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REVIEW ARTICLE

Anti-inflammatory Plants: An Elementary Review

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ABSTRACT

The inflammatory action is described as a chain of events that arise in response to noxious stimuli, infection or trauma. Various botanical species and plant parts comprise a diverse array of polyphenolic non-steroidal phytochemicals that are incorporated as floral pigments for the attraction of insects as their pollination. Various autoimmune disorders are defined by distinct inflammation and associated failure of the repair process. Pro-inflammatory molecules like TNF, certain interleukins, prostaglandins and even pathogenic concentration of nitric oxide are instrumental in raising such response. More interestingly, nitric oxide has been shown to have the ability to stimulate COX-2 showing a potential synergism. Bryophyllum pinnatum commonly known in some parts of Africa as "good luck" or "resurrection plant", often used as an herbal remedy for human disorders, including: hypertension, diabetes mellitus, rheumatism, joint pains, insect bites, arthritis, bruises, wounds, boils, abscesses, headaches, and body pains. The leaves are also used for inguinal lymphadenitis and ear diseases. Rue contains different active compounds, out of them rutin, a flavonoid, is known to have nitric oxide scavenging activity.

KEY WORDS: Anti-inflammatory,TNF, Interleukins, COX-2, Cytokines

History

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INTRODUCTION

Tissue damage which are resulted by a wound or by an invading pathogenic microorganism causes a complicated array of events collectively known as the inflammatory response. A molecular component of microbes, such as LPS, may spark an inflammatory response via interaction with cell surface receptors. The final result of inflammation may be the marshalling of a specific immune response to the invasion or clearance of the invader by components of the innate immune system.

Macrophages are major immune cells and generate a variety of immunomodulatory mediators, including reactive oxygen species and cytokines. Generally, the inflammatory process involves a series of events that can bring out by diverse stimuli such as infectious agents, antigen–antibody interaction and thermal or physical injury ischaemia (Insel, 1990). Macrophages play major roles in the immunity and inflammatory responses involved in host defence. Once activated, they initiate the production of cytokines, oxygen and nitrogen species, and eicosanoids.

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The mast cells when activated releases pro-inflammatory cytokines, like tumour necrosis factor (TNF), interleukin IL-6, IL-8, IL-13 and inflammatory mediators such as histamine, leukotrienes, serotonin, prostaglandins (Zhu Z et al., 1999, Royer B et al., 2001). Autoimmune disorders are characterized by different inflammations and associated failure of the repair process. Pro-inflammatory molecules like TNF, prostaglandins, certain interleukins and even pathogenic concentration of nitric oxide are instrumental in raising such response (Van der Vliet et al., 2000).

This review focus on the anti-inflammatory plants in brief which may benefit to the researchers directly or indirectly to carry out research activities.

Phyllanthus polyphyllus

Phyllanthus polyphyllus (Euphorbiaceae), is a short shrub widely extensively dispersed in tropical and subtropical areas in India and Sri Lanka (Gamble, 1956). In many Asian countries, the species of Phyllanthushas long been used in folk medicine for intestinal infections, antihepatitis B, liver protection, cathartic, jaundice, diabetes, astringent, diuretic and dropsy (Thyagarajan and Jayaram, 1992; Gamble, 1956; Thammanna et al., 1994; Prakash et al., 1995).

