid (XXVII)	48



27	<i>Brassicarigra</i>	Rubefacient	Allyl isothiocynate (XXXVIII)	64
28	<i>Camellia sinensis</i>	Diuretic, Bronchodilator, CNS stimulant	Theophylline (XXIX), caffeine (XXX)	80,81
29	<i>Camptotheca acuminata</i>	Anticancerous	Camptothecin (XXXI)	82-84
30	<i>Cannabis sativa</i>	Antiemetic, decrease ocular tension	a-Tetrahydrocannabinol (THC) (XXXII)	85-87
31	<i>Catharanthus roseus</i>	Antitumor, antileukemic agent	Vinblastine (XXXIII)	88,89
32	<i>Centella asiatica</i>	Vulnerary	Asiaticoside (XXXIV)	90,91
33	<i>Cephaelis ipecacuanha</i>	Amoebicide, emetic	Emetine (XXXV)	92
34	<i>Cephalotaxus genus</i>	Anticancer	Cephalotaxine (XXXVI)	93,94
35	<i>Cinchona edgeriana</i>	Antimalarial, Antipyretic, Antiarrhythmic	Quinine(XXXVII)	95,96
36	<i>Cinnamomum camphora</i>	Rubefacient	Camphor(XXXVIII)	97
37	<i>Citrus spp.</i>	Capillary fragility Antioxidant	Hesperidin(XXXIX)	98,99
38	<i>Connarus sernidecandrus</i>	Antiplasmodial	Bergenin (XL), homorapanone (XLI)	100
39	<i>Convallaria majalis</i>	Cardiotonic	Convallatoxin(XLII)	101,102
40	<i>Coptis japonica</i>	Antipyretic, detoxicant	Palmatine(XLIII)	103,104
41	<i>Coptis trifolial</i>	Antibacterial, Antifungal	Berberine (XXVI), palmatine(XLIII)	103-106
42	<i>Corydalis ambiguo</i>	Analgasic, sedative	Tetrahydropalmatine(XLIV)	106,107
43	<i>Curcuma longa</i>	Choloretic, Antiinflammatory, Antispasmodic, Anticancer	Curcumin (XLV)	108-110



55	<i>Gaultheria procumbens</i>	Anticardiacal, anti-inflammatory	Gaultherin (LXIII)	64
56	<i>Gaultheria procumbens</i>	Rubefacient	Methyl salicylate (LXIV)	129,130
57	<i>Glaucium flavum</i>	Antitussive	Glaucine (LXV)	131,132
58	<i>Glycyrrhiza glabra</i>	Sweetener	Glycyrrhizin (LXVI)	133
59	<i>Gossypium malvaceae</i>	Male contraceptive	Gossypol (LXVII)	134,135
60	<i>Helminthostachys zeylanica</i>	Sciatica, boils, ulcers, malaria	Ugonin J (LXIX), ugonin K (LXX), ugonin L (LXXI)	136
61	<i>Heracleum persicum</i>	Analgesic, anti-inflammatory	Isopimpinellin (LXXII), bergapten (LXXIII), Pimpinellin (LXXIV), bakuchicin (LXXV)	137
62	<i>Hunteria zeylanica</i>	Vasorelaxant, Antiplasmodial, Anticholinergic	Barakol (LXXVI), strictosidinic acid (LXXVII)	100
63	<i>Hydrastis Canadensis</i>	Anticarcinogenic, Whooping cough, Pneumonia	Berberine (XXVI), canadine (LXXVIII), b-hydrastine (LXXIX)	138-141
64	<i>Hyoscyamus niger</i>	Anticholinergic	Hyoscyamine (LXXX)	142
65	<i>Hyoscyamus reticulatus</i>	Suppress the central nervous system, Antiperspirants, Antiasthmatic	Tropane (LXXXI), hyoscyamine (LXXXII), scopolamine	143
66	<i>Hypericum perforatum</i>	Wound healing, antiviral, anticancer	Caffeoylquinic acid (LXXXIII)	63,143



67	<i>Iryanthera juruensis</i>	Antioxidant, antiviral, antifungal	Tocotrienol (LXXXIV)	144
68	<i>Justice adhatoda</i>	Cytotoxic cough and cold, skin diseases	Vasicine (LXXXV)	145
69	<i>Larrea divaricata</i>	Antifungal, Antitumor, Antidiabetic	Nordihydroguaiaric acid (LXXXVI)	146-149
70	<i>Lobelia inflata</i>	Smoking deterrent, Respiratory stimulant	Lobeline (LXXXVII)	150-152
71	<i>Lonchocarpus nicou</i>	Piscicide	Rotenone (LXXXVIII)	48-50
72	<i>Lycoris squamigera</i>	Cholinesterase inhibitor	Galanthamine (LXXXIX)	153,154
73	<i>Mongifera indica</i>	Hypoglycemic, Astringent for bronchitis	Ascorbic acid (XX)	155
74	<i>Melissa officinalis</i>	Antioxidant, Antiviral, Herpes	Rosmarinic acid (XC)	63,156-158
75	<i>Mentha spp.</i>	Rubefacient	Menthol (XCI)	159-161
76	<i>Mucuna deeringiana</i>	Anti-parkinsonism	L-dopa (XCII)	48-50
77	<i>Mucuna prurines</i>	Snakebite, Antitumor, Anti-parkinsonism	Bufotenine (XCIII)	162-164
78	<i>Nicotiana tabacum</i>	Insecticide	Nicotine (XCIV)	48-50
79	<i>Pandanus odoratissimus</i>	CNS depressant, Liver injury	Pinoselin (XCV), 3,4-bis(4-hydroxy-3-methoxybenzyl)tetrahydro-furan (XCVI)	165
80	<i>Papaver somniferum</i>	Analgesic, Antitussive, Smooth muscle relaxant	Codeine, morphine, noscapine, papavarine (XCVII)	166,167
81	<i>Paulinia cupana</i>	Antioxidant, larvicidal	Caffeine (XXX)	168



82	<i>Pausinystalia yohimbe</i>	Aphrodisiac	Yohimbine (XCVIII)	169
83	<i>Peganum hatmala</i>	Antimutagenic, Antigenotoxic, Antimicrobial, Cytotoxic	$\beta$ -carboline (XCIX), harmol, harmaline, harmalol	170,171
84	<i>Peumus boldus</i>	Inhibitory, Antibacterial	Boldine (C)	172-174
85	<i>Phyllostachys edulis</i>	Toxicity, Antioxidant	Phyllostadimers A (CI)	175
86	<i>Pilocarpus jaborandi</i>	Parasympathomimetic	Pilocarpine (CII)	176,177
87	<i>Pleuropterus ciliinervis</i>	Antimalarial, Antibacterial	Pieceid-2''-o-gallate (CIII), Pieceid-2''-o-coumarate (CIV)	178
88	<i>Podophyllum peltatum</i>	Antitumor agent, Anticancer agent	Etoposide (CV), podophyllotoxin, teniposide	179-181
89	<i>Polygonum hydropiper</i>	Fungitoxic, Anthelmintic, Anticholinesterase	Galloyl kaempferol 3-glucoside (CVI), galloylquercetin (CVII)	182
90	<i>Prismatomeris malayana</i>	Anti-inflammatory, Antiallergic	Lucidin-w-methylether (CVIII)	100
91	<i>Prunus domestica</i>	Jaundice, Hepatitis, Bactericidal	Prunetin (CIX), genistein (CX), quercetin (CXI)	183
92	<i>Psoralea carylifolia</i>	Antibacterial, Antidesmatophytic	Psoralen (CXII)	184-187
93	<i>Punica granatum</i>	Anti-inflammatory, Anticancer	Punicalin (CXIII)	188-190
94	<i>Quisqualis indica</i>	Anthelmintic	Quisqualic acid (CXIV)	48-50
95	<i>Rauwolfia conescens</i>	Antihypertensive, Tranquillizer	Deserpidine (CXV)	179,191,192



96	<i>Rauwolfia serpentine</i>	Antihypertensive, Tranquillizer, Circulatory, Disorders	Rescinnamine (CXVI), reserpine, ajmalicine	191-193
97	<i>Rosmarinus officinalis</i>	Antibacterial, Antimicrobial	Rosmarinic acid (XC)	63,194
98	<i>Salix alba</i>	Analgesic	Salicin (CXVII)	48-50
99	<i>Salvia officinalis</i>	Antioxidant, Diabetes mellitus	Rosmarinic acid (XC)	63,194
100	<i>Salvia plebeian</i>	Hepatitis, Antioxidant, Cholinesterase inhibitory	$\beta$ -sitosterol (CXIX), 6-methoxy luteolin-7-o-glucoside (CXX)	195
101	<i>Sanguinary Canadensis</i>	Dental plaque inhibitor	Sanguinarine (CXXI)	196
102	<i>Silybum marianum</i>	Antihepatotoxic	Silymarin (CXXII)	197-199
103	<i>Simarouba glauca</i>	Amoebicide	Glaucarubin (CXXIII)	200,201
104	<i>Sophora pachycarpa</i>	Cytotoxic, Apaphotogenic	Pachycarpine (CXXIV)	173,202,203
105	<i>Stephania sinica</i>	Analgesic, Sedative	Rotundine (CXXV)	48,50
106	<i>Stephania tetrandra</i>	Antihypertensive	Tetrandrine (CXXVI)	203,204
107	<i>Stevia rebaudiana</i>	Sweetener	Stevioside (CXXVII)	49,50
108	<i>Strophanthus gratus</i>	Cardiotonic	Quabain (CXXVIII)	205,206
109	<i>Tabebuia argentea</i>	Cytotoxic, Anticancer	Lapachol (CXXIX)	207-209
110	<i>Taxus brevifolia</i>	Antitumor agent	Taxol (CXXX)	210
111	<i>Terminalia chebula</i>	Antimicrobial, Multidrug resistant (MDR), Antibacterial	Gallic acid (XVIII), chebulinic acid(CXXXI)	47

