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Traditional uses, pharmacological properties and chemical constituents review of *Combretum glutinosum* Perr. ex DC (Combretaceae)

TOKLO Placide Mahougnan[1,2] ;LADEKAN YAYI Eleonore Chikani[1]; ASSOGBA Mahoudo Fidèle[1,3]; SAKIRIGUI Amoussatou[1,3]; ALOWANOU G. Géorcelin[2]; MOUDACHIROU Mausourou[1] ; GBENOU Joachim Djimon[1,3*]

[1]Laboratoire de Pharmacognosie et des Huiles Essentielles, Facultés des Sciences et Techniques et des Science de la Santé, Université d'Abomey-Calavi, 01 BP: 918 ISBA Cotonou, Bénin
[2]Laboratoire d'Ethnopharmacologie et de Santé Animale, Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, 01 BP: 526 Cotonou, Bénin
[3]Laboratoire de Recherche sur les Plantes à Parfums, Aromatiques, Alimentaires et Médicinales Faculté des Sciences et Techniques, UNSTIM d'Abomey, BP 72 Natitingou, Benin
Corresponding Author: GBENOU Joachim Djimon/ gjdjim@yahoo.fr / +22964116222

Abstract The considerable number of secondary metabolites found in a plant gives it several biological properties in traditional medicine. Thus, *Combretum glutinosum,* is a plant of the Combretaceae family which is known to be used in the treatment of several diseases. This plant has been the subject of several scientific studies that have shown not only that it is rich in gum, but also that it is a tannic plant that has immunological, antiviral, anti-sickle cell disease, diuretic, antiradicals, hypoglycemic, anti-inflammatory, antiplasmodial, anticercarial properties etc. Extracts of the plant are isolated from compounds of the family of tannins, flavonoids, steroids, and triterpenoids. The cytotoxicity evaluated *in vitro* onA549, U373, Hs683, PC3, Kaka, MRC-5 cells and the acute oral toxicity evaluated *in vivo* on Wistars rats showed that the plant extracts would not be toxic. In summary, this work has allowed a refinement of the work done on *C. glutinosum* with a view to exploring other areas.

Keywords *Combretum glutinosum*, pharmacological properties, toxicity, phytochemical studies

Introduction

Medicinal plants are an inexhaustible source of substances with a wide range of biological and pharmacological activities [1]. A medicinal plant, by the variety of its chemical constituents, can be used to treat several diseases at the same time and this following the presence of an organic compound that may be responsible for the activity or synergy of chemical constituents present in the extract of the plant. This is the strength of traditional medicine which today has a paramount importance in the resolution of health problems. At the present time when, on the one hand, humanity is facing diseases of all kinds and, on the other hand, we are witnessing the blatant resistance of modern medicines to various pathologies, the management of health issues is proving to be a real problem for society, especially in developing countries [2]. The use of local resources, i.e. accessible, highly effective and less toxic medicinal plants, has been a real solution to these problems for several years now. The evaluation of the therapeutic value of secondary metabolites present in plants is the subject of much research and leads to the identification of the

main active elements of the plant. Thus, from aspirin to taxol, the pharmaceutical industry has largely relied on the diversity and biological properties of secondary plant metabolites for the development of new drugs [3]. It is therefore important to note that today, chemistry and biology laboratories throughout the world have followed the lead of traditional medicine in the search for ways to overcome various pathologies, through the search for new active ingredients and the understanding of their modes of action [5]. The present work proposed to take stock of previous phytochemical, pharmacological and toxicological studies with a view to a better use of *C. glutinosum and* an exploration of other areas of research on the plant.

The genus Combretum and the species *Combretum glutinosum*

The genus *Combretum*

Presentation

The genus *Combretum* belongsto the most important genera of the Combrataceae family with 20 species *C. apiculatum*; *C. micranthum*; C. *molle; C. nelsonii*; C. *nelsonii; C. nelsonii*; C. nelsonii; C. nelsonii; *C. nelsonii; C. nelsonii; C. nelsonii. padoides*; *C. petrophilum*; *C. psidioides*; C. *quadrangulare; C. woodii*; *C. zeyheri; C. apiculatum*; *C. bracteatum; C. caffrum; C. edwardsii*; *C. glutinosum; C. hereroense*; C. *imberbe*; *C. leprosum.*

Species *Combretum glutinosum*

Synonyms

Combretum passargei Engl. and Diels
Combretum leonense Engl. and Diels
Combretum hypopilinum Diels
Combretum relictum (Aubrév.) Hutch.
Combretum etessei Aubreville