Strychnos Nux-vomica

Strychnos Nux-comical. (Loganiaceae), widely used

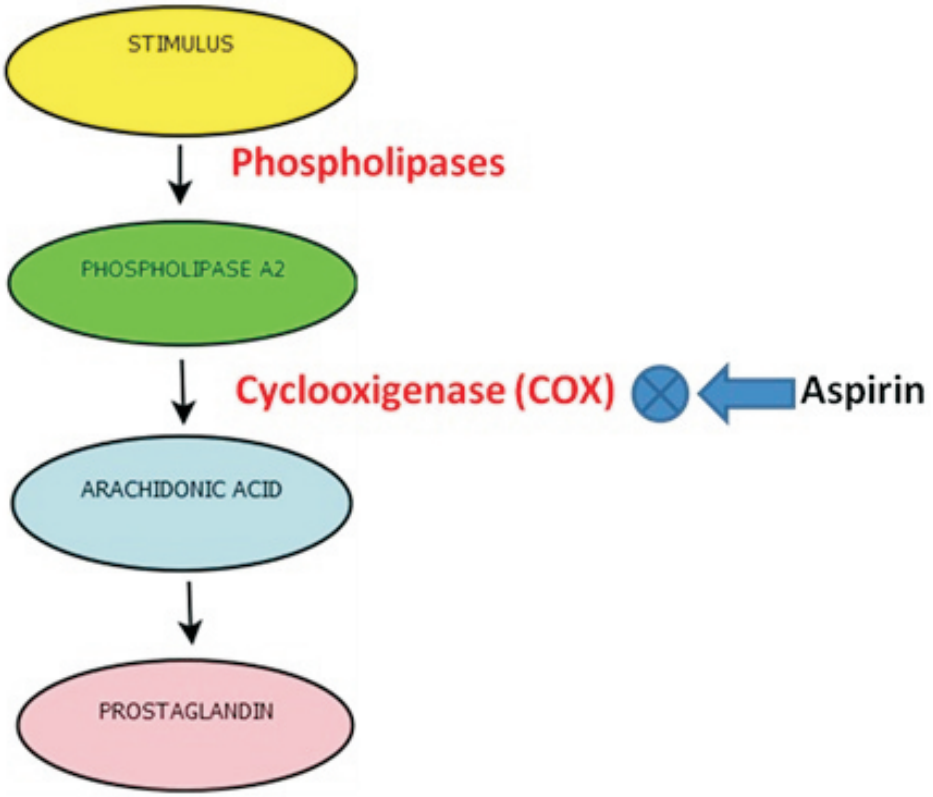

Figure: 1. Action of aspirin on platelets

It is supposed that nowdays analgesia inducing drugs like opiates and NSAIDs are not beneficial in all cases, because of their side effects and potency. So the search for other alternatives seems necessary and beneficial. Different medicinal plants shows topical anti-inflammatory activity. The topical application of Lippia sidoides essential oil have capabale to reduce inflammations (Kim et al., 2004). The essential oil of Lippia sidoides reduced the inflammation of the periodontium in dogs (Gir ao et al., 2003).

Generally compounds present in the plant play key role in the anti-inflammatory and analgesic properties are: triterpenes (lupeol, oleanolic acid, friedelin, betulin, ursolic acid), flavonoids (luteolin, apigenin, kaempferol), phytosterols (stigmasterol, beta-sitosterol), anthraquinones (emodin) (Thongsaard et al., 2001; Koyama et al., 2001, Fiorino et al., 1998), these compounds represents the analgesic or anti-inflammatory properties: lupeol, stigmasterol and beta-sitosterol (Ongoka et al., 2008), luteolin (Block et al., 1998), emodin (Oliver-Bever,1983), oleanolic acid (Lukaczer et al., 2005), friedelin (Isaias et al., 2004), kaempferol (Parveen et al., 2007), ursolic acid (Kang et al., 2008), betulin (De Souza et al., 2007).