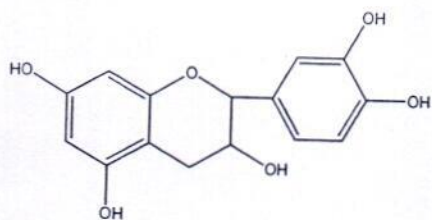


112	<i>Teucrium polium</i>	Antioxidant, Acetylcholine, Sterase inhibitor	Rosmarinic acid (XC)	47,194
113	<i>Theobroma cacao</i>	Diuretic, Vasodilator	Theobromine (CXXXII)	211
114	<i>Thymus vulgaris</i>	Abortifacient, Antifungal	Trichosanthin, thymol (CXXXIII)	48-50,212,213
115	<i>Urginea maritima</i>	Cardiotonic	Scillarin A (CXXXIV)	214
116	<i>Valeriana officinalis</i>	Sedative	Valpotriates (CXXXV)	215,216
117	<i>Veratrum album</i>	Antihypertensive	Protoveratrine A (CXXXVI), protoveratrine B (CXXXVII)	48-50
118	<i>Vermonia thymoides</i>	Antibacterial, Antiviral	3'-Hydroxy scutellarein-7-o-(6'',-o-protocatechuoyl)-beta-glucopyranoside (CXXXVIII), 3'-hydroxy scutellarein-7-o-(6''-o-trans-feruloyl)-beta-glucopyranoside (CXXXIX), 3,5-dihydroxyphenethylalcohol-3-o-beta-glucopyr--anoside (CXL)	217
119	<i>Vinca minor</i>	Cerebral stimulant	Vincamine (CXLI)	218
120	<i>Wincaria tomantose</i>	Antimutagen, Cardiovascular, CNS active	Pteropidine, rhychophylline (CXLII)	219,220

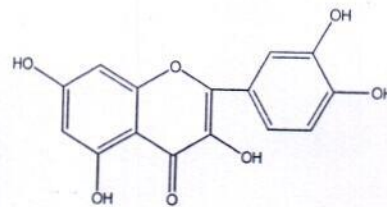


## Introduction

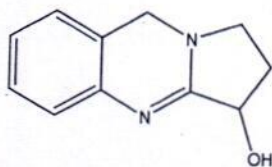
Table-1.2 (Structure of Active Principle):



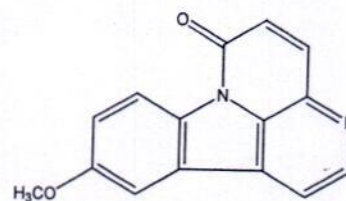
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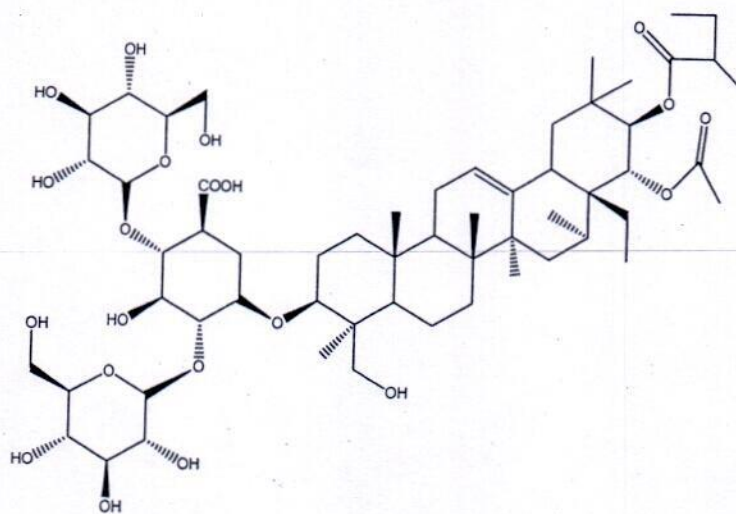
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(III)



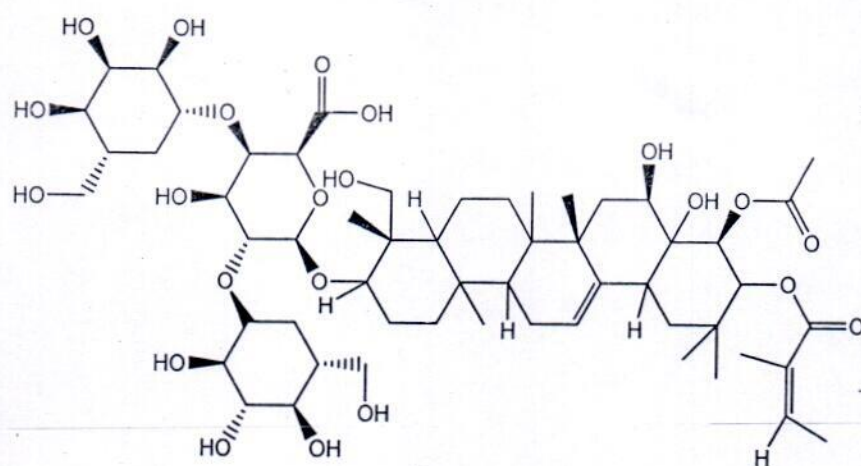
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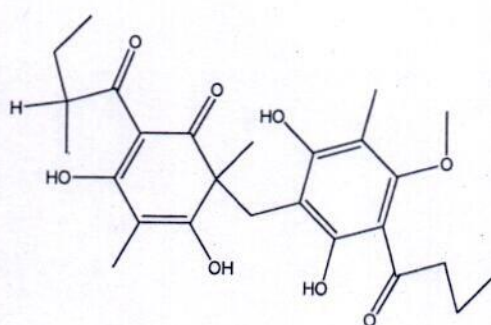
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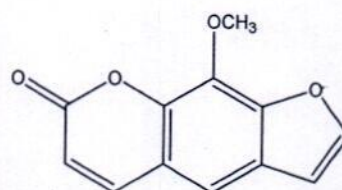
## Introduction



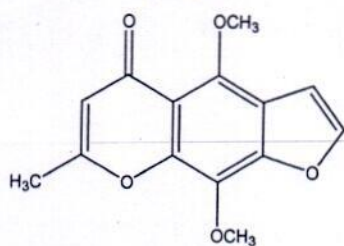
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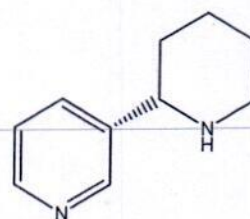
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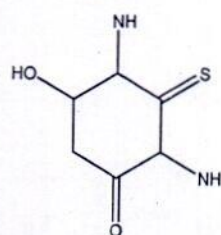
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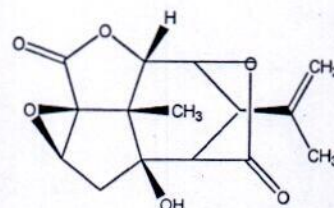
(IX)



(X)



(XI)

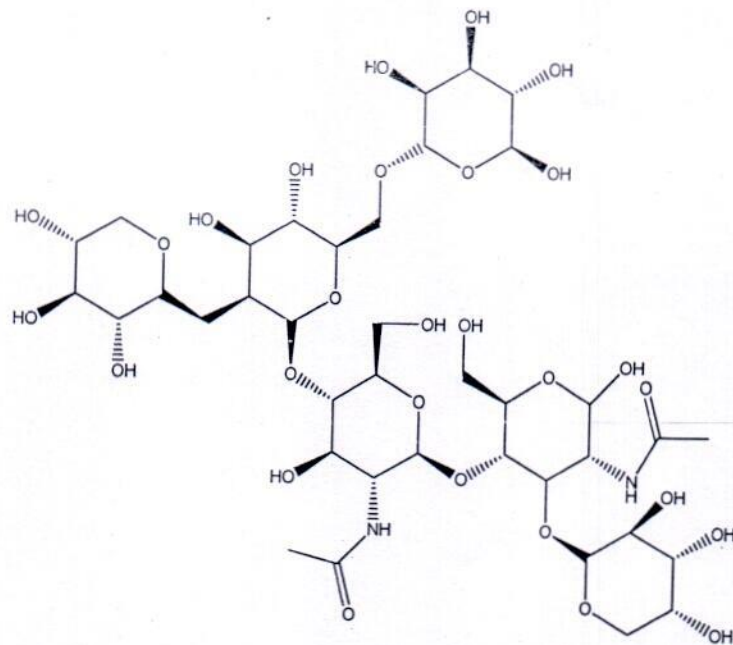


(XII)

