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CROTON BONPLANDIANUM IN TRADITIONAL INDIA

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ABSTRACT

In an attempt to strengthen the scientific foundation for the extraction of bioactive components from the plant, the cytotoxic and antioxidant properties of Croton bonplandianum Baill's methanolic and dichloromethane extracts were assessed. Dichloromethane extract was not poisonous, and the methanolic extract had 59.62% DPPH and hydroxyl radical scavenging activity. The reference compound, gallic acid, displayed greater antioxidant activity than the plant extracts. The lethality of both methanolic and dichloromethane extracts on brine shrimp was assessed. An in vitro cytotoxic activity test for methanolic extract yielded an LD50 value of 115.76 (0.0048 - 13.76) µg/ml. The standard medication used was etoposide.The standard medication used was etoposide. Together, these findings support the notion that Croton bonplandianum extracts have significant inherent cytotoxic and antioxidant potentials, which is a strong argument in favor of isolating pure bioactive substances. The plant's parts are widely used in traditional medicine to treat a wide range of conditions, including wound healing, hepatoprotective, body swelling, hypertensive, abdominal dropsy, anti-fungal, anti-microbial, antidiabetic, anti-tumor, and anti-cancer. Because traditional multiplication proceeds slowly, the plant is abundant. Its traditional medical applications have been proven by several in vivo and in vitro tests.

KEYWORDS:*Croton bonplandianus, Antioxidant Activity , anticancer activity medicinal plant, phytochemicals .Pharmacological uses; biological activity; bioactive compounds.*

INTRODUCTION

As a complementary and alternative treatment, herbal medicine has developed to treat a wide range of illnesses brought on by anxiety, industrial dangers, pathogenic microorganisms, stress, and other factors. Even with the availability of contemporary synthetic pharmaceuticals and antibiotics, herbal remedies continue to be used in daily therapy and the medical sector. Many characteristics, including its relative lack of major side effects, affordability, accessibility, and effectiveness, have made herbal therapy a popular and respectable means of treating illnesses even in the present era. Ayurveda, which means "knowledge of long life," started in India during the Vedic era [6] . The two founders of the Ayurvedic medical system, Susrata and Charaka Sanhita, discussed the therapeutic use of several medicinal plants. Ayurvedic literature mentions Croton bonplandianus Baill as one such plant. Therefore, the review is predicated on C. bonplandianus's pharmacological and therapeutic qualities. [5] Diterpines and phorbolesters, such as 12-orthotrideconeoly-phorbol-13-acetate (TPA) and myristoyl-phorbol acetate (MPA), are present in Croton bonplandianum seeds. TPA alters prostaglandin metabolism and is a carcinogen [9,10]. Some ethnic groups utilize the plant's fresh juice as a remedy for headaches. Plant latex has the ability to mend cuts and wounds[11,12].This paper examines various phytochemicals, including tannin, phlobatannin, terpenoid, glycoside, phenolic, flavonoid, steroid, anthraquinone, saponin, alkaloid, cholesterol, carbohydrate, and protein, both qualitatively and quantitatively. The goal is to provide a clear understanding of the phytochemical status of the stem of C. bonplandianus, which will aid future researchers in their pharmacological analysis of this species. Various methods are employed with croton species. According to Salatino et al. (2007), common applications include the management of cancer, constipation, diabetes, dysentery, digestive issues, external wounds, fever, hypercholesterolemia, hypertension, inflammation, intestinal worms, malaria, pain, ulcers, and weight reduction.People in some regions of India used to treat rheumatism by applying a heated poultice made from powdered C. calefornicus leaves (Wilson et al., 1976). Croton nuts, like those from C. megalocarpus, have recently been demonstrated in Kenya to be a more cost-effective source of biofuel than jatropha. In Kenya, the production of one liter of biofuel from Jatropha requires up to 20,000 liters of water, whereas 0.35 liters are produced from wild cotyledon trees. Any region of the body can be affected by a wide range of disorders, collectively referred to as cancer. Neoplasms and malignant tumors are other words that are used.The primary cause of cancer-related mortality is a process known as metastasis. Globally, cancer is the leading cause of mortality (1 in 8). Between 1975 and 2000, the global cancer burden doubled; by 2020, it is expected to double once more, and by 2030, it is predicted to nearly quadruple. Globally, there were about 12 million new instances of cancer and 7 million cancer-related deaths in 2008; by 2030, that number is expected to rise to 20–26 million new cases and 13–17 million deaths [1]. Consequently, it is imperative that cancer be managed, treated, and cured effectively. The potential of alternative medicines may prove beneficial in the management of cancer, which is one of the primary causes