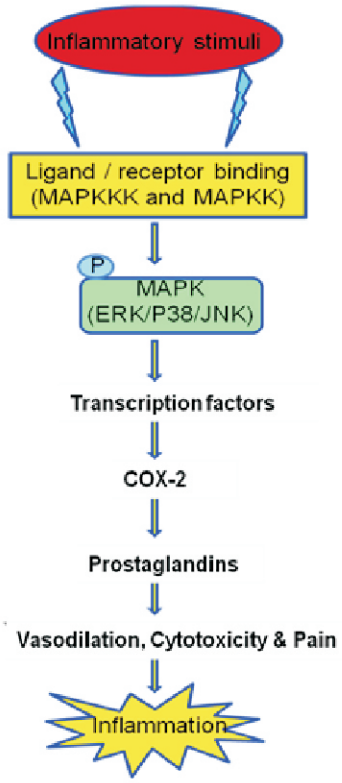

Figure: 2 A brief mechanism of inflammation by MAPK pathway

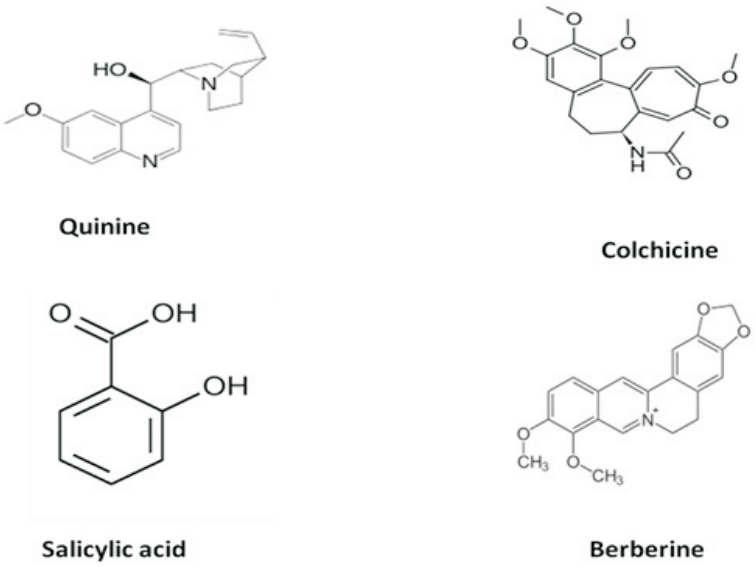

Figure: 3. Anti- inflammatory plant product.

Reactive oxygen species (ROS), essentially superoxide radical, hydrogen peroxide, hydroxyl radical and hypochlorous acid, likewise reactive nitrogen species (RNS), such as nitric oxide and peroxynitrite, contribute significantly to tissue injury in asthma, burns and rheumatism (Andreadis et al., 2003; Bauerova and Bezek, 1999; Horton, 2003).

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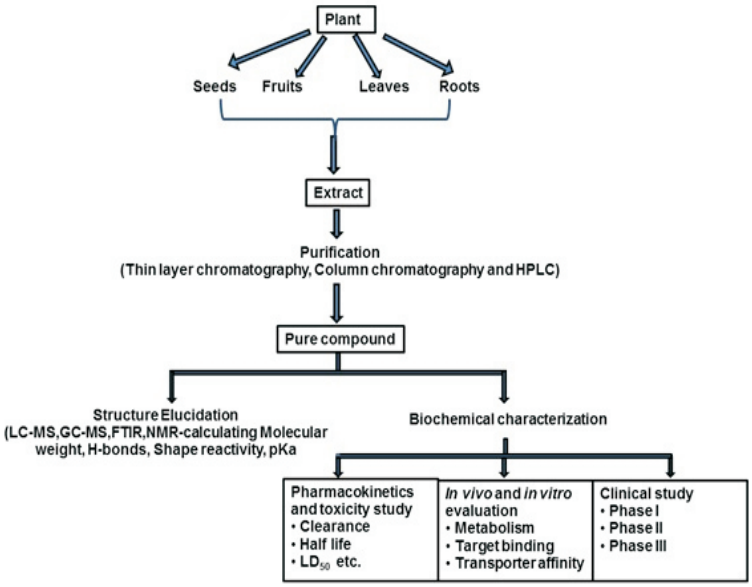

Figure 4: A schematic representation of extraction, purification and characterization of bioactive compounds from plants.

in Chinese folk medicine, is grown extensively in southern Asian countries (Bisset and Phillipson, 1976). Dehydrated seeds of this plant have been shown to improve blood circulation and relieve joints pain (Guizhi, 1996). Hysterically, the plant has been generally used in treating diseases, such as tumor and rheumatic arthritis (Yong, 1975).

Thymus satureioides

Thymus species are aromatic plants of the Mediterranean flora, commonly used as spices and as traditional medicine remedies. Recently, found that the chloroform extracts of two related Thymus species, endemic to Morocco, Thymus willdenowii Boiss and Thymus broussonettii Boiss (Ismaili et al., 2001, 2002), were responsible for the topical anti-inflammatory activity of the plants.

Balanites aegyptiaca

Balanites aegyptiaca Delile is a tropical plant used in East Africa as a component of several primitive medicinal remedies (Liu and Nakanishi, 1982; Mohamed, 1999). It is largely used as a component of many popular preparations for its abortive, antiseptic, anti-malarial, antisyphilitic and anti-viral (Herpes zoster) activity (Duke, 1983; Kokwano, 1976).