Vernacular Names

The names of the plant in some Benin languages have been reported by de-Souza [6].
French: koo blanc ou bois d'éléphant ou chigommier
Fon: Dosso ou Magbêvidé
Bariba: Bwangossa, bekpagorou, bobume, doge
Peul: Ya dookey, dooko, kogo boonayi
Yoruba et Nago: Bodomi
Mina: Ati sèn sèn
Gourmancèma: Litata pieni
Biali: Tatapwa

Systematic

The systematic position of the species is as follows [7]:

Règne	:	Plantae
Under reign	:	Eukaryote
Branch	:	Tracheophyta
Under branch line	:	Angiosperm
Class	:	Magnoliopsida
Series	:	Dialypetale
Order	:	Myrtales
Family	:	Combretaceae
Sub-family	:	Combretoideae
Like	:	Combretum
Species	:	*glutinosum*

Botanical description

Shrub from 4 to 14 m high. The leaves of *C. glutinosum* are opposite or whorled by 4, coriaceous, highly variable in shape elliptical to obovate-elliptical, from 6 to 10 cm long and 3 to 4 cm wide, largely wedge-shaped to rounded at the base, rounded-oblate at the top. Inflorescences in axillary spikes, 4 to 6 cm long. Small, greenish-yellow flowers. Fruits with 4 wings, up to 3 cm long and 2.5 cm wide. Species of the Sudano-Guinean and Sudano-Sahelian regions. It is found from Senegal to the Republic of Sudan [8].

Advantages of using combretum glutinosum

In West Africa, particularly from Senegal to the Ivory Coast, the leaves, stems and root bark of *C. glutinosum*, collected from the wild, are important sources of yellow to brownish yellow dyes for cotton fabrics. In Burkina Faso, Benin and Nigeria, these dyes are also used to dye leather as well as mats made of various plant fibers. The primary importance of *C. glutinosum* in Mali is that it is used in the manufacture of internationally renowned textiles, where other tannin-rich plants are also used, depending on local resources and traditions. *C. glutinosum* is widely used north of Bamako to obtain black dyes by reacting the tannins of the plant with the iron salts contained in the fermented mud found there. *C. glutinosum* is used in indigo dyeing in Senegal in Nigeria and wood ashes are particularly appreciated to maintain the optimum alkaline pH in the indigo vat [9].

The fresh young leaves are sometimes eaten as a vegetable, in Senegal they are mixed with taro (*Colocasia esculenta* (L.) Schott), and provide useful fodder that is highly appreciated by all livestock in the Sahelian zone. The yellowish, hard and very solid wood is used in construction, to make tool handles and as firewood. In Nigeria, its smoke is used for fumigation and as incense. It is reported by Adjanohoun [8] that washing several times with the aqueous decoction of three bundles of leafy stems allows one to remove the bundle and protect oneself.

Use in traditional medicine

C. glutinosum is one of the most widely used medicinal plants in West Africa [10]. This is due to its usefulness in pharmacology and the diversity of diseases it can treat. The different parts of the plant (leaves, bark, roots) are used in different forms (decoction, maceration, trituration, piling, infusion) to treat urinary, liver and kidney problems, respiratory problems, fever, intestinal disorders, anaemia, cough, liver disease, diarrhea and combat malaria (Table 1).

Table 1: Traditional use of the plant

Disease	Part used	How to use	Reference
Dysenteric amoebiasis	The tender Leaves	Chewed and swallowed saliva	[11]
Repeated abortions	Sheets	The infusion is taken as a drink and a bath during pregnancy and some time beforehand	[11]
Anemia	Sheets	Decocted and infused extracts	[12]
	Sheets	Decoction	[10]
Helminth	Trunk, stem and root bark		[13]
Aphrodisiac	Trunk, stem and root bark		[13]
Sexual invigorator	Bark	Infusion	[13]
Veterinary art	Crushed green seeds are useful in treatment		[12]
Gonorrhea	Roots	Decoction	[14]
Injuries (care of wounds in the bath)	Tender leaves	Decoction	[15]