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of death globally. At best, conventional medicines just prolong the patient's life through significant side effects.only add a few years to the patient's life expectancy at most. There is an urgent need for more effective cancer therapies with fewer adverse effects. Therefore, it is necessary to employ alternate theories or methods for cancer prevention [2]. In order to reduce harm to normal tissues and target the various physiological and biochemical processes that promote tumor formation, an integrative approach to cancer patient care should be used. Interestingly, studies in the lab and in clinical trials have shown that herbal remedies may increase the level of efficacy and decrease harmful effects when used in conjunction with chemotherapy. These details made the use of herbal medicine in conjunction with chemotherapy more feasible [3].Significant advancements in the field of cancer treatment have been accomplished by higher plants. Vinblatine and vincristine, two antileukemic alkaloids derived from the Madagascan periwinkle (Catharanthus roseus syn. Vinca roseus), are two early examples. A few more anti-cancer medications are homoharringtonine, taxol, and several camplothein derivatives [4]. One of the common characteristics of cancer is an excess of apoptosis. For multicellular organisms, programmed cell death, or apoptosis, is an essential part of growth and development. Numerous triggers can cause cells to die, and during apoptosis, they do so in a regulated and controlled manner.Damaged cells normally go through apoptosis, but in the case of cancerous cells, changes may have taken place that stop cells from going through this process. Because there is no control over the growth of cells in these situations, the illness may worsen and lead to the development of tumors.Since many cancer treatments involve using radiation or chemicals to harm the cells, mutations in the apoptotic pathway frequently result in cells that are resistant to this kind of attack, making these tumors often tough to eradicate.[7]Many methods can be used to trigger apoptosis in cells grown in vitro.Glucocorticoid exposure to thymocytes is one of the conventional systems. Additional techniques include radiation exposure, topoisomerase inhibitor-treated environments, removing growth factors from growth media, cell cycle disruption, exposure to kinase or phosphatase inhibitors or activators, disruption of Ca2+homeostasis, overexpression of p [9], members of Ced-3/ICE, and many more [8].

Taxonomical Position



Fig. 1. Croton bonplandianus[47]

Kingdom: Plantae
Subkingdom: Tracheobionta
Infrakingdom: Streptophyta
Superdivision: Spermatophyta
Division: Magnoliophyta
Class: Magnoliopsida
Subclass: Rosidae
Order: Malpighiales
Family: Euphorbiaceae
Subfamily: Crotonoideae

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Tribe: Crotoneae
Genus: Croton L.
Species: Croton bonplandianus

Genus Croton

The deciduous shrubs and small trees that make up the Genus Croton can have lepidote scales or stellate hair. Minute requirements apply. Leaf blades have two glands at the base and alternate. Flowers can be either dioecious or monoecious. Racemose inflorescence that is often terminal. Flowers: five merous; males have little disk glands; stamens: five to thirty; females frequently have remnant petals; ovary: three lozenges. Fruit a pill. Small seeds ecaruncle or caruncle.[15]

