IJP (2021), Vol. 8, Issue 1 **(Review Article)**

Received on 14 November 2020; received in revised form, 25 January 2021; accepted, 27 January 2021; published 31 January 2021

A SYSTEMATIC REVIEW ON MEDICINAL IMPORTANCE AND PHYTOCHEMICAL SCREENING OF *CROTON MACROSTACHYUS* LEAVE EXTRACTS IN EAST AFRICA

Yesuneh Tefera [*1], Bereket Dessalegn [2], Fikadu Endeshaw [1], Asnakew mulaw [2], Elias Kebede [1], Achenef Melaku [1] and Zenebe Reta [3]

Department of Veterinary Pharmacy [1], College of Veterinary Medicine and Animal Sciences, University of Gondar, Gondar, Ethiopia.
Department of Biomedical Sciences [2], College of Veterinary Medicine and Animal Sciences, University of Gondar, Gondar, Ethiopia.
Mettu University [3], Department of Forestry, Mettu, Ethiopia.

Keywords:

Croton macrostachyus, East Africa, Ethnoveterinary medicine, Phytochemical screening, Systematic Review

Correspondence to Author:
Yesuneh Tefera

Department of Veterinary Pharmacy, College of Veterinary Medicine, University of Gondar, Addis Ababa, Ethiopia.

E-mail: yetefera19@gmail.com

ABSTRACT: *Croto macrostachyus* has a potential source of a wide range of pharmaceutical products in tropical Africa and will provide a new direction for researchers in the future. In this study, systematic review attempted to explore the medicinal importance of *C. macrostachyus* based on ethnomedicinal research findings in East Africa, and phytochemical compounds from *C. macrostachyus* leaves extracts were determined. The study was conducted from February to June 2018 on google scholar, BMC, PubMed, and google search engines. For research study, inclusion and exclusion criteria were used (Ethnobotanical and ethno-medicinal surveys reporting on medicinal importance of *C. macrostachyus*, written in English, conducted in East Africa, year of publication of a study that describes method of preparation, route of administration, and Articles focused on ethnoveterinary practice). Descriptive statistics were used to analyze data collected from *C. macrostachyus*. From a total of 90 studies, 20 studies were used as a systematic review. Most of the ethnoveterinary study conducted in Ethiopia. Leaves were the most frequently used plant parts. Oral administration was the most common frequently utilized route of administration. In this study, a total of 23 major animal diseases that can be treated by *C. macrostachyus* were reported. The leaf of *C. macrostachyus* extracts revealed the presence of various phytochemical compounds such as terpenoids, flavonoids, saponins, cardiac glycosides, and phenols, whereas tannins were not detected. This finding has shown that there is a lack of precision in the determination of doses and side effects in the study area since there were variations in the units of measurement and the quantity of plant parts used. Therefore, further study is needed to determine the dosage, concentration of the preparation, side effects, and phytochemical compounds present in this medicinal plant.

INTRODUCTION: Background: Ethiopia is a country characterized by a wide range of climate and ecological conditions, possesses enormous diversity of fauna and flora [1]. The country possesses a wide range of potentially useful medicinal plants, more extensive indeed than available in many other parts of the world [2].

The application of traditional medicine to veterinary medicine has been termed ethno-veterinary medicine. It is mainly concerned with beliefs, knowledge, skills, methods, and practices which are used in the healthcare of animals. The knowledge varies from region to region, and from the community to community [3].

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.IJP.8(1).1-13

The article can be accessed online on www.ijpjournal.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.8(1).1-13

Popular knowledge of plants used by humans is based on thousands of years of experience. By "trial and error", people learned how to recognize and use plants, including those with a magic-religious function [4, 5] estimated that 95% of traditional medical preparations in Ethiopia are of plant origin. The problem thus makes it mandatory for mankind to seek new antimicrobial agents and/or new effective ways of treating infectious diseases caused by microorganisms such as the drug Resistant bacteria [6].

Due to incomplete coverage of the modern medical system, shortage of pharmaceuticals, and unaffordable prices of modern drugs, the majority of Ethiopian people still depend on traditional medicine. The problem of ensuring the equitable distribution of modern healthcare has become more serious, as the gap between supply and demand has continued to widen. There is considerable global interest in tapping the accumulated knowledge of traditional medicine [7]. Communities of Ethiopia used traditional medicine to treat both human and livestock diseases. This is likely due to the availability of these low-cost, locally sourced plant-based medicine [8].

Medicinal plants, also called medicinal herbs, have been discovered and used in traditional medicine practices since prehistoric times. Plants synthesize hundreds of chemical compounds for functions, including defense against insect, fungi diseases, and herbivorous mammals. Numerous phytochemicals with potential or established biological activity have been identified. However, since a single plant contains widely diverse phytochemicals, the effects of using a whole plant as medicine are uncertain. Further, the phytochemical content and pharmacological actions, if any, of many plants having medicinal potential remain unassessed by rigorous scientific research to define efficacy and safety [9].

Considering the documented ethnomedicinal uses of *C. macrostachyus* in tropical Africa, certainly the species has the potential in playing an important role in the primary healthcare of communities throughout its distributional range. It is therefore important to assess if there is a correlation between the ethnomedicinal uses of *C. macrostachyus* and the recent documented phytochemical and pharmacological properties of the species. The collected information on traditional uses, phytochemistry, pharmacology, and toxicology of the species, It is hoped that this information will highlight the importance of *C. macrostachyus* as a potential source of a wide range of pharmaceutical products in tropical Africa and will provide a new direction for researchers in the future [10].

Phytochemicals are naturally occurring in the medicinal plants, leaves, barks, vegetables, and roots that have defense mechanism and protect from various diseases. Phytochemicals are primary and secondary compounds. Chlorophyll, proteins and common sugars are included in primary constituents, and secondary compounds have terpenoid, alkaloids, and phenolic compounds [11]. Terpenoids exhibit various important pharmacological activities that mean antiinflammatory, anticancer, antimalarial, inhibition of cholesterol synthesis, antiviral and antibacterial activities [12]. In this study, systematic review attempted to explore medicinal importance of *Croton macrostachyus* based on ethnomedicinal research findings in East Africa.

Therefore, the objectives of this study were: To review the medicinal importance of *Croton macrostachyus* extracts in East Africa.

2. Literature Review:

2.1. General Description of Medicinal Plants:

Traditional animal healthcare system is also known as ethnoveterinary medicine (EVM) as old as the history of documentation of animals [13]. Traditional medicine is a health practice, approaches, knowledge, and beliefs incorporating plant, animal, and mineral-based medicines, spiritual therapies, manual techniques, and exercises, applied singularly in combination to treat and prevent illness and maintain well-being. Medicinal plants are useful plants for primary health care and as a remedy for diseases and injury for both humans and livestock traditionally [14].

In Ethiopia, people used traditional methods to treat both human and livestock diseases for generations. It is still widely practiced in rural areas where modern healthcare services are limited and even in areas where conventional veterinary service is available. It is deep-rooted and rational practice for pastoral communities that can contribute better to

animal health management. The ethnoveterinary practice has, therefore, proved itself to be a potential resource for the community-based animal healthcare activities [15].

Medicinal plants have been used to treat various health ailments for a long period of time in different countries. Natural products have been playing a dominant role in drug discovery efforts for the treatment of human and livestock diseases [16]. Nature has been a source of medicinal agents for thousands of years, and an impressive number of modern drugs have been isolated from natural sources; many of these isolations were based on the uses of the agents in traditional medicine. This plant-based, traditional medicine system continues to play an essential role in health care, with about 80% of the world's inhabitants relying mainly on traditional medicines for their primary health care [17].

Hundreds of plant species have been identified by traditional practitioners for treating a wide range of livestock and human ailments, although the efficacy of plant treatments has often not been tested through formal trials, on which more work is required. Nevertheless, a large body of information on traditional use, over a number of centuries in many cases for indigenous plants, supports their utility for treatment and control [18].