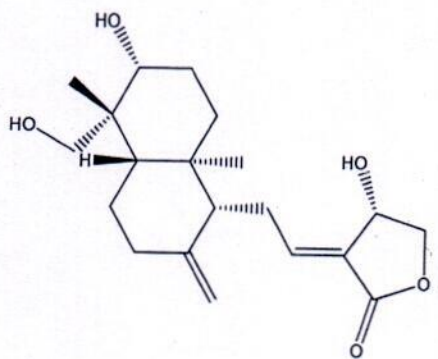


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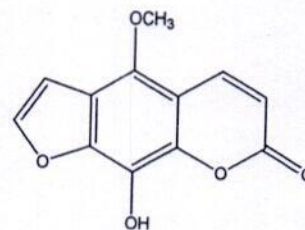
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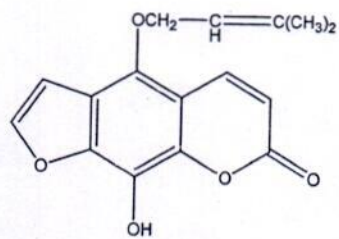
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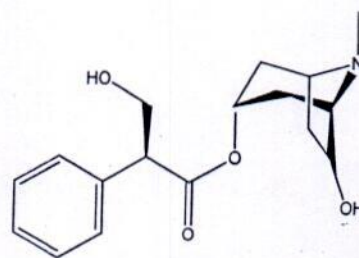
(XIV)



(XV)



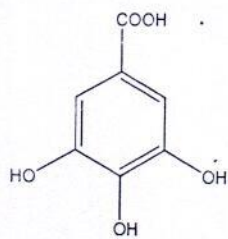
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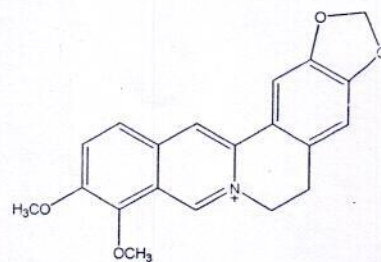
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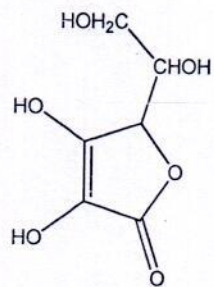
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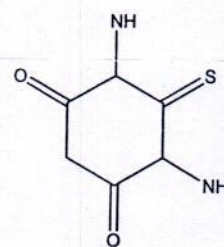
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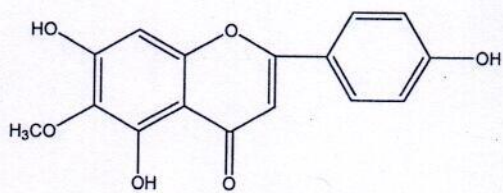
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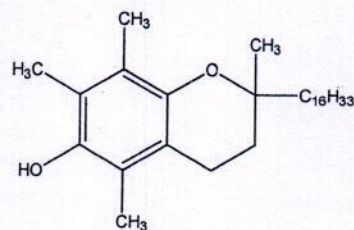
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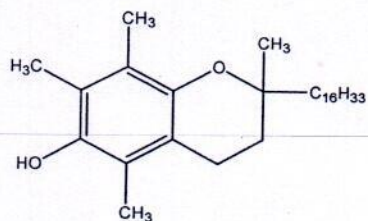
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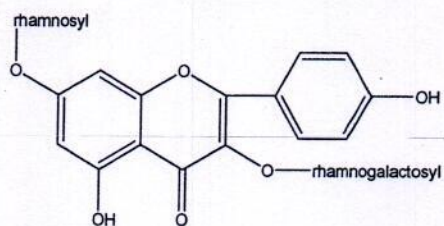
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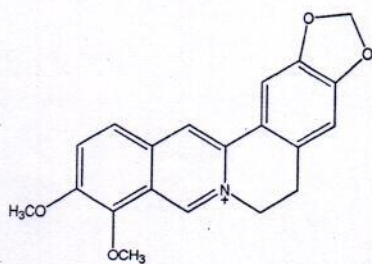
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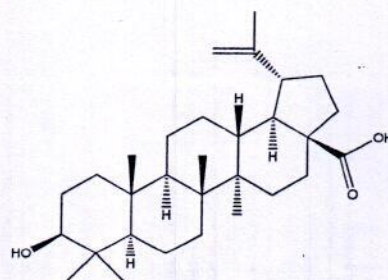
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(XXV)



(XXVI)

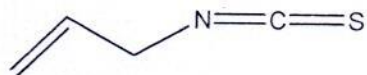


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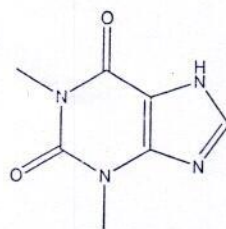


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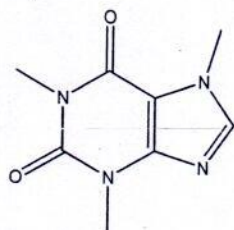
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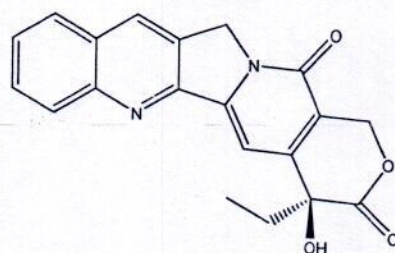
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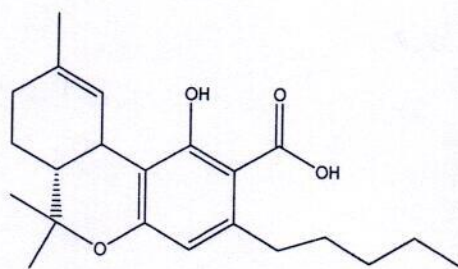
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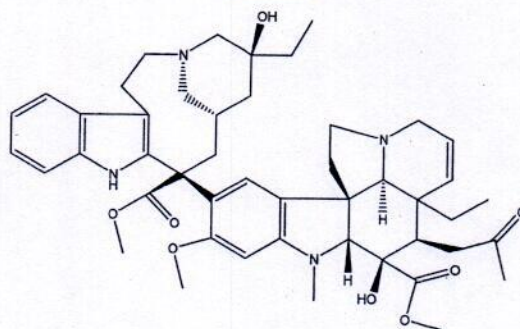
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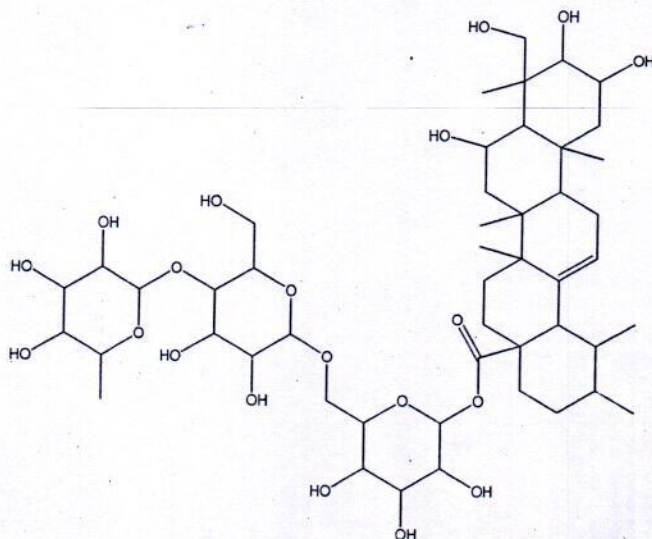
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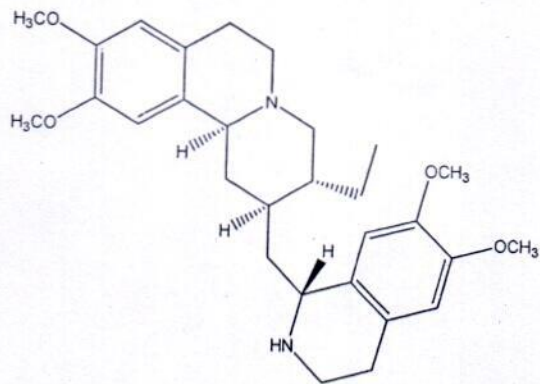
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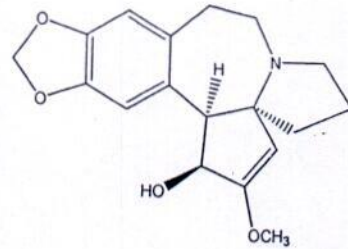
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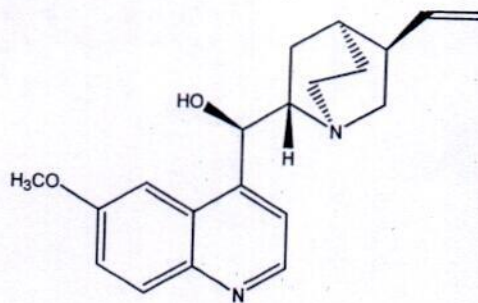
## Introduction