Phytochemical Aspect of Croton bonplandianum

The genus Croton contains diverse types of biomolecules. Terpenoids are the predominant secondary metabolite constituents in the genus, chiefly diterpenoids, which may belong to the cembranoid, clerodane, neoclerodane, halimane, isopimarane, kaurane, secokaurane, labdane, phorbol, and trachylobane skeletal types. Triterpenoids, either pentacyclic or steroidal, have frequently been reported from Croton species. Volatile oils containing mono- and sesquiterpenoids, and sometimes also shikimate-derived compounds, are not rare in the genus. Several species have been reported as sources of different classes of alkaloids, a fact that considerably enhances the importance of the genus from a medicinal point of view. Phenolic substances have frequently been reported, among which flavonoids, lignoids, and proanthocyanidins predominate. (Salatino et al., 2007)A crimson sap is produced by a number of Croton species that include proanthocyanidins and/or alkaloids. The latter might be taspine or any of a number of benzyl compounds that resemble oquinolines. Diterpenes, which are related to clerodanes, cembranoids, halimanes, kauranes, labdanes, phorbol esters, trachylobanes, and sarcopetalanes, are highly prevalent in Croton. Certain species have volatile oils, which make them fragrant. From Croton species, representatives of novel chemical classes, such as phenylbutanoids, glycomate alkaloids, and sarcopetalane diterpenes, have been identified. Although laticifers have been reported in Croton species, little anatomical research has been done on the secretory structures of volatile oils yet. There isn't much research on flavonoids using Croton species. The genus has chemical affinities that group species that contain (i) alkaloids, (ii) trachylobanes, and (iii) kauranes and/or labdanes. pharmacological tests have repeatedly confirmed the customary applications of Croton species. The clerodane trans-dehydrocrotonin was the focus of a large portion of pharmacological tests involving Croton compounds (Salatino et al., 2007). 2010 saw the isolation of crotoncaudatin, a novel flavone, along with nine recognized analogues from the stems of Croton bonplandianum Geisel var. tomentosus Hook. Zou et al. (2010) identified the following compounds: 3,5,6,7,8,3′,4′-heptamethoxyflavone, tangeretin, nobiletin, 5,6,7,4′-tetramethoxyflavone, sinensetin, kaempferol, tiliroside, kaempferol-3-O-rutinoside, and rutin. Three flavonoids, two diterpenoids, and an indanone derivative are all present in the ethanol extract of Croton steenkampianus leaves (Adeboye et al., 2008). From the methanolic extract of Croton urucuruna, several antimicrobial compounds were isolated, including acetyl aleuritolic acid, stigmasterol, β-sitosterol, campesterol, β-sitosterol-O-glucoside, sonderianin, catechin, and gallocatechin (Marize et al., 1997).Phytochemically, the plant has been reported to contain rutin (C18 H36 O19) as its main constituent, together with crotsparinine, crotosparine, and its methyl derivative, aphorbol, which play a key role in wound healing (Divya et al., 2011). Apart from this, Croton bonplandianum is a good source of steroids, unsaturated steroids, phenolics, and alkaloids. It also contains flavonols, cardinolids, leucoanthocyanins, and flavonoids (Kothale et al., 2011). The plant also contains another two groups of compounds, viz., terpenoids and glycosides, along with flavonoids and alkaloids. The spent residue obtained after biocrude extraction of Croton bonplandianum is rich in biopolymers such as cellulose, hemicellulose, and lignin.This can produce ethanol and oil (Sharma et al., 1990). Jeeshna et al. (2011) investigated the potential of various solvents to extract various groups of compounds from Croton bonplandianum. They found that methanol was significantly more effective than acetone, chloroform, and petroleum ether in extracting alkaloids, flavonoids, glycosides, steroids, phenols, tannins, saponins, and resins (Table 1). Despite the absence of alkaloids and saponins in the chloroform fraction (Jeeshna et al., 2011), According to Ghosh et al. (2013), some identified triterpenoid compounds from the root of C. bonplandianum include sitosterol, ursolic acid, oleanolic acid, and 3-hydroxyurs-12,15-dien of the ursane skeleton. Tiwar et al. (1981) identified an alkaloid from extracts of Croton bonplandianum 3-methoxy-4,6-dihydroxymorphinandien-7-one and norsinoacutine.Alkaloids such as proporphine, isoquinoline dionone, sparsiflorine, crotoflorine, crotsparine, crotosparinine, Nmethylcrotsparine, and N-methylcrotsparinine are found in the plant and its leaves. β-sitosterol, tartaric acid, vomifoliol, uric acid, and tetrahydroglazievine are found in the leaves and stem. Rutin is also present in leaves. (C18 H 36O 19). The following compounds were detected in leaves: 16-Hexadecanoyl Hydrazide (88.69%), 1,2-Benzenedicarboxylic Acid, diisooctyl Ester (5.56%), 2-Piperidinone, N-[4-bromo-n-butyl] (2.56%), Phthalic Acid, bis (7-methyloctyl) Ester (1.80%), and Phytol (1.39%). Diterpines and phorbol esters, such as 12-orthotrideconeoly-phorbol-13-acetat (TPA) and myristoyl phorbol acetate (MPA), are present in Croton bonplandianum seeds. Apart from ß-sitosterol, the roots also include Diterpines and phorbol esters, such as 12-orthotrideconeoly-phorbol-13-acetat (TPA) and myristoyl phorbol acetate (MPA), are present in Croton bonplandianum seeds. The roots include 3-methoxy-4, 6-dihydroxy morphinan-dien-7-one, and the phenolic quinonoid alkaloid norsinoacutine in addition to ß-sitosterol. The hyperaccumulation of copper in this