Injuries	Green seeds	Crushed and applied	[12]
	Leaves	Crushed and applied to the wounds which are also washed with a infusion of leaves	[12]
	Bark	Crushed, they give a kind of applied plush.	[14]
	Fruits	Dried green fruit powder	[10]
Injuries, especially circumcision wounds	Sheets	Decoction is used for washing	[16]
Bronchitis	Sheets	Decoction	[10]
Bronchite	Sheets	Decocted and infused extracts	[15]
Colics	Sheets		[9]
Constipation	Sheets	Decoction	[17]
	Sheets	Trituration	[16]
	Sheets	Macerate with added alum is administered on an empty stomach.	[11]
Dental caries	The latex of the plant is applied on the part of the		[18]
Toothache	The pulp of the leaves	Apply around the teeth	[17]
Cholagogue	Sheets	Decocted and infused extracts	[13]
	Sheets	Decoction	[10]
Conjunctivitis	Leafy branches	Decoction	[15]
Kidney stones (urinary problems)	Sheets	Decoction	[10]
Kidney pain	Roots	Decoction	[14]
Diuretic	Sheets	Decoction	[10]
	Sheets	Decocted and infused extracts	[13]
	Sheets	Decoction	[8]
Diuretic - hypotensive	Sheets	Decoction	[19]
Diarrhea		Gum	[20]
Dysentery	Leaf buds	Crushed, mixed with the cooled red millet porridge	[13]
	Sheets	Decoction	[8]
Depurative	Sheets	Decocted and infused extracts	[13]
Sickle cell disease	Sheets		[21]
Stomach diseases	Root		[12]
Stomach pain		Decoction	[18]
	Roots	Decoction	[22]
Dream state (drug addicts), state of bewitchment	Branches	Decoction used for the bath	[8]
Blood spills	Sheets	Decocted and infused extracts	[12]
Envenimation	Sheets	Pilage	[23]
General fatigue	Sheets	Decoction is drunk and used for the bath	[24]
	Sheet	The decoction is used in bath and fumigation.	[15]
	Sheet	Decorticated leaves in bath and draught	[14]

Muscle weakness	Sheets	Crushed in water and the sweet filtrate is drunk	[16]
	Leaf pulps	Soaked in water and then heated	[17]
Children's fever	Tender leaves	Decoction	[15]
Fever	Sheets	Infusion and decoction	[17]
Biliary hemoglobinuric Fever	Sheets	Macerated	[11]
Fever	Sheets	Trituration	[16]
Bilious fever	Sheets	Decoction	[10]
Febrifuge	Sheets	Decocted and infused extracts	[13]
Infantile gastritis	Leafy branches	Decoction	[15]
Influenza	Bark	Infusion	[14]
Post circumcision Hemorrhages	Leaves		[14]
Hypertension	Sheets	Decoction	[19]
Hematuric	Sheets	Decoction	[10]
Icter	Leafy branches	Decoction	[15]
	Sheets	Decoction	[8]
Laxative	Gum		[20]
	Sheet	Decoction	[8]
Metrorrgagia	Fresh twigs	Decoction	[8]
Headaches	Drunk leaves	Maceration	[22]
Migraine	Sheets	Decocted and infused extracts	[12]
Snake bite	Tender leaves	The tender leaves are chewed and the juice swallowed, then the residue is applied to the wound.	[11]
Chest discomfort	Sheet	The decoction is used in bath and fumigation.	[15]
Edema	Sheets	Decoction	[10]
Liver problems	Sheets	Decoction	[10]
Purgative	Sheets	Macerated	[9]
	Sheets	Decoction	[8]
Malaria	Sheets	Decocted and infused extracts	[12]
	Sheets	Decoction	[10]
	Leafy branches	Decoction	[15]
Cold	Sheets	Decocted and infused extracts	[12]
	Sheets	Trituration	[16]
	Leaf pulps	Maceration and infusion	[17]
	Bark	Infused with bark for bathing	[14]
Syphilis	Green seeds		[12]
Syphilitic cankers	The immature Fruits	Dried and crushed	[12]
Syphilitic wounds	Fruits	Dried green fruit powder	[10]
Syncope	Roots	Decoction	[8]
Cough	Root	Excerpts	[12]
	Tender leaves	Decoction	[15]

	Sheets	Decoction	[10]
	Sheets	Decoction	[19]
Gall bladder	Sheets	Decoction	[10]
Vomiting	Twigs	Drinks twig extract	[16]
	Bark	Infusion	[13]
Tetanus	Sheets	Used for bathing	[4]
Combination of *C. glutinosum* with other plants			
Schistosomiasis	Sheets	Decoction in combination with the roots of *Spermacoce verticillata* and the leafy branches of *Flueggea virosa.*	[10]
Pertussis	Sheets	Decoction in association with *Tapinanthus bangwensis* and *Arachis* seed skin *hypogaea*	[10]
Epilepsy	leafy branches	Decoction in association with *acanthospermum hispidum,* drunk and used for the bath	[8]
Gonorrhea	sheets	The decoction in association with *waltheria indica*	[8]
Coughing fits	sheets	Decoction with Tapinanthus bangwensis and *Arachis hypogaea* seed skin)	[10]