(XXXV)



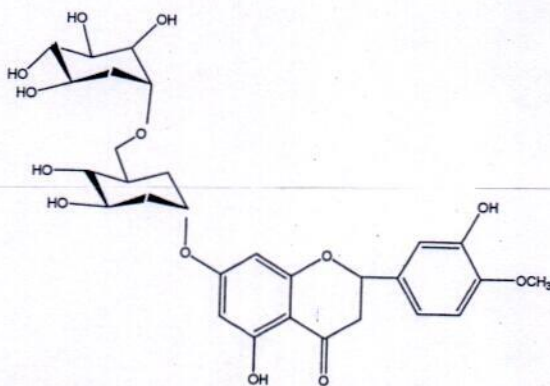
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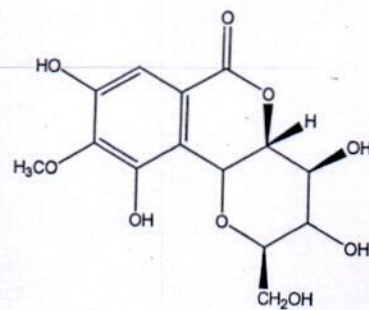
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(XXXVIII)



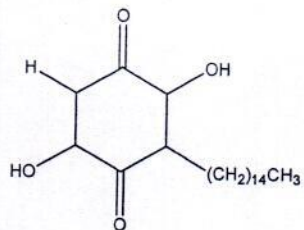
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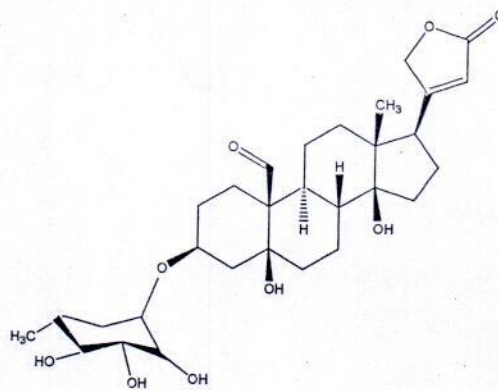
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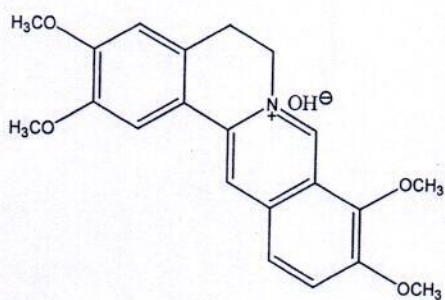
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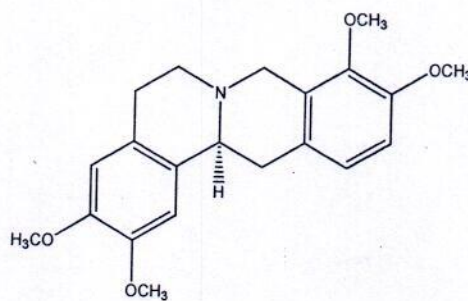
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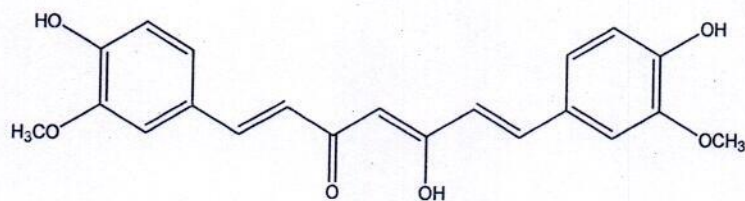
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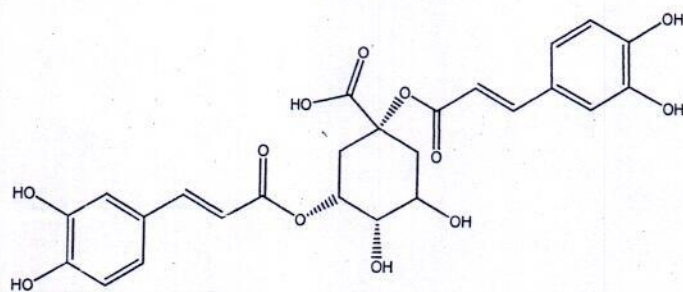
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(XLIV)



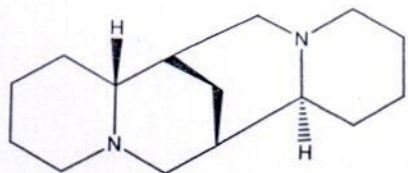
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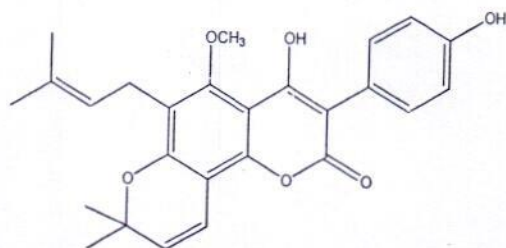
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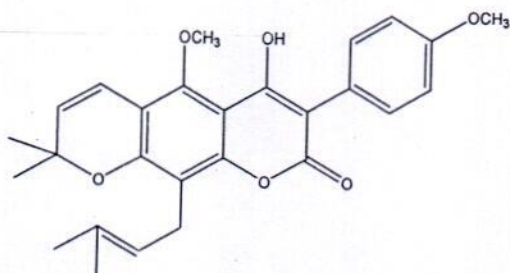
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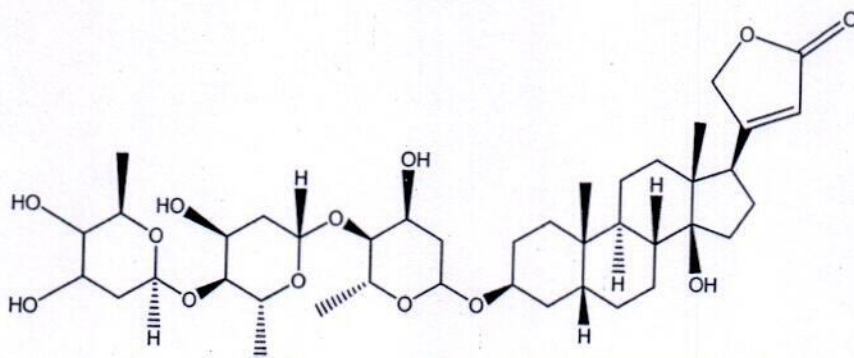
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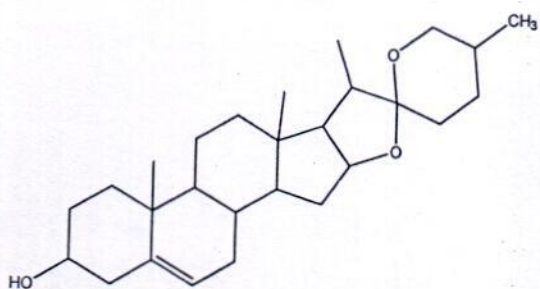
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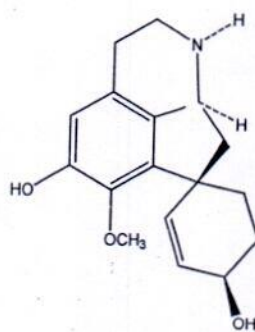
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(L)