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species is a remarkable discovery. The latex of C. bonplandianum contains the phytocompounds 3-methylquinoline (0.44%), 4-methylphenol (6.86%), and mequinol (0.74%). The fruits of C. bonplandianum were found to contain fifteen major phytocompounds: 1, propene, 2-nitro-3-(1-cyclooctenyl) (4.58%), 9,12,15-Octadecatrienoic acid, methyl ester (z,z) (41.81%), diazoprogesterone (19.03%), decanoic acid, ethyl ester (4.86%), and 6,9,12-Octadecatrienoic acid, 13-Tetradece-11-yn-1-ol (3.47%). [15]

Analysis of Croton bonplandianum

Qualitative Analysis

Chemical tests were carried out on the Chloroform, Methanol, and aqueous, extracts using procedures to identify the phytochemicals as described by Sofowara [14], Trease and Evans [15] and Harborne [16].

Test for Carbohydrates

To 2ml of extract, 1ml of Molisch's reagent and few drops of concentrated sulphuric acid were added. Formation of Purple colour at the inter phase of the two layers indicated the presence of carbohydrates

Test for Amino acids and Proteins

2ml of filtrate was treated with 2-5 drops of ninhydrin solution placed in a boiling water bath for 1-2 minutes and observed for the formation of purple colour.

Test for Tannins

To 1ml of extract, 2ml of 5% ferric chloride was added. Formation of greenish black color indicated the presence of tannins.

Test for Saponins

To 2ml of extract, 2ml of distilled water was added and shaken in a graduated cylinder for 15minutes lengthwise. Formation of 1cm layer of foam indicated the presence of saponins.

Test for Flavonoids

5ml of dilute ammonia solution was added to a portion of the aqueous filtrate of extract followed by addition of concentrated sulphuric acid. Appearance of yellow colouration indicated the presence of flavonoids.

Test for Alkaloids

To 2ml of extract, 2ml of concentrated hydrochloric acid was added. Then few drops of Mayer's reagent were added. Presence of green color indicated the presence of alkaloids.

Test for Quinones

To 1ml of extract, 1ml of concentrated sulphuric acid was added. Formation of red color indicated the presence of quinones

Test for Glycosides

To 1 ml of the extract add few drops of HCl, allowed for 5 minutes for hydrolysis and neutralized with NaOH solution. A few drops of Fehling's solution A and B for few minutes. An orange red precipitate indicates the presence of glycosides.

Test for Terpenoids

To 0.5ml of extract, 2ml of chloroform was added and concentrated sulphuric acid was added carefully. Red brown color formation at the interface indicated the presence of terpenoids.

Test for Phenols

To 1ml of the extract, 2ml of distilled water followed by few drops of 10% ferric chloride was added. Formation of green color indicated the presence of phenols.

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Test for Coumarins

To 1 ml of extract, 1ml of 10% Sodium hydroxide was added. Formation of yellow color indicated the presence of coumarins.[43]

Compound	Water extrct	Methanol extract	Chloroform extract	Water extract	Methanol extract	Chloroform extract
Carbohydates	+	+	+	+	+	+
Amino acids and proteins	+	+	+	+	+	+
Tannins	+	+	+	+	+	+
Saponins	-	-	-	-	-	-
Flavanoids	+	+	+	+	+	+
Alkaloids	-	-	+	-	-	+
Anthrocyanins & β-Cyanins	+	+	+	+	+	+
Quinones	+	+	+	+	+	+
Glycosides	+	+	+	+	+	+
Terpenoids	+	+	-	+	+	-
Phenols	+	+	+	+	+	+
Coumarins	+	+	-	+	+	-