Pharmacological study

Several properties of the plant *C. glutinosum* have been evaluated and have proven that the plant can be used in traditional medicine in the treatment of several diseases. we can cite:

Antifungal activity: The hydroalcoholic extract of *C. glutinosum* leaves has been studied for its antifungal activity against five pathogenic fungi. The results of the work reveal that the minimum inhibitory concentration is 1mg/ml for the strains of *Microsporum gypseum, Trichophyton mentagrophytes* and *Trichophyton rubrum*, 4 g/ml for the strain *Epidermophyton floccosum* and higher than 4mg/ml on *Candida albicans* [25].

Antimicrobial activities: Extracts specific to crude flavonoids and crude saponins were prepared from *C. glutinosum* bark and tested at different concentrations (25; 50 and 100 mg/mL) on isolated microbial strains including *Escherichia coli, Shigella dysenteriae, Bacillus subtilis* and the bacterial species *Corynae* and *Aspergillus niger*. Apart from *Aspergillus niger* on which no extract showed activity, the flavonoid crude extract inhibited the growth of 4 other microbial strains with an inhibition diameter ranging from 14.67 to 30.33 mm. This extract was more effective on all strains than the saponin extract, which not only showed no activity on *Bacillus subtilis* but with an inhibition diameter ranging from 8 to 19.67 mm [26].

Antibacterial activity: *C. glutinosum* leaves are used for the preparation of three different extracts (ethanolic, methanolic and hydromethanolic v/v) which are tested *in vitro* on reference strains of *Staphylococcus aureus* ATCC 29213, *Eschericha coli* ATCC 25922, *Enterococcus faecalis* ATCC 29212 and *Pseudomonas aeruginosa* ATCC 27853. Among the extracts tested, the methanolic extract showed the highest minimum inhibitory concentrations (MIC) of 125 µg/ml on *Staphylococcus aureus*, 250 µg/ml on Enterococcus faecalis, 500 µg/ml on *Pseudomonas aeruginosa* and 500 µg/ml on *Escherichia coli* [27].

Antibacterial activity: Aqueous and methanolic extracts from the leaves and stem bark of *C. glutinosum* were tested on clinically isolated bacterial strains including: *Salmonella typhi, Pseudomonas aeruginosa, Staphylococcus aureus* and *Escherichia coli*. In addition to the methanolic leaf extract which showed no activity on *Pseudomonas aeruginosa* and *Escherichia coli*, all other extracts inhibited the growth of microbial strains with inhibition diameters ranging from 7 nm to 20 nm. Stem bark extracts generally showed better activity compared to leaf extracts. And on the 4 strains, *Escherichia coli* seems to be more sensitive [28].

Antiparasitic activity: Methanolic and chloroformic extracts of *C. glutinosum* leaves were tested *in vitro* on four different strains of parasites including *Plasmodium falciparum, Trypanosoma brucei brucei, Trypanosoma cruzi* and *Leishmania infantum*. Only the chroloformic extract from the leaves of the plant showed a strong activity on strains of *Trypanosoma brucei brucei, Trypanosoma cruzi* with an IC_{50}< 5µg/ml. While it was recorded on the other strains, a low activity with both the methanolic and chroloformic extracts. On the other hand, the methanolic extract has practically no activity on *Leishmania infantum* [29].

Anti-malaria: Methanolic and hydromethanolic extracts from *C. glutinosum* leaves harvested in Burkina Faso were examined on the chloroquine-resistant Plasmodium falciparum strain W2 *in vitro*. The results showed that the hydromethanolic extract of the leaves of *C. glutinosum* inhibited the growth of *Plasmodium falciparum* strain W2 with an IC_{50} = 43.6 µg/ml while the methanolic extract was less active on the same strain with an IC_{50} = 53 µg/ml [30].

Sickle cell disease: Tests were performed on blood drawn from patients with sickle cell disease type SS. Methanol and ethyl acetate extracts from the leaves of *C. glutinosum* were evaluated on SS sickles to determine their anti-mowing potential. The results show a strong antidrepanositosis activity of the extracts with a maximum antidrepanositosis inversion ranging from 81% and 69% respectively for methanol and ethyl acetate extracts at 10 mg/mL versus 67% for arginine used as a positive reference control [21].