Bryophyllum pinnatum

Bryophyllum pinnatum, usually known as "good luck" or "resurrection plant", in some parts of Africa. In Nigeria and few other West African countries, the fleshy leaves of Bryophyllum pinnatumare generally used as an herbal remedy for a kind of human disorders, including: hypertension (Ojewole, 2002), diabetes mellitus, bruises, wounds, boils, abscesses, insect bites, arthritis, rheumatism, joint pains, headaches, and body pains. The leaves are also used for inguinal lymphadenitis and ear diseases (Adjanohoun et al., 1991).

Inonotus obliquus

Mushrooms are a nutritive food and a good source of beneficial medicinal properties. In Russian traditional medicine, an extract from the mushroom Inonotus obliquus (Hymenochaetaceae) is used as an anti-tumor and diuretic medicine (Huang, 2002). Moreover, it has been shown that Inonotus obliquus has therapeutic effects, such as anti-inflammatory, and hepatoprotective effects immuno-modulatory (Solomon and Alexander, 1999). It has been reported that Inonotus obliquus, and other mushrooms, has therapeutic effects, i.e., anti-tumor, anti-inflammatory, immuno-modulatory and hepatoprotective effects (Solomon and Alexander, 1999).

Houttuynia cordata

Houttuynia cordata Thunb. (Saururaceae) is a classical medicinal plant used in China for years for the cure of cough, leucorrhea and ureteritis so on (Zhou, 2003; Ji and Zhao, 2003; Sun et al., 2004).

Ruta graveolens

The most typical medicinal plant of this family is Ruta graveolens, known as rue and native to Europe. Rue contains various active compounds, one of them rutin, a flavonoid, is known to have nitric oxide scavenging activity (Van Acker et al., 1995). The available literature shows (CSIR, 1988), Ruta graveolens have approximately 2% of rutin. An amusing recent study showed that the decrease in lipopolysaccharide (LPS) induced the nitric oxide production by rutin in vivo due to inhibition of nitric oxide synthase (iNOS) protein expression. In homeopathy medicines, rue is an important remedy for deep aching pain and rheumatism (Miguel, 2003).

Sphenocentrum jollyanum

This plant belongs to the family Menispermaceae and is known locally in Yoruba as Akerejupon. The root hair is used with other anti-malarial plants for the treatment against fevers, body pains and rheumatism, while leafy twigs and fruits are used for its aphrodisiac activity (Iwu, 1993, Burkill, 1985).

Ledum groenlandicum

Ledum groenlandicum Retzius (Labrador tea) belong to Ericaceae and normally distributed in North America. Leaves and twigs were used in Amerindian traditional medicine to treat several pathologies such as inflammatory diseases (Rousseau, 1947; Moerman, 2000) rheumatisms (Gunther, 1973), burns (Leighton, 1985).

Garcinia hanburyi

Garcinia hanburyi Hook (Family Guttiferae) popular in Thailand as “Rong Thong” is widely distributed throughout Southeast Asia (Duke, 1985). In Thailand, dry stembark of Garcinia cowais used as an antipyretic agent and fresh pericarp of Garcinia mangostanais used as a topical anti-inflammatory agent (Likhiwitayawuid et al., 1997, Chairungstrilere et al., 1996). In Nigeria, dry fruits and roots of Garcinia kolaare marked to treat arthritis and inflammation of the respiratory tract, respectively (Iwu and Anyanwu, 1982; Iwu et al., 1990). The methanol extract from the bark of Garcinia speciosa demonstrated anti-inflammatory and analgesic effects (O-urai, 2000).

Sideritis ozturkii

Plants of the genus Sideritis (Lamiaceae), widely distributed in Mediterranean–Macronesian region are traditionally used in Spanish folk medicine for their anti-inflammatory. Several anti-inflammatory compounds have been obtained from plants of this genus, especially flavonoids and terpenoids (Godoy et al., 2000).

Eupatorium arnottianum

The genus Eupatorium belongs to the Eupatoriaetribe. Eupatorium perfoliatumare are the most popular species of the genus and are extensively used in phytotherapy as choleretic, hepato-protective, and against fever, colds and rheumatism. Fifteen medicinal Eupatorium species are reported as native to Argentina. These have been used by indian and rural populations as febrifuge, antiseptic, for the treatment of different types of pains and inflammation, headaches and to cure sores and pimples (Zardini, 1984, Toursarkissian, 1980; Mart´ınez Crovetto, 1981).