Table 1: Phytochemical screening

RECENT PHARMACOLOGICAL STUDIES

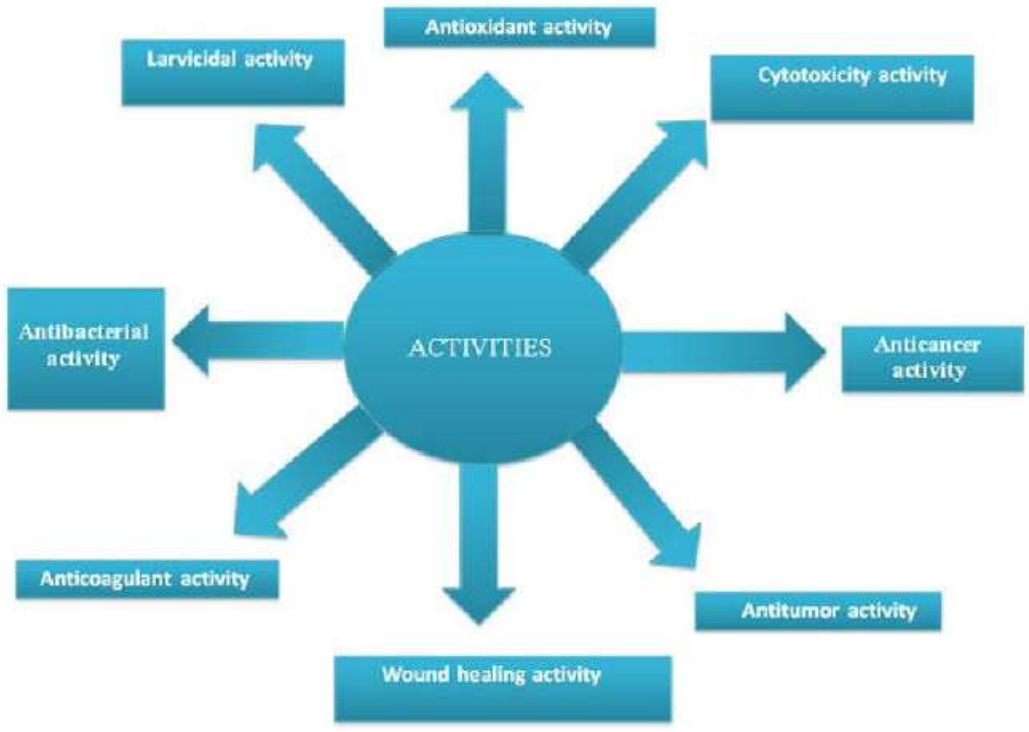


Fig.2 Role of Croton bonplandianum Baill in different activities[46]

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Antioxidant Activity of Croton

In traditional medicine, Croton lechleri sap, often known as "dragon's blood," is applied as a cicatrizant, an anti-inflammatory, and a cancer treatment. When Croton lechleri sap was tested against Saccharomyces cerevisiae, a yeast, and against maize plantlets treated with apomorphine and hydrogen peroxide, an oxidative agent, it was discovered that Croton lechleri sap exhibited a notable amount of antioxidant activity against the oxidative damages Caspomyces cerevisiae caused. With hydrogen peroxide, on the other hand, the sap's antioxidant activity was only seen in cells that were in the stationary phase of growth. Additionally, the sap was able to shield maize plantlet cells from apomorphine's harmful effects[30].A literature survey revealed that the essential oils from northeastern Brazilian Croton species, Croton zenthmeri, Croton nepetaefolius, and Croton argyrophylloides, exhibited good antioxidant activities .[31] The crude essential oil obtained from the stem bark of Croton urucurana exhibited antioxidant properties. The main components of the antioxidant fraction are α-bisabolol, α-eudesmol, and guaiol [32]. Two of the aromatic acids, vanillic and 4-hydroxybenzoic acid, along with N-methyltyrosine, have been isolated from Croton cajucara. These two aromatic acids have shown remarkable antioxidant activity in other species [33,34]. Based on such results, C. cajucara could be expected to possess antioxidant properties. Several kaempferol metabolites have proved to be antioxidant agents [35,36], and C. cajucara leaves also contain two of them, e.g., kaempferol 3,4',7-trimethyl ether and 3,7-dimethyl ether. [37,38]