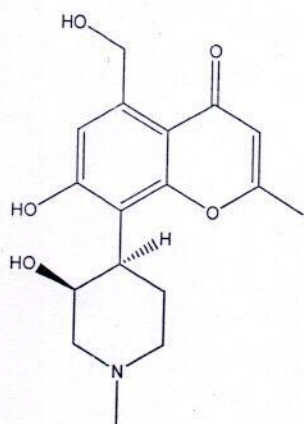
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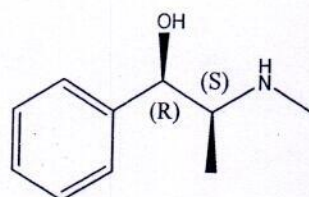
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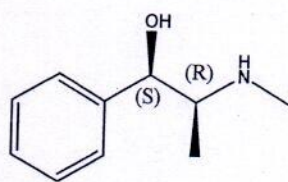
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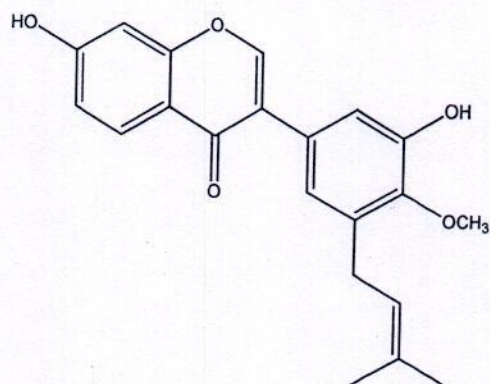
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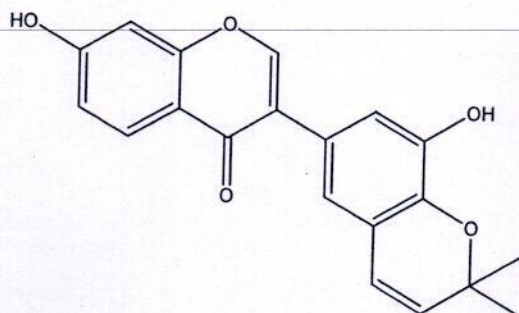
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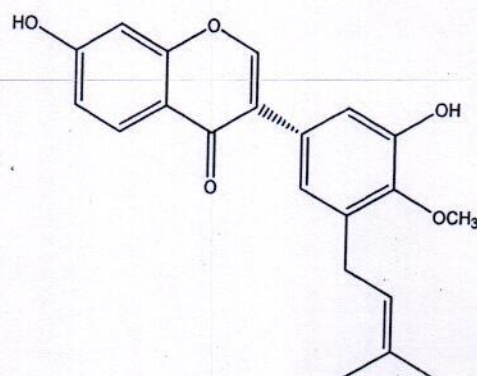
(LV)



(LVI)



(LVII)

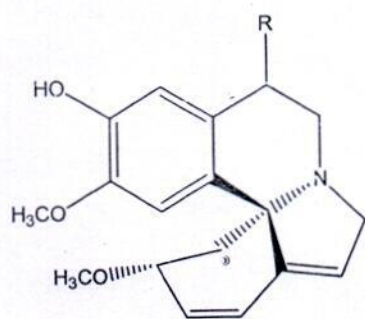


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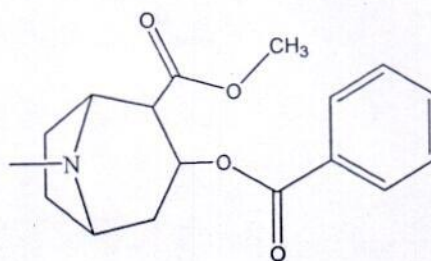


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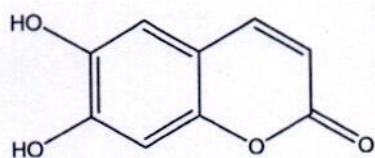
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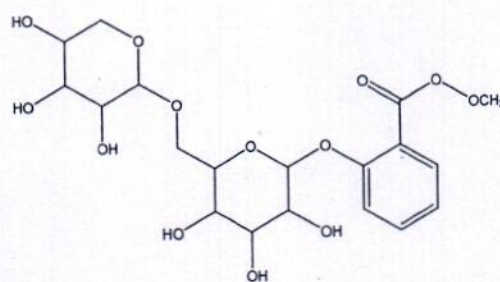
(LX) R = OH



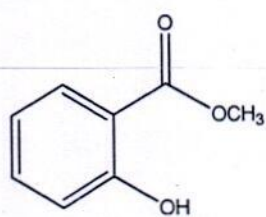
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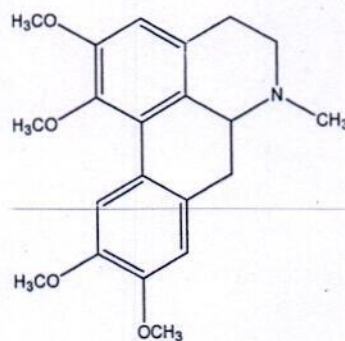
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(LXIII)



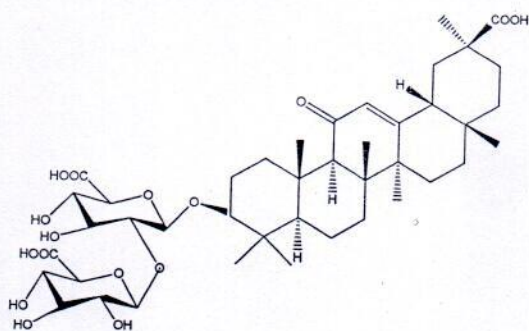
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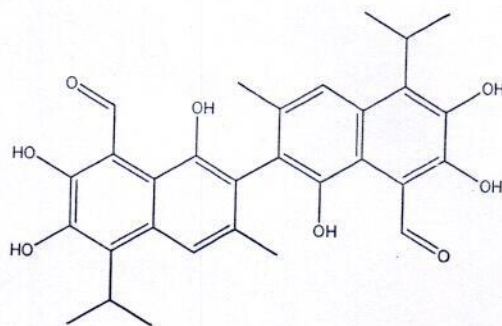
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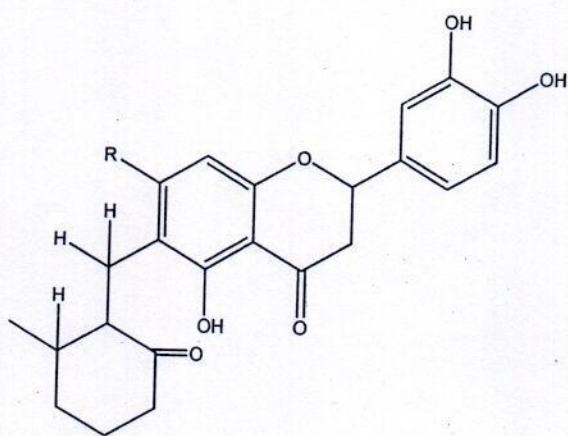
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(LXVI)

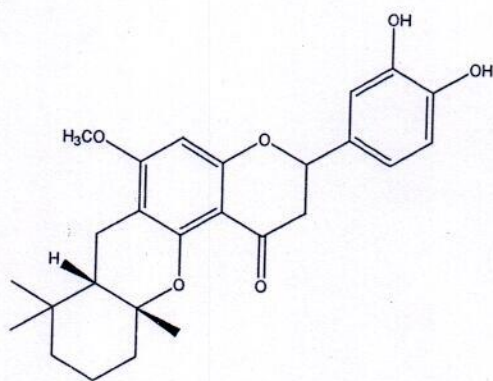


(LXVII)

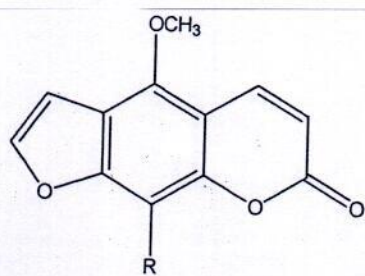


(LXIX) R = OH

(LXX) R = OCH<sub>3</sub>

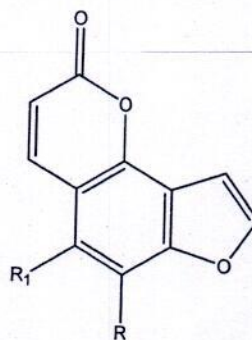


(LXXI)



(LXXII) R = OCH<sub>3</sub>

(LXXIII) R = H

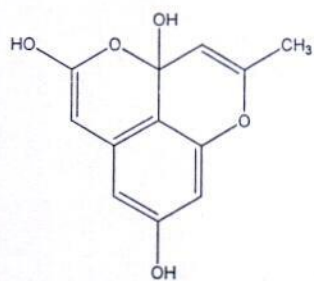


(LXXIV) R = R<sub>1</sub> = OCH<sub>3</sub>

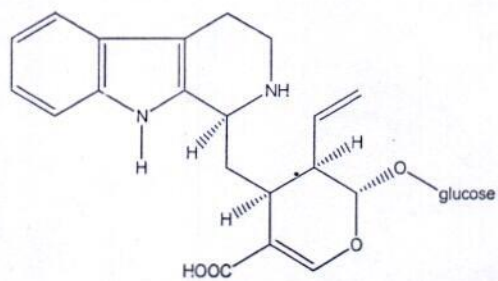
(LXXV) R = R<sub>1</sub> = H



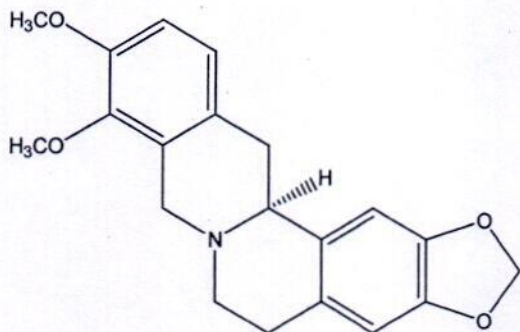
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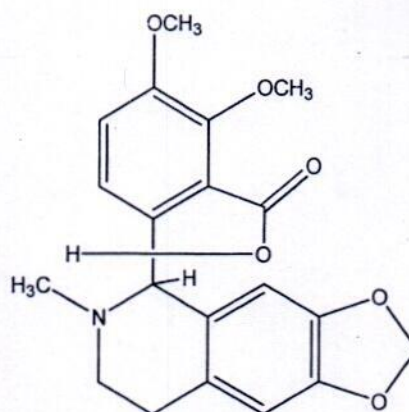
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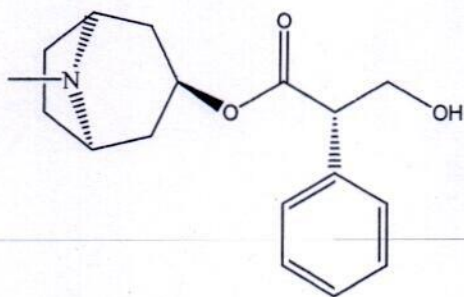
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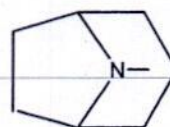
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(LXXIX)