Anticercarial Activities: Ethanolic extracts of leaves, stem and roots of *C. glutinosum* were tested for their anticancer activity against *Schistosoma mansoni* cercariae within 6 hours. The extracts were tested on cercarias at different concentrations of 500, 250, 125, 100, 50, 20 and 5 ppm. It was found that the ethanolic extract from the plant stem showed a better result with total inhibition of the pathogen at 4 hours [31].

Antioxidant activity: The antiradical provision of the methanolic extract has been evaluated using the DPPH radical as an oxidant. The measured IC_{50} were 0.65 and 0.163 respectively for the methanolic extract and ascorbic acid. The antiradical power of the methanolic extract is 0.155 compared to that of ascorbic acid which is 0.62 [21].

Antioxidant activity : The 10% aqueous decocate, aqueous macerate, ethanolic macerate, dichloromethane extract and methanolic extract of *C. glutinosum* trunk bark and root bark were evaluated on CCM plate for their antiradical activity. The reduction in DPPH indicated by the change from purple to yellow on the TLC plate indicated the antiradical capacity of all the extracts tested [9].

Antifungal activity: Evaluated on clinical strains of *Candida albicans* isolated from vaginal swabs, aqueous, ethanol, methanolic and dichloromethanic extracts of trunk and root bark showed no antifungal activity at a dose of 600 µg [9].

Antibacterial activity: Aqueous, ethanol, methanolic and dichloromethanic extracts of *C. glutinosum* trunk and root bark were tested *in vitro* on *Staphylococcus aureus, Escherichia coli, Salmonella enterica* and haemolytic Streptococcus β at 400 µg/ml and 500 µg/ml. Only the dichloromethane extracts of both organs were active on *Salmonella enterica* with an inhibition diameter ranging from 11 to 20 mm. On *E. coli*, only the dichloromethane extract of root bark showed weak antibacterial activity with an inhibition zone diameter of 8 mm and 7 mm for the 400 µg/ml and 500 µg/ml doses respectively. With trunk bark, dichloromethane extract, 10% aqueous decocate and methanolic extract inhibited the growth of *E. coli* with an inhibition zone diameter of 7-10 mm. In addition to the decocted root bark extract, all other extracts inhibited the growth of *Staphylococcus aureus with an inhibition* diameter ranging from 7 to 15 mm.

Finally, only the aqueous macerate of the root bark had no effect on hemolytic Streptococcus β [9].

Anti-inflammatory activity: Aqueous decoction of trunk and root bark have been tested for their anti-inflammatory activities *in vivo*. No significant difference was found between the effect of the extracts and the positive reference control (indomethacin) [9].

Antiplasmodial activity: The dichloromethane extract of root bark, all trunk bark extracts have an IC_{50} greater than 20 µg/ml. The methanolic extract of root bark was the most active, followed by aqueous macerate, ethanolic macerate and aqueous decocate with IC_{50} of 7.47; 8.85; 9.13 and 10.90 µg/ml, respectively [9].

Tannic plant: *C. glutinosum* is a plant known for its high tannin content and thus, used as recipes to effectively treat acute forms of certain diseases such as hypotension. The tannin content (% by dry matter) of the organs of *C. glutinosum* is 0.2 for flowers, 5.5 for leaves, 14.7 for bark, 1.7 for both immature and ripe fruits. The average tannin content is estimated at 4.76% per dry matter [32].

Hypoglycemicactivity: Aqueous and methanolic extracts of *C. glutinosum* leaves normalized the 2H blood glucose level after intraperitoneal glucose injection in rats [33].

Antiradical activities: Evaluated qualitatively on CCM plates, aqueous and ethanol extracts of *C. glutinosum* demonstrated antiradical activity by the color decoloration of DPPH. After a quantitative study, using the DPPH radical as oxidant, the IC_{50} of the lyophilized aqueous extract of *C. glutinosum* is 8.943 [34].

Diuretic activity: the aqueous extract at 200 mg/kg and the extemporaneous solution of *C. glutinosum* have no diuretic activity [34].

Anthelmintic activity: Residues obtained after incubation of *C. glutinosum* powder for 72 hours in the rumen are extracted and then tested at different doses (1200, 600, 300, 150 µg/ml) on *H. contortus* larvae. The acetone extract of the residues except the 72h residue at the dose of 300 µg/ml significantly reduced the migration of *H. contortus* larvae ($p < 0.05$) [35]..