Antimicrobial

The agar disc diffusion technique was used to examine the in vitro antibacterial activity of aqueous extracts (say) of Croton bonplandianus against three strains of Grampositive and four strains of Gram-negative bacteria, according to the National Committee for Clinical Laboratory Standards (1997). Sterile nutrient medium was removed and 100 µL of bacterial suspension containing 108 colony-forming units (CFU)/mL was mixed with sterile liquid nutritional agar and put to the sterile Petri dishes after the temperature was maintained at 45–50˚C. The nutrient-dense agar medium plates were initially dip-soaked in different extract concentrations (10, 25, 50, 75, and As an example, 100 mg/mL. The plates were allowed to harden before filter discs with a diameter of 5 mm were placed on top of them. The plates were incubated at 37 oC for an entire day. The nutritional agar was made by autoclaving it for 15–20 minutes (HI Media Laboratories Limited, Mumbai, India). The diameter of the zone of inhibition—which includes the 5 mm disc diameter—was calculated using a scale. Each experiment was conducted three times to reduce error, and the mean results were presented. [39,40]

Anticancer Activity

Native to Southeast Asia, Croton tiglium L is a leafy shrub of the Euphorbiaceae family. The plant's seed oil, known as croton oil, or its main active ingredient, 12-Otetradecanoylphorbol-13-acetate (TPA), is an irritant and an inflammatory agent that has been widely used on mice's skin that had previously been exposed to 7,12-dimethylbenz(a)anthracene or other polycyclic aromatic hydrocarbons as a tumor promoter (usual dose: 5–16 nmol, twice a week) [23,24] ,In vitro TPA is an incredibly powerful activator of differentiation in myeloid leukemia cells, even at concentrations 10,000 times lower. TPA has been demonstrated to suppress proliferation, induce apoptosis, or improve differentiation in human tumor cell lines generated from patients suffering from melanoma, prostate, breast, colon, or lung cancer in investigations involving solid tumors [25,26]. Treatment of LNCaP cells for prostate cancer with clinically feasible TPA doses (1-6 nM)induced apoptosis when these cells were treated with TPA at a concentration that was several times greater, and this treatment led to growth inhibition [27].TPA plus ATRA treatment had a synergistic inhibitory effect on the growth of cultured prostate cancer LNCaP cells and also inhibited the growth of existing LNCaP tumors in immunodeficient mice. A combination of TPA and ATRA administered to these tumor-bearing mice caused some tumor regression in all of the treated animals, and tumor regressions were seen in several of the treated mice [28] . It is unknown what molecular pathways TPA and ATRA use in concert to suppress proliferation and cause apoptosis in LNCaP cells. There has been evidence of a TPA-dependent rise in tumor necrosis factor-alpha (TNF-) in LNCaP cells [29] .

Anthelmintic Activity

The procedure was followed for performing the anthelmintic activity. Due to its morphological and physiological similarities to human intestinal roundworm parasites, the adult Indian earthworm, Pheretima pothuma. [41] Pheretima pothuma was put in a petridish with three different concentrations of Croton bonplandianum (pet ether, ethanol, and water extract) solutions (20, 40, and 60 mg/ml) in it. Six worms were added to each petri dish, and the worms' paralysis or death was monitored. The mean time for paralysis was recorded when the worm showed no movement at all, with the exception of when it was shaken violently; the time of worm death (min) was recorded once it was determined that the worms did not move when shaken or when the light of outside stimuli. Albendazole was also added as a reference substance in the same way. The test findings were contrasted with samples treated with albendazole (20, 40, and 60 mg/ml) as the reference compound [42].