Alchornea cordifolia

This is reported that ethanol fraction from the hexane extract of A. cordifolia leaves displayed potent anti-inflammatory activity (AIA) in rats (Osadebe and Okoye, 2003).

Taraxacum officinale

Taraxacum officinale contain acute anti-inflammatory activity by exhibited its protective effect against cholecystokinin induced acute pancreatitis in rats (Seo et al., 2005).

Opuntia dillenii

Opuntia dillenii is a cactus belongs to the family Opuntiae. The fleshy leaf of the plant used externally against various kind of inflammation as a wound healer (Bosh-Millares, 1967).

Assure kappa

Clarke (Compositae), generally known as Kushta in Sanskrit, is a tall robust perennial herb scattered in Kashmir. The extract of the roots is traditionally used for inflammations and rheumatism (Shah, 1982; Lechner-Knecht, 1982), asthma (Shah, 1982; Sircar, 1984).

Argyreia speciosa

Sweet (Convolvulaceae), generally known as Vryddhadaru in Sanskrit, is a woody climber occuring throughout India and used as a 'rasayana' drug in the traditional Ayurveda. The roots of plant

Table: 1. Represent the plant species and their parts used for medicinal purposes.

Plant species (family)	Parts of plants used/Importance
Phyllanthus polyphyllus (Euphorbiaceae)	Leaves
Strychnos Nux-vomica (Loganiaceae)	Dried seeds relieve rheumatic pain (Guizhi,1996).
Thymus satureioides	Topical anti-inflammatory
Balanites aegyptiaca (Zygophyllaceae)	Antiseptic, anti-malarial, anti-syphilitic and anti-viral (Herpes zoster) activity (Duke, 1983; Kokwano, 1976).
Bryophyllum pinnatum	Leaves, hypertension (Ojewole, 2002), arthritis, rheumatism, joint pains, headaches, and body pains.
Inonotus obliquus	Anti-tumor medicine and diuretic (Huang, 2002), anti-inflammatory, immuno-modulatory and hepatoprotective effects (Solomon and Alexander, 1999).
Houttuynia cordata (Saururaceae)	Anti-viral, very popular health tonic in Japan, Anti-inflammatory.
Ruta graveolens	Pain and rheumatism
Sphenocentrum jollyanum (Menispermaceae)	Fevers and body pains and rheumatism (Burkill, 1985; Iwo, 1993).
Ledum groenlandicum	Leaves and twigs, inflammatory diseases (Rousseau, 1947; Moerman,2000) rheumatisms (Gunther,1973).
Garcinia hanburyi (Guttiferae)	Dry stem bark antipyretic
Sideritis ozturkii (Lamiaceae)	Anti-inflammatory
Eupatorium arnottianum (Eupatoriaetribe)	Pains and inflammation
Alchornea cordifolia	Potent anti-inflammatory activity Osadebe and Okoye, 2003).
Taraxacum officinale	Anti-inflammatory activity
Opuntia dillenii	Fleshy leaf, used externally against different types of inflamed wounds as a wound healer (Bosh-Millares, 1967).
Assure kappa (Compositae)	Roots, inflammations and rheumatism (Shah, 1982; Lechner-Knecht, 1982).
Argyreia speciosa (Convolvulaceae)	Useful in rheumatism and diseases of the nervous system (Chadha, 1976).
Achyranthes aspera (Amaranthaceae)	Rheumatism (Satyavati et al., 1976).
Mangifera indica (Anacardiaceae)	Stem bark, Analgesic and anti-inflammatory Nunez-Selles A 2002
Kalopanax pictus	‘‘Undo rheumatism’’ [Hui-Lin, 1975].
Uncaria tomentosa (Rubiaceae)	Bark, arthritis and other inflammatory disorders (Reinhard, 1997).
Aconitum	Potent analgesic and anti-inflammatory activities (Muroyama and Mori, 1993).
Cedrus deodara (Pinaceae)	Treatment of inflammations and rheumatoid arthritis (Kirtikar and Basu, 1933).
Hippocratea excels (Hipocrateaceae)	Variety of inflammatory conditions.
Opuntia ficus-indica Cactaceae (cactus)	Anti-inflammatory, Eun-Hee Park et al., 2000).
Vernonia cinerea (Asteraceae)	Anti-inflammatory Latha et al., 1998).
Cassia siamea	The roots are used as antipyretic Ahn et al., 1978).
Eucomis	Rheumatism, and fever
Croton malambo (Euphorbiaceae)	Anti-inflammatory

have been regarded as tonic, and used in rheumatism and nervous system diseases (Chadha, 1976).