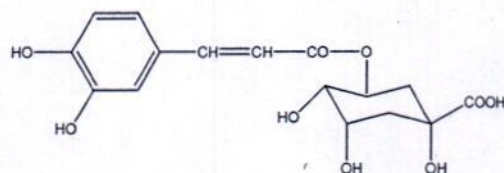
(LXXX)



(LXXXI)



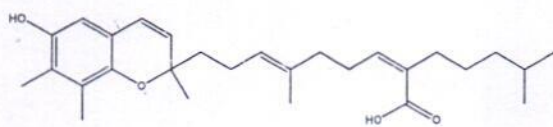
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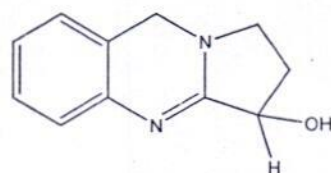
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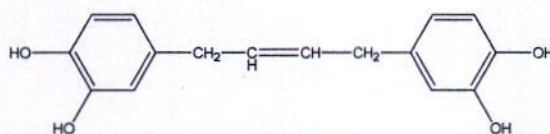
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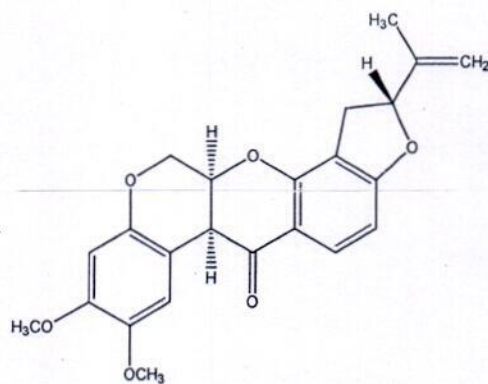
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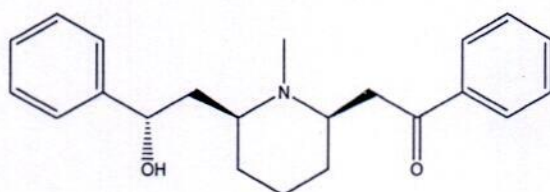
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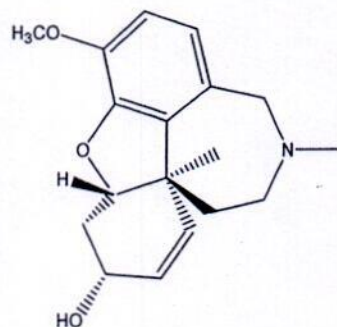
(LXXXVI)



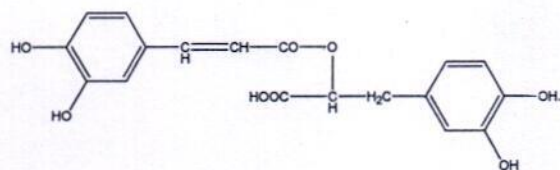
(LXXXVIII)



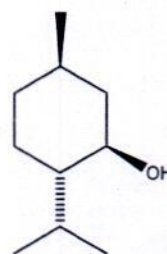
(LXXXVII)



(LXXXIX)



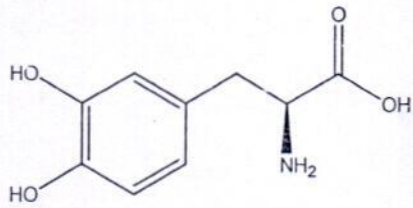
(XC)



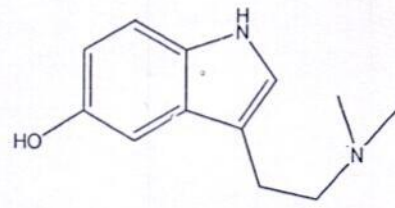
(XCI)



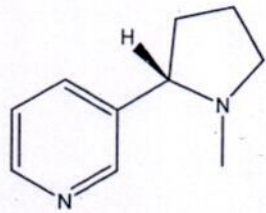
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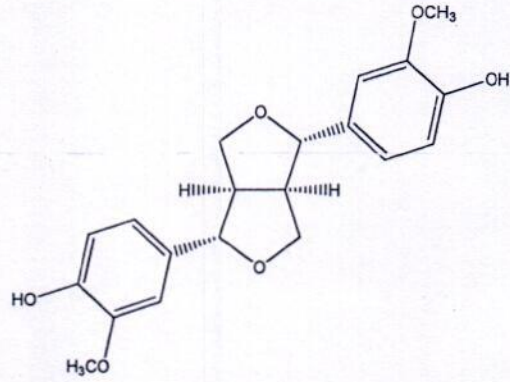
(XCII)



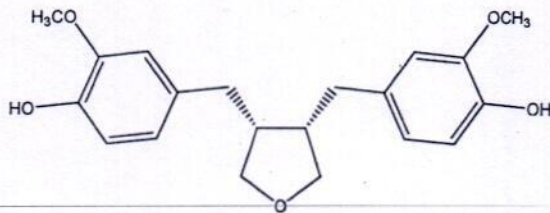
(XCIII)



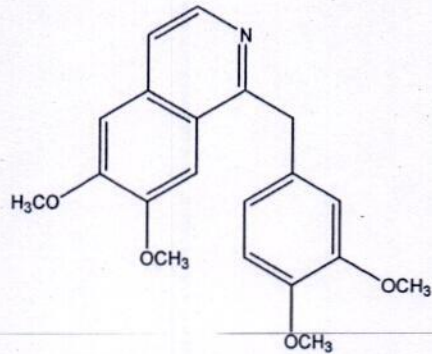
(XCIV)



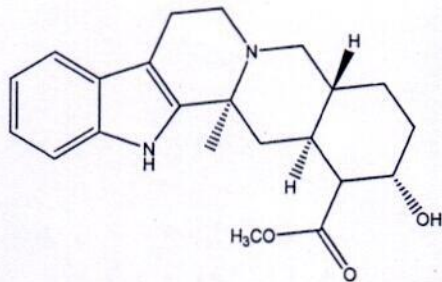
(XCV)



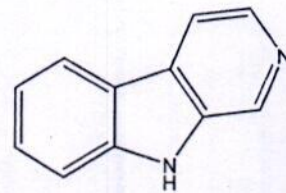
(XCVI)



(XCVII)



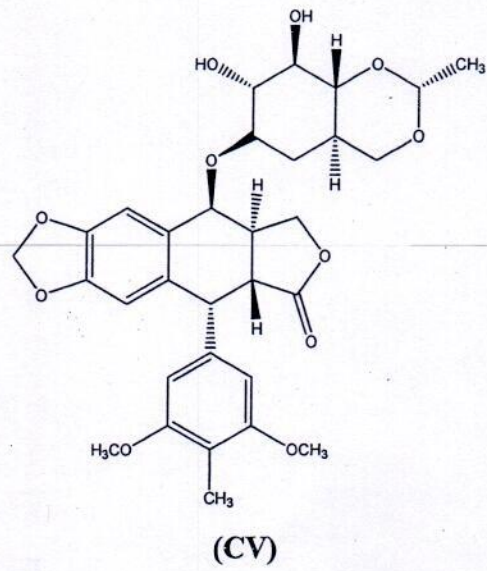
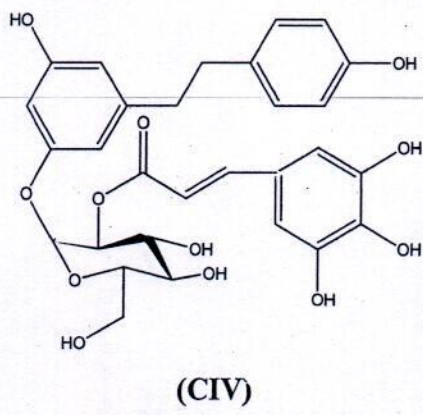
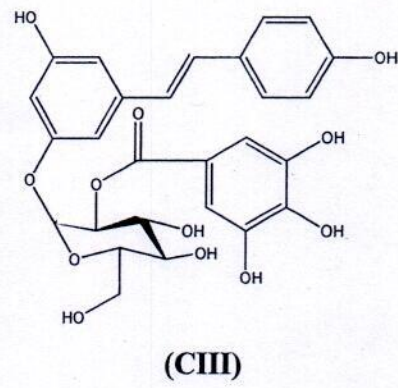
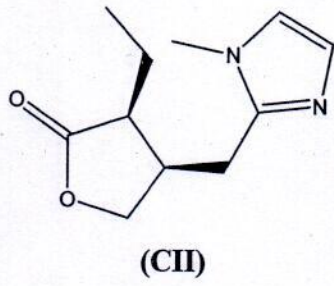
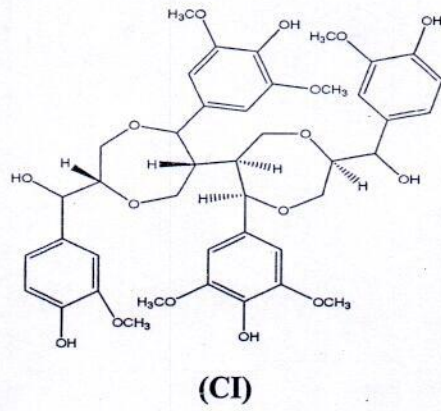
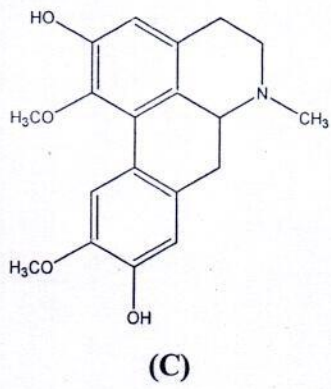
(XCVIII)