Anthelmintic activity: Hydroacetonic and hydromethanolic extracts from the leaves of *C. glutinosum* inhibited *in vitro* egg hatch, larval migration and motility of adult worms of *H. contortus* [36].

Antiviral activity: Aqueous and methanolic extracts of *C. glutinosum* leaves inhibited hepatitis B virus *in vitro at* doses of 500 and 100 ng/ml respectively [37].

Immunological properties: Polysaccharides from the large and small leaves of *C. glutinosum* were isolated and structurally characterized. Their bioactivities were tested in the human complement fixation assay, as well as their ability to produce nitric oxide from macrophages and to induce the release of cytokines from B cells and dendritic cells. It was found that the aqueous extracts from the small leaves yielded polysaccharides with a proportion of the xylogalacturonan region in both the 50 and 100C aqueous extract that was found to be present in similar extracts from large leaves. Slightly higher bioactivities in small leaves may be related to the xylogalacturonan region of their polymers [38].

Toxicological study

Cytotoxicity evaluated *in vitro* on MRC-5 cells with methanolic, chloroformic and dichloromethanol extracts [29,33] and on the 5 human cancer lines (A549, U373, Hs683, PC3, Kaka) with dichloromethanolic and methanolic extracts [33] revealed that only the methanolic extract is non-cytotoxic on the cells. *In vivo*, acute oral toxicity was evaluated at a dose of 2000 mg/kg body weight in rats of Wistars strains. The aqueous extract from the leaves of the plant showed no signs of toxicity according to studies carried out in Benin by Alowanou [39] and studies carried out in Mali by Coulibaly [34].

Some data on *C. glutinosum* gum

An analytical study was performed on samples of *C. glutinosum* gum and revealed the presence of glucuronic acid, galacturonic acid, Co-methylglucuronic acid, galactose, arabinose and rhamnose [40]. Three main components of *C. glutinosum* gum referred to as arabinogalactan protein, arabinogalactan and glycoprotein have been identified in the determination of the weight average molecular weight (Mw) and radius of gyration (Rg) of habeil gum by a gel permeation chromatography and multi-angle laser light scattering system [41].

Physico-chemical characterization of *C. glutinosum* gum: The phitochemical characterization of *C. glutinosum* gum indicates that the contents of moisture, ash, nitrogen, protein and then total uronic acid are respectively 7.96%, 4.51%, 0.37%, 2.43% and 15.53%. Acid hydrolysis showed that the gum content of the monosccharides was 56.1% for arabinose, 33% for galactose and 10.9% for rhamnose. While the acid equivalent weight was 1524.15 and the intrinsic viscosity was 11.2 ml/g, tannin and starch or dextrin were not detected in the gum. Atomic absorption spectrophotometric analysis showed that calcium (46.73 ppm), potassium (35.97 ppm) and magnesium (17.36 ppm)

are the most abundant cations contained in the plant gum [43]. With an unexpectedly high level of sodium ion (3.53x10-3% ppm), the rest of the elements, Co, Ni, Cr, Zn, Mn, Cu and Fe are of trace value [42].

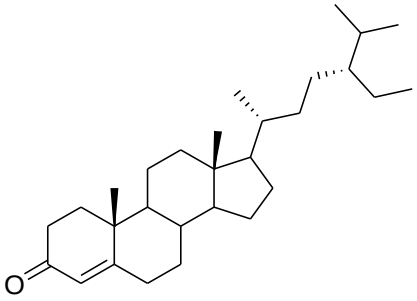
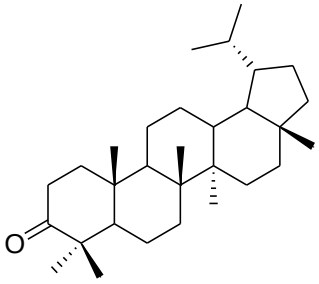
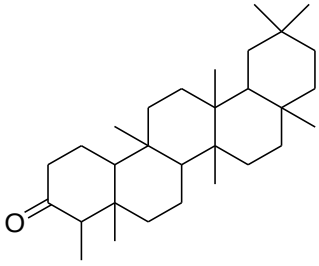
Toxicity of *C. glutinosum* gum: A toxicological study using *in vitro* cytotoxic methods on different types of normal and cancerous human cell lines showed that the IC_{50} was less than 100 µg/ml in the majority of gum samples studied [43].