2.2. The Importance of Plants as a Source of New Drugs: Herbal medicine is widely practiced worldwide. For centuries, people have turned to natural remedies to cure common ailments such as colds, allergies, upsets stomachs and toothaches, and the trend is constantly increasing. Thus, there has been a shift in universal trend from synthetic to herbal medicines, which we can say Return to Nature for the prevention of diseases. Nature has been a source of medicinal plants. The World Health Organization (WHO) reported that 4 billion people (80% of the world's population) use herbal medicines for some aspect of primary healthcare [19]. Herbal medicine has been recognized by WHO as essential components for primary healthcare; about 11% of the 252 drugs are derived from plants [20].

Since time immemorial, human civilization has been used several plants as food, medicine, clothing, and shelter. Vegetarian foods contain a high amount of various super-nutrients such as protective anti-oxidant, phytochemicals, micro-nutrients, which promote health and protect from diseases. Plants have several pharmacological roles such as anti-oxidant, anticancer, antimicrobial, antifungal, and antiparasitic. Free radical scavenger molecules that present in plants, including flavonoids, phenols, anthocyanin's and vitamins which show anti-oxidant-like activity [21].

2.3. Factors that Hinders the Use of Medicinal Plants: Factors that can effectively hinder the use of medicinal plants usually go with both intrinsic and extrinsic situations. Intrinsic factors refer to the genetic makeup of a particular plant claimed to have a medicinal property that influences the chemical composition as well as the growth and development of the plant. Since the genetic makeup of plants determines not only the presence or absence of chemicals with medicinal properties but also the relative amount of such agents, only those having genes with superior quality for the production of the high amount of the active constituents can only be selected.

The chemical composition of medicinal plants and hence their medicinal properties can also be affected by external factors such as interference by humans or other organisms, climatic conditions, soil type, and even ways of handling them during collection. Adulteration, contamination, drying condition, time of collection, transportation, and storage are among external factors to affect obtaining of such agents from medicinal plants [22].

2.4. Problems Associated with Conservation of Medicinal Plants: Medicinal plants are plants adaptable to mitigate or cure various diseases. They can be used as medicines, foods, or materials for pharmaceutical preparations. This interdependence of their uses provides strong concern and need for their conservation. A protective measure is taken to prevent the loss of their genetic diversity, save them from going into extinction, and protect their ecosystem from damage to promote their sustained utilization. Over-exploitation of medicinal plants in the field by traditional healers and others, Extensive and uncontrolled habitat destruction for developmental purpose, Poor environmental perception and education on the need and methods of conservation, Non-prioritization of plant species list for conservation, High cost of implementing

conservation strategies are problems associated with conservation of medicinal plants [23].

2.5. *Croton macrostachyus* (Local Name Bissanna): *Croton macrostachyus* belong to one of the largest genera of the family Euphorbiaceous, called Croton under the subfamily Crotonoideae, which comprises more than 1200 species of herbs, shrubs, trees, and occasionally lianas. Croton is ecologically prominent and important elements of secondary vegetation in the tropics and subtropics [24]. *Croton macrostachyus* have ethnomedicinal uses, and the extraction have phytochemistry, pharmacological, and toxicity effect [25].

In Ethiopia, *Croton macrostachyus* has many uses. A leaf extract is applied against the itchy scalp. The preparation is taken with pepper, butter, and milk. An infusion of the leafy branches and roots is used as a mouthwash to treat toothache. The leaves or young shoots are eaten to treat fever and edema and mashed leaves are applied to hemorrhoids. Preparation of the seed is instilled into the ear to treat ear problems. The seeds are poisonous and are used to make the fish poison, while crushed seed and leaves in water are taken to treat tapeworm infection; the seed is eaten to induce abortion, and a fruit, bark or root decoction or raw fruit is taken to treat venereal diseases [26].

Bark maceration is drunk as an abortifacient and uterotonic, to expel a retained placenta. The root or stem bark is chewed to treat toothache but also rabies. Ripe crushed fruits mixed with butter or honey and ground leaves are applied to skin diseases. A leaf decoction is also taken to treat cough and stomach problems. A root decoction is taken to treat indigestion. A decoction of the stem and root bark is used for bathing babies with skin rash, a bark infusion is taken to treat chest problems and rheumatism. Leaves made into a poultice are externally applied to treat pleurisy. A powder of leaves and twig bark is eaten to calm insanity and possession [27].

2.5.1. Chemical and Pharmacological Studies: The individual chemicals from which plants are made are phytochemicals. Phytochemical studies of plant are of great importance in developing drugs. The terpenes are ubiquitous metabolites found in all living organism; they include essential metabolites such as the sterols acting as membrane stabilizers in eukaryotes or precursors of steroid hormones. They are among the most widespread and chemically diverse group of natural products throughout the plant and animal kingdom [28]. The phytochemical studies on the genus croton have to lead to the isolation and characterization of different classes of secondary metabolites. Terpenes, flavonoids, and alkaloids have been isolated from different croton species [29].

2.5.2. Other Ethnobotanical Uses: Raw materials from the forest are used to make a wide range of products, while substitutes for many items are available in larger towns; in most villages, people still rely almost exclusively on material from forest and woodlands for domestic items. *Croton macrostachyus* is one of the locally available hard and softwood among commonly utilized species. In most rural areas, the scarcity of other forest trees due to forest destruction has led to the increased cutting of this medicinal plant for construction, use as farm implements such as yoke and traditional pestle and mortars [30].

2.5.3. Ecology: *Croton macrostachyus* commonly grows in secondary forests, especially on forest edges and along rivers or lakes, in moist or dry evergreen upland forest, woodland, wooded grassland, bushland, and along roadsides, often on soils of volcanic origin, at 200–2500(–3400) m altitude. The mean annual rainfall varies from 150 to 1200 mm [31].

FIG. 1: PHOTOGRAPH OF *CROTON MACROSTACHYUS* PLANT

3. MATERIALS AND METHODS:

3.1. Description of Study Area: The present systematic review was conducted in East Africa based on ethnobotanical and ethnomedicinal surveys reporting on the medicinal importance of *Croton macrostachyus* from February to June 2018.

The East African region is endowed with a rich diversity of plant and animal species. This is because of the varied vegetation types distributed across the region. The need for mankind to meet his basic necessities of life such as food, fiber, and medicines creates an interactive atmosphere between man and his surrounding environment [32].

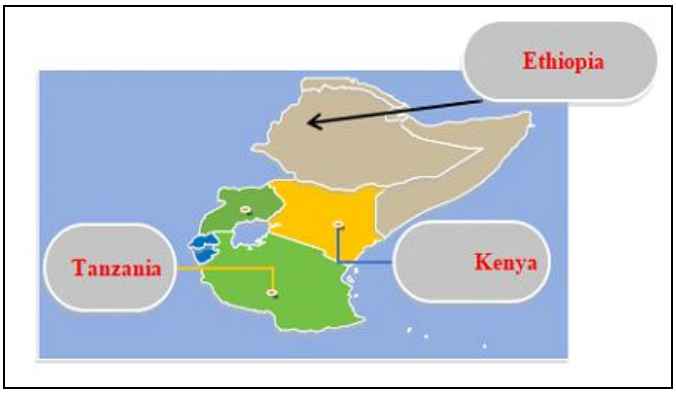

FIG. 2: MAP SHOWING SELECTED EAST AFRICAN COUNTRIES

3.2. Geographic Location of Plant: Fresh leaves of *Croton macrostachyus* were collected from the University of Gondar at Maraki campus for the purpose of identifying chemical constituents. The plant is found at12035'17'N latitude and 37026'29' E longitude with an altitude of 1800 meters above sea level.

3.3. Search Strategies: *Croton macrostachyus* and other related species were used as the keywords in searching the major database, including web of science, Google scholar, Biomed central (BMC), and PubMed used as a literature search strategy.

3.4. Preparation of plant extracts: The study was conducted experimentally using the appropriate method to determine phytochemical constituents present in Croton macrostachyus leaves extraction by using the phytochemical screening process the laboratory. Plant leaves materials were washed to remove dust particles that cause contamination. Then until dried, the leaves were shaded at room temperature. Next to that, the dried leaves powdered with the help of a grinder. The powdered plant materials of 200 gram of dried leaf powder were soaked separately in solvents of ethanol (80%) and distilled water (20%) for 48 h for three times days until the desired extraction of bioactive extracts achieved. Then with the help of a rotary evaporator, the solvent evaporated at 90 ºC, and the remaining parts undergo a dry oven process at 68 ºC. Then yield products forwarded for the actual procedure.

3.5. Phytochemical Screening: The qualitative phytochemical investigations of the crude extract of leaves of *Croton macrostachyus* were carried out using standardized tests as described below.

3.5.1. Test for Terpenoids (Salkowski Test): To 0.25 g of each of the crude and solvent fractions of leaves, 2 ml of chloroform was added. Then, 3 ml concentrated sulfuric acid was carefully added to form a layer. A reddish-brown coloration of the interface indicated the presence of terpenoid [33].

3.5.2. Test for Saponins: To 0.25 g of the crude extract and each fraction, 5 ml of distilled water was added in a test tube. Then, the solution was shaken vigorously and observed for a stable, persistent froth. Formation of froth indicated the presence of saponins [33].

3.5.3. Test for Tannins: About 0.25 g of each fraction, and the crude extract was boiled in 10 ml of water in a test tube and then filtered. The addition of a few drops of 0.1% ferric chloride to the filtrate resulting in blue, blue-black, green or blue-green coloration or precipitation was taken as evidence for the presence of tannins [33].

3.5.4. Test for Flavonoids: 250 mg of ethanol extract was dissolved in a small amount of dilute NaOH, and concentrated HCl (3 ml) was added. A yellow solution that turns colorless was inspected [34].

3.5.5. Test for cardiac Glycosides (Keller-Killiani Test): To 0.25 g of the crude extract and each fraction diluted to 5 ml in water, 2 ml of glacial acetic acid containing one drop of ferric chloride solution was added. This was under lied with 1 ml of concentrated sulfuric acid. A brown ring at the interface indicated the presence of a deoxysugar characteristic of cardenolides. A violet ring may appear below the brown ring, while in the acetic acid layer, a greenish ring may form just above the brown ring and gradually spread throughout this layer [33].

3.5.6. Test for Phenols: To 2ml of test solution, added alcohol and then a few drops of neutral ferric

chloride solution. The appearance of fresh reddish blue color indicated the presence of polyphenols [35].

3.6. Inclusion and Exclusion Criteria:

The following inclusion and exclusion criteria were used:

- Ethno-botanical and ethnomedicinal surveys are reporting on the medicinal importance of croton macrostachyus.
- Written in English, conducted in East Africa, year of publication of study that describes method of preparation and route of administration.
- Articles focused on ethnoveterinary practice.

The following research data were excluded from analysis:

- Data from ethnobotanical and ethno-medicinal survey reporting on this selected medicinal plant lacking information about method of preparation and route of administration.
- Data from partially accessed articles (abstract only).
- Research conducted before 1994 outside east Africa.

3.7. Data Collection: The following data were extracted for the actual studies: the first author, year of publication, year of study, study area, method of preparation, route of administration, and type of diseases treated by this medicinal plant.

3.8. Data Analysis: The collected data were entered in to excel spreadsheet and summarized using descriptive statistics. The spreadsheet data was employed to determine the frequency and the percentages so as to identify the most common ailments, Geographical distribution of studies site, and method of remedy preparation, parts of plant used and route of administration in the study area.

4. RESULTS:

4.1. Literature Search Results: A total of 90 studies were identified through the help of different search engines. From these, 20 were considered for the actual systematic review. **Fig. 2** shows the search results and the method of inclusion, exclusion criteria, and the selection techniques.