(XCIX)

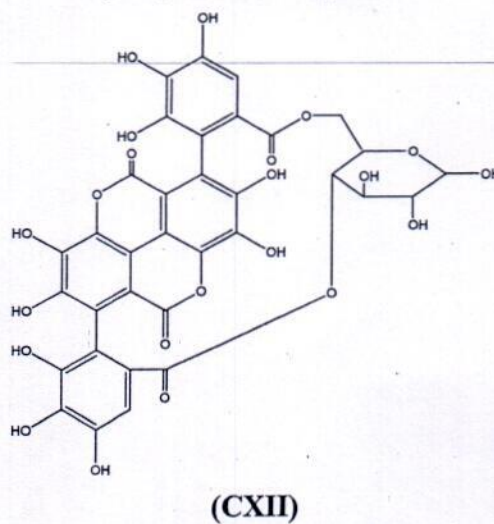
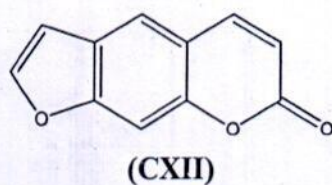
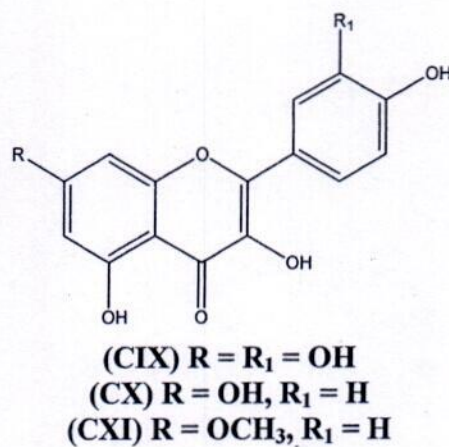
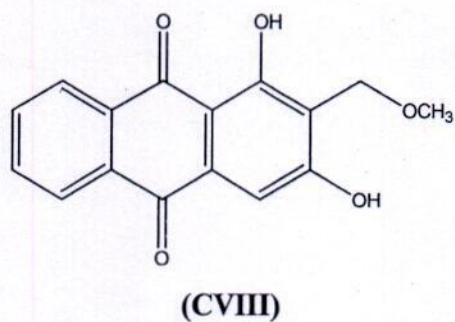
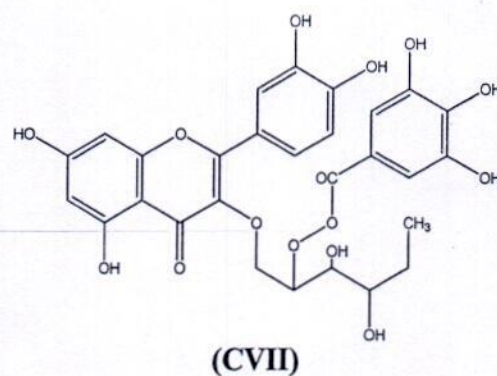
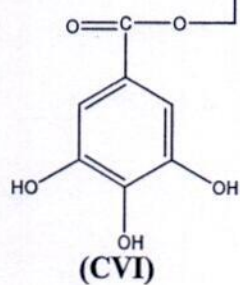
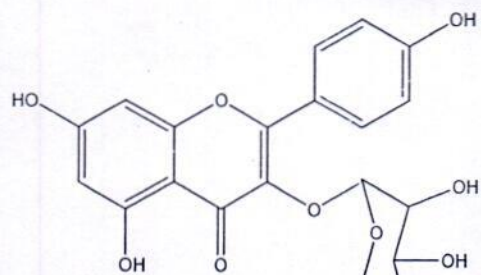


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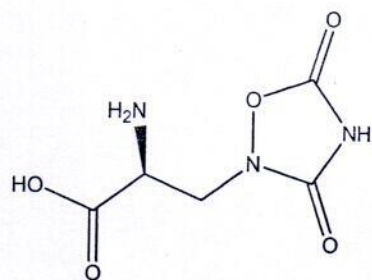


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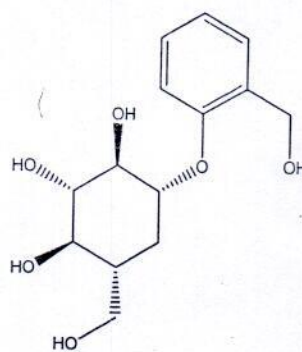




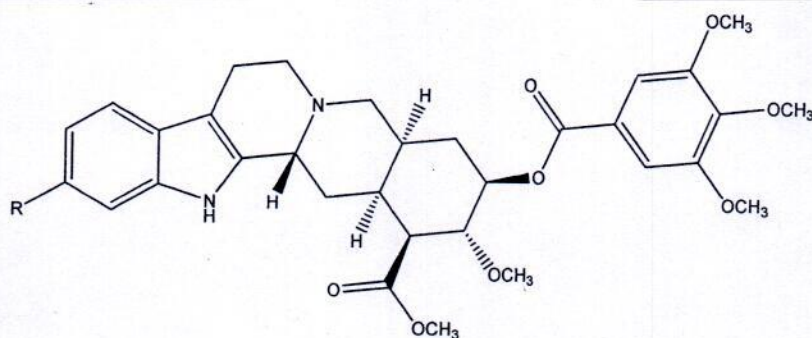
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(CXIV)

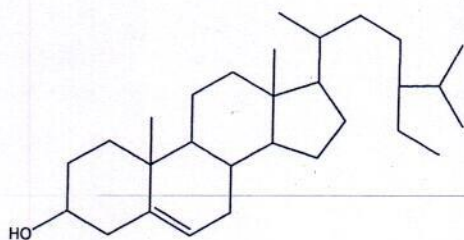


(CXVII)

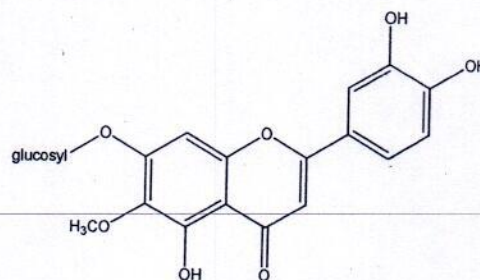


(CXV) R = H

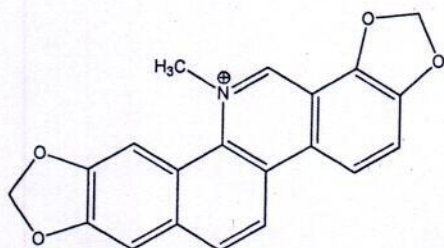
(CXVI) R = OCH<sub>3</sub>



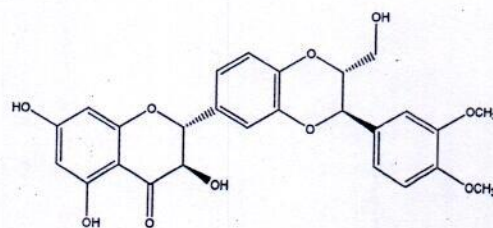
(CXIX)



(CXX)



(CXXI)

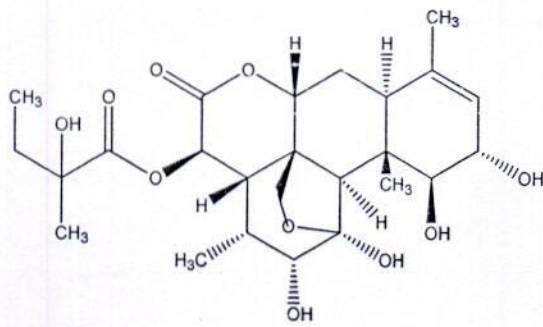


(CXXII)