Achyranthes aspera

(Amaranthaceae), is familiar as Apamarga in Sanskrit, is a small herb occur all over regions of India and have beneficial medicinal properties used in cough, bronchitis and rheumatism (Satyavati et al., 1976).

Mangifera indica

Mangifera indica (Anacardiaceae) found in the tropical and subtropical regions of india and its parts are commonly used in a wide variety of remedies. Recently, the first analgesic and anti-inflammatory effects of VIMANG® which is an extract of the stem bark of M. Indicia contains a defined mixture of components: polyphenols, terpenoids, steroids, fatty acids and microelements (Nunez-Selles A. 2002).

Kalopanax pictus

Kalopanax pictus (Araliaceae) is found in countries of the Orient. The stem bark of this plant have been used in traditional medicine to treat rheumatic arthritis, neuralgia, lumbago. (Joon Huh1984).

Cannabis sativa

Preparations derived from Cannabis sativa have been the source of medicinal preparations since the earliest written records on pharmacobotany (Abel, 1980). Among these, it was claimed that Cannabis can "undo rheumatism" (Hui-Lin, 1975).

Uncaria tomentosa

Uncaria tomentosa (Rubiaceae), known as 'Cat's claw' is a vine that grows in the Amazon rainforest. In Peru, its bark has been traditionally used for the cure of many ailments, such as viral infections, cancer, gastric ulcers, arthritis and other inflammatory disorders (Reinhard, 1997).

Aconitum

Plants of the genus Aconitumare a rich source of diterpenoid alkaloids, many of which exhibit a broad spectrum of activities. Some aconitine and mesaconitine derivatives having potent analgesic and anti-inflammatory activities (Muroyama and Mori, 1993).

Cedrus deodara

The plant Cedrus deodara (Roxb.) belong to the family Pinaceae (Sanskrit-Devadaru; Hindi/Marathi-Deodar; English-Cedar) is a ornamental evergreen tree growing extensively on the slopes of the Himalayas (Gulati, 1977). The wood of C. deodara has been used since ancient days in Ayurvedic medical practice for the cure of rheumatoid arthritis and inflammations (Kirtikar and Basu, 1933).

Hippocratea excels

Hippocratea excelsa is belong to family Hipocrateaceae, found in Mexico as 'Mata piojo' or 'Cancerina', and is used as medicine for a different types of inflammatory conditions.

Opuntia ficus-indica cactaceae (cactus)

This plant is used for the treatment of burns, wounds, edema, and indigestion. Anti-inflammatory, hypoglycemic and anti-viral activities were also reported in alcoholic fractions (Eun-Hee Park et al 2000).

Vernonia cinerea

Vernonia cinerea belong to family of Asteraceae and has many therapeutic properties, used in various traditional medicines. Recently, the alcoholic extract of the flower has been reported anti-inflammatory activity in adjuvant-induced arthritis of rats (Latha et al., 1998).

Cassia siamea

Cassia siamea is a very scattered medicinal and food plant grown in southeast Asia and sub-Saharan Africa. Its stem bark is traditionally used in the treatment of constipation, malaria and related diseases such as jaundice and fevers (2005; Kaur et al., 2006, Ahn et al., 1978; Nsonde-Ntandou et al.). The roots are used as antipyretic and leaves for constipation, hypertension, insomnia and asthma (Ahn et al., 1978).

Eucomis

African traditional medicine are used in the treatment of a variety of ailments, including respiratory problems, urinary and venereal diseases, rheumatism, and fever (1996 Hutchings A, Iwu MM (1993, Roberts M 1990, Watt JM 1962).

Croton malambo

Plants of the Euphorbiaceae family have been

distributed around the world to cure various diseases (Roengsumram et al., 1999; Anti-inflammatory and antitumor activities of diterpenes (Ichihara et al., 1992), and the chemical properties of alkaloids and triterpenoids (Piacente et al., 1998) of this genus (Gewali et al., 1990; Gunasekera et al.,1980).

The information concluded in this review may be exploited in study of anti-inflammatory, anti-cancerous or immunological studies by the researchers and scholars.

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