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Anti-Bacterial Activity

10% w/v test solutions of C. bonplandianum's leaves, fruits, and latex extracts, as well as fresh latex, were made by mixing 500 mg of each extract separately with 5 milliliters of sterile 10% dimethyl sulfoxide (DMSO) in order to examine the antibacterial properties of the plant's materials. To assess fresh latex, extracts from the same source were used to calculate 25, 50, 75, and 100, which had 2.5, 7.5, and 10 mg of antibacterial activity, respectively. At different doses (2.5, 5, 7.5, and 10 mg), the C. bonplandianum whole plant and latex extracts were added to each well of Mueller Hinton Agar (MHA) plates that had already been previously infected with the corresponding bacterial cultures. The plates were then incubated at 37 oC for the entire day. In this investigation, 10% DMSO was utilized as the solvent, and the positive and negative control groups were streptomycin (10 µ g), respectively. Following incubation, the diameter of the inhibition zone (measured in millimeters) surrounding the well was determined using a zone reader.[44]

Diphenly-2-picrylhydrazyl (DPPH) Scavenging Effect

Diphenyl-2-picrylhydrazyl (DPPH) is used to measure the radical scavenging ability of natural products since it can create a stable molecule when it accepts an electron or a hydrogen atom .When an antioxidant and DPPH combine, a free radical known as 1,1-diphenyl-2-picrylhydrazine is produced. The antioxidant drug's scavenging potential is indicated by the degree of decolorization . To 3 ml of extract solution in ethanol at various concentrations (10, 20, 40, 80, and 100 µg/ml), a 0.1 mm solution of DPPH in ethanol was made. One milliliter of this solution was then added. At 517 nm, absorbance was measured after 30 minutes. The reaction mixture's reduced absorbance suggests increased free radical scavenging activity. Using the following formula, the ability to scavenge the DPPH radical was determined. The extract's antioxidant activity was reported as IC. The extract concentration (µg/ml) that suppresses the production of free radicals by 50% is known as the 50% inhibition coefficient (IC value)[15]

Larvicidal Activity

The study's results, which are shown in the larval susceptibility of Aegypti to C. bonplandianum methanolic leaf extracts, showed that the methanolic leaf extract was efficient against mosquito larvae. Moreover, it was shown that the effect of larval mortality was dose-dependent. The fourth instar of A. aegypti was found to have LC50 and LC90 values of 123.8 ppm and 364.0 ppm, respectively. Therefore, leaves at 124 ppm are recommended for improved vector control. The larvicidal characteristic of C. bonplandianum leaf extract could perhaps be attributed to the existence of phorbol derivatives, which are secondary metabolites belonging to the diterpenoids category (Chandel et al., 2005). According to Maria et al. (2006), the essential oils found in four species of a genus, Croton are responsible for their larvicidal activity against the mosquito, A. aegypti. Nazer et al.[45]

Traditional Uses

It was discovered that this plant originated in Asia and South America. C. bonplandianum is used to treat skin conditions such as ringworm infection, inflammation of the body, and respiratory issues because of its antiseptic qualities. Cholagogue and purgative are the properties of C. bonplandianum's bark and roots [17,18]. C. bonplandianum leaves are used to cure cholera, venereal sores, and cuts and lesions on the body to halt the bleeding. This plant's seeds are used to cure abdominal dropsy, liver problems, acute constipation, and internal abscesses. C. bonplandianumis fresh juice is used to treat headaches [19,21]. C. bonplandianum is widely grown in the rural parts of Malda, West Bengal, and is used as a detergent for fuel C. bonplandianum stems and branches are utilized. Once gathered, the ash is stored for five or six days in a bottle. To make a detergent for cotton clothing, mix ash with warm water. Ethnic people in rural West Bengal, India, use C. bonplandianum leaves and roots to treat high fever and snake venom [20].

CONCLUSION

Traditional methods of treating cancer have involved the widespread usage of numerous medicinal herbs for many generations. One of the biggest genera of flowering plants is Croton, and several of its species are widely utilized in ethnomedicine to cure a variety of illnesses, including cancer. As a result, this genus has drawn increasing attention for phytochemical screening and the isolation of any and all anticancer chemicals. The quest for enhanced cytotoxic agents remains a crucial avenue in the advancement of contemporary anticancer pharmaceuticals.The oldest known kind of treatment is phytomedicine. One such plant that is widely utilized in ethnomedical traditions around the globe to cure a variety of ailments is Croton bonplandianus. The herb is quite safe and useful for usage as medicine against a variety of ailments, according to traditional and ethnomedical literature. In natural drug discovery, reverse pharmacological methods can be used to explore a plant for a safe and effective medicine.

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