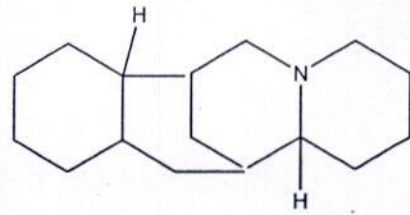


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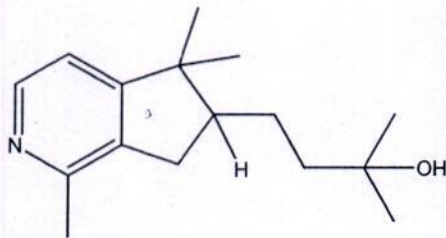
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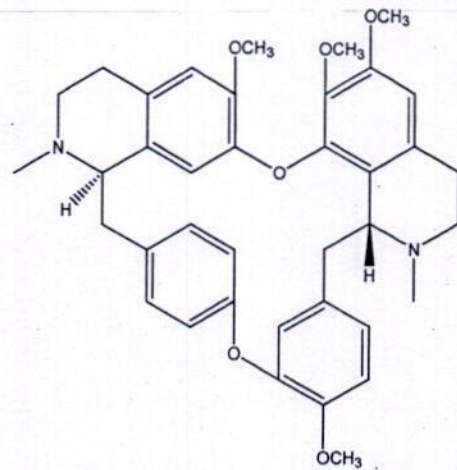
(CXXIII)



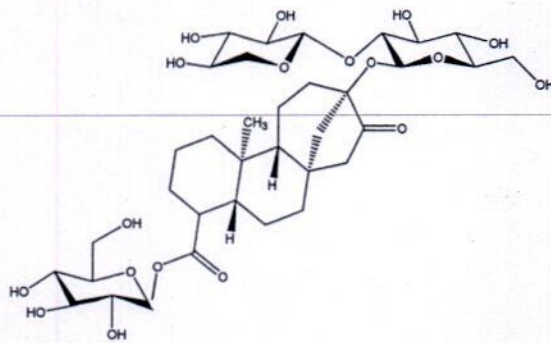
(CXXIV)



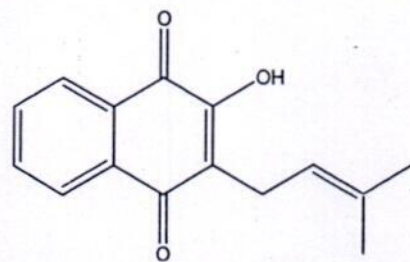
(CXXV)



(CXXVI)



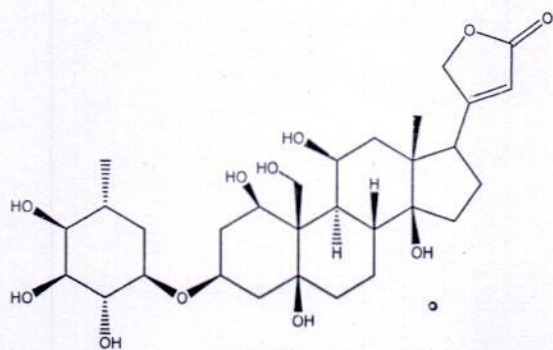
(CXXVII)



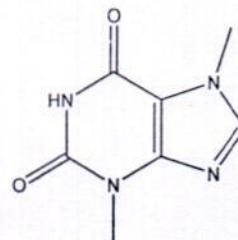
(CXXIX)



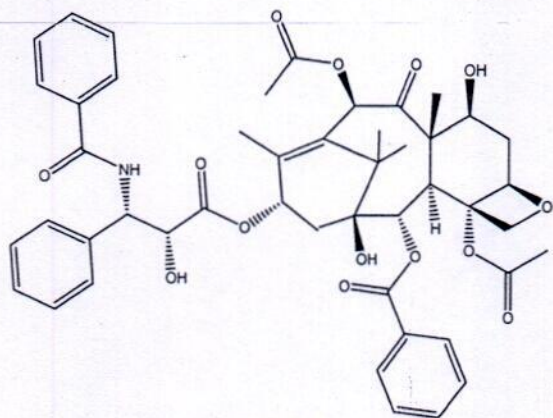
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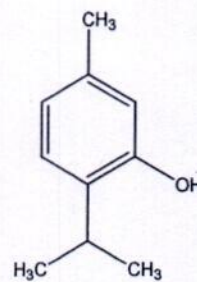
(CXXVIII)



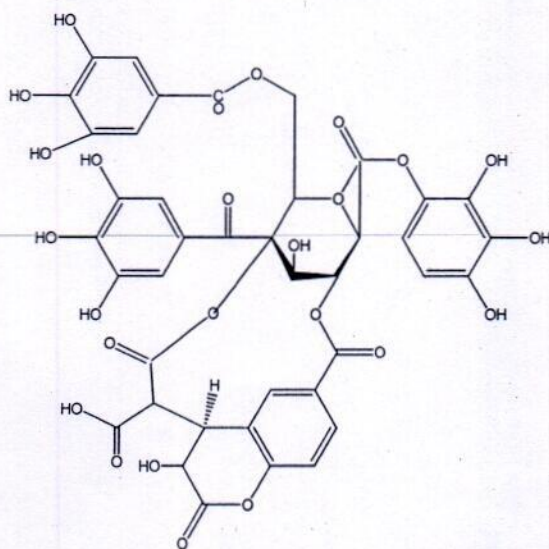
(CXXXII)



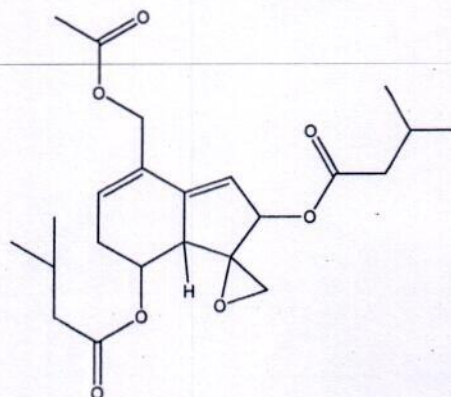
(CXXX)



(CXXXIII)

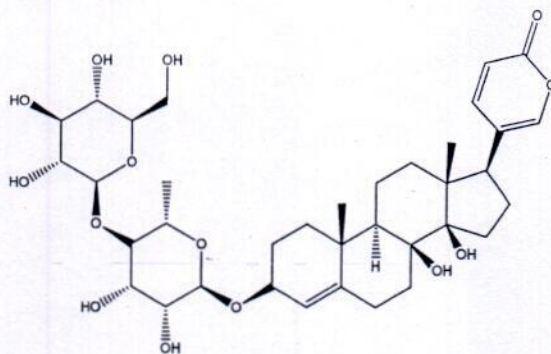


(CXXXI)

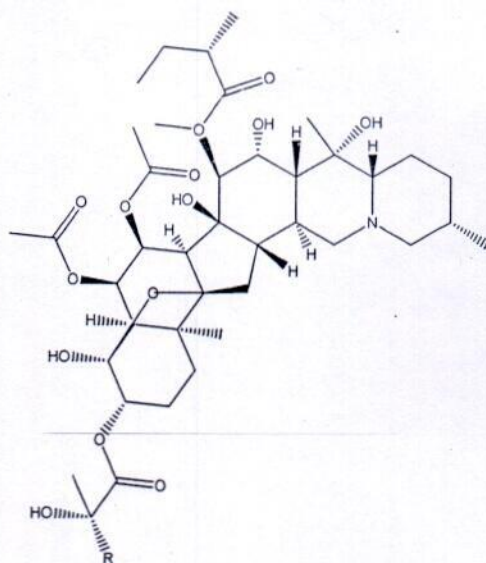


(CXXXV)



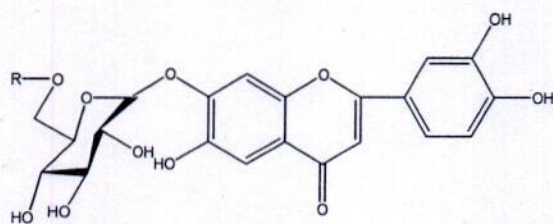


(CXXXIV)



(CXXXVI)  $R = C_2H_5$

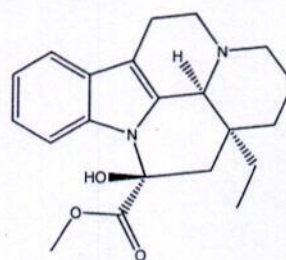
(CXXXVII)  $R = OH$



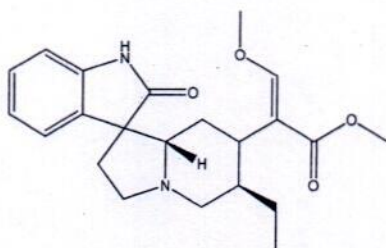
(CXXXVIII)  $R = \text{protocatechuoyl}$

(CXXXIX)  $R = \text{trans feruloyl}$

(CXL)  $R = H$



(CXLI)



(CXLII)



## Introduction

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