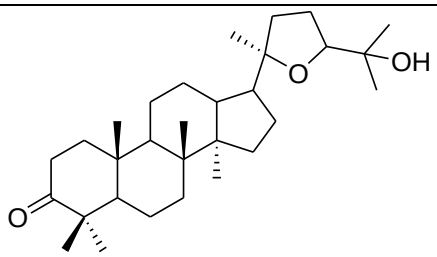
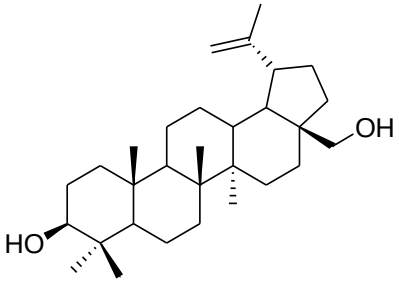
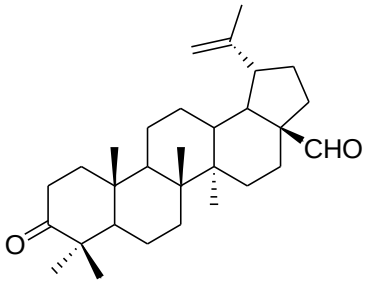
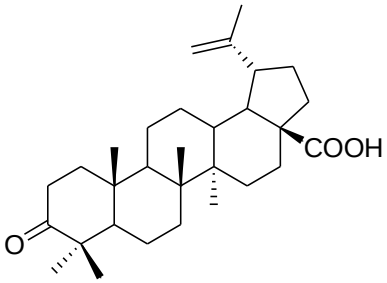
Phytochemical study

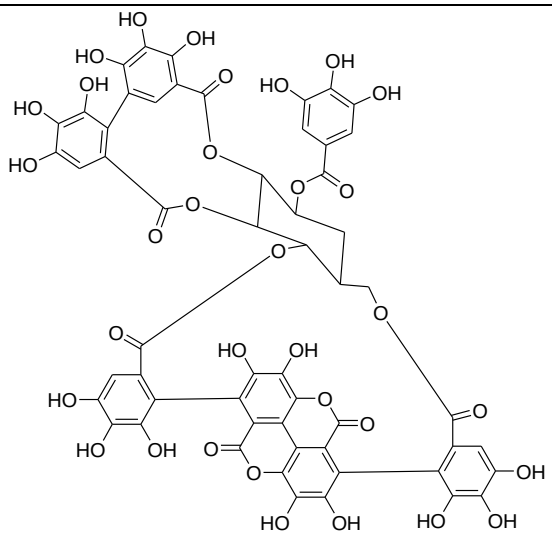
The phytochemical screening of the different powders or extracts of *C. glutinosum* has generally revealed the presence of polyphenols, tannins and flavonoids in addition to saponins [21], Cardiotonic heterosides [27], sterols, triterpenes, leucoanthocyans, and mucilages [34], coumarins [31], cardiac alkaloids and glycosides [26], reducing compounds [36] and anthroquinones [28]. Compounds isolated from the plant are listed in the table 2.

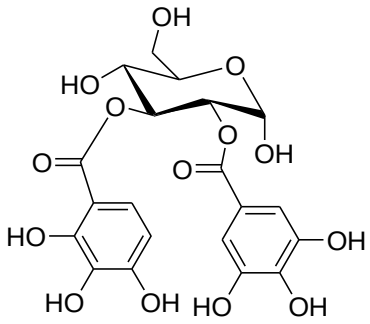
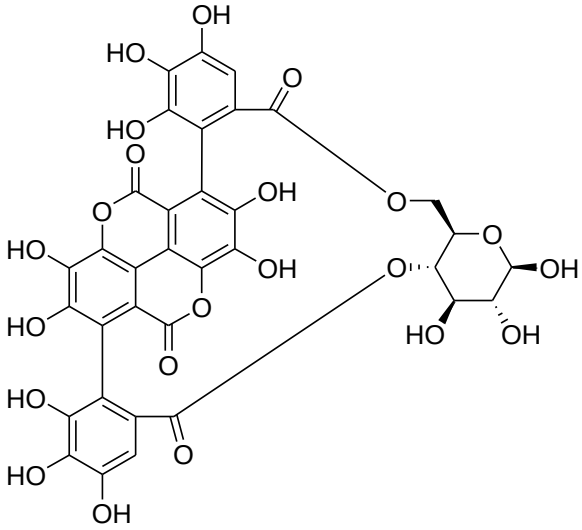
The literature review of pharmacological proprieties and chemical compounds were also consulted in the present work [48-50].

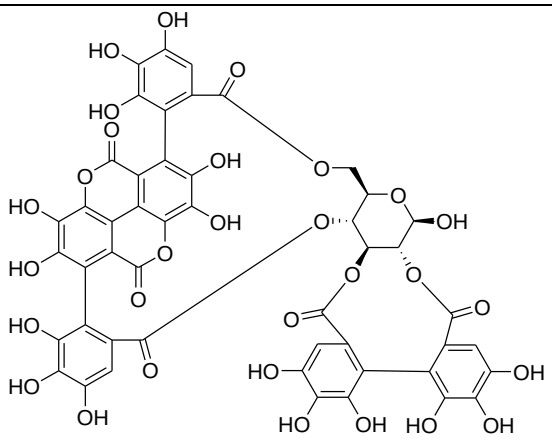
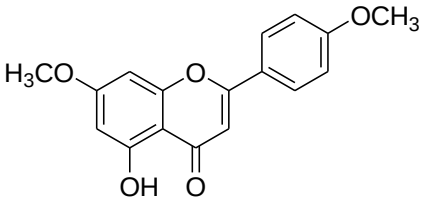
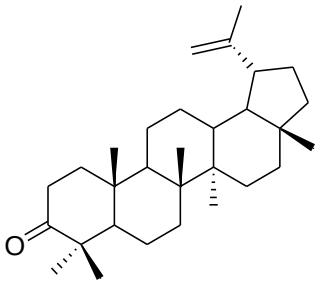
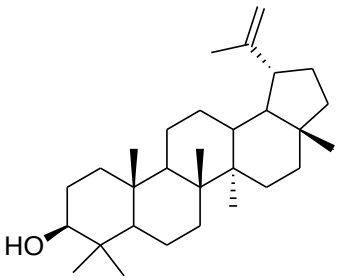
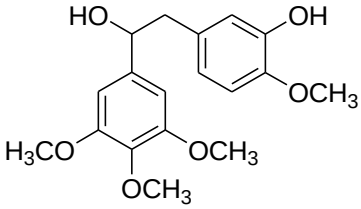
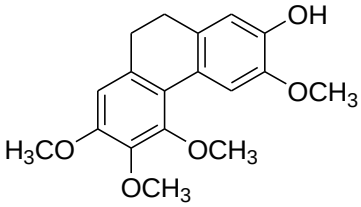
Table 2: Some compounds have been isolated from different parts of the plant

Compound Name	Chemical Formulas	m/z	Mol. Formula	Authors
stigmast-4-en-3-one		412.3705	$C_{29}H_{48}O$	[44]
lupan-3-one		426.3862	$C_{30}H_{50}O$	[44]
friedelan-3-one		426.3862	$C_{30}H_{50}O$	[44]

Cabraleone		458.376	$C_{30}H_{50}O_3$	[45][46]
betulinol		442.3811	$C_{30}H_{50}O_2$	[46]
betulonal		438.3498	$C_{30}H_{46}O_2$	[46]
betulonic acid		454.3447	$C_{30}H_{46}O_3$	[45][46]
Combreglutinin		1234.0998	$C_{56}H_{34}O_{33}$	[47]



2,3-(S)-hexahydroxydiphenoyl-D-glucose		484.0853	$C_{20}H_{20}O_{14}$	[47]
punicalin		782.0603	$C_{34}H_{22}O_{22}$	[47]

punicalagin		1084.0665	$C_{48}H_{28}O_{30}$	[47]
5-hydroxy-7-4'-dimethoxy flavone		298.0841	$C_{17}H_{14}O_5$	[33]
lupenone		424.3705	$C_{30}H_{48}O$	[33]
lupeol		426.3862	$C_{30}H_{50}O$	[33][44]
Combretastatine B		334.1416	$C_{18}H_{22}O_6$	[47]
Combretastatine A		316.1311	$C_{18}H_{20}O_5$	[47]

Conclusion

C. glutinosum is a plant found in several countries of the sub-region and used by traditional therapists to treat microbial, parasitic, viral and cardiovascular diseases. Several scientific researches have approved the therapeutic properties of this plant and have shown that the aqueous extracts are no-toxic. The diversity of chemical groups and isolated compounds may explain the use of this plant in the traditional treatment of several diseases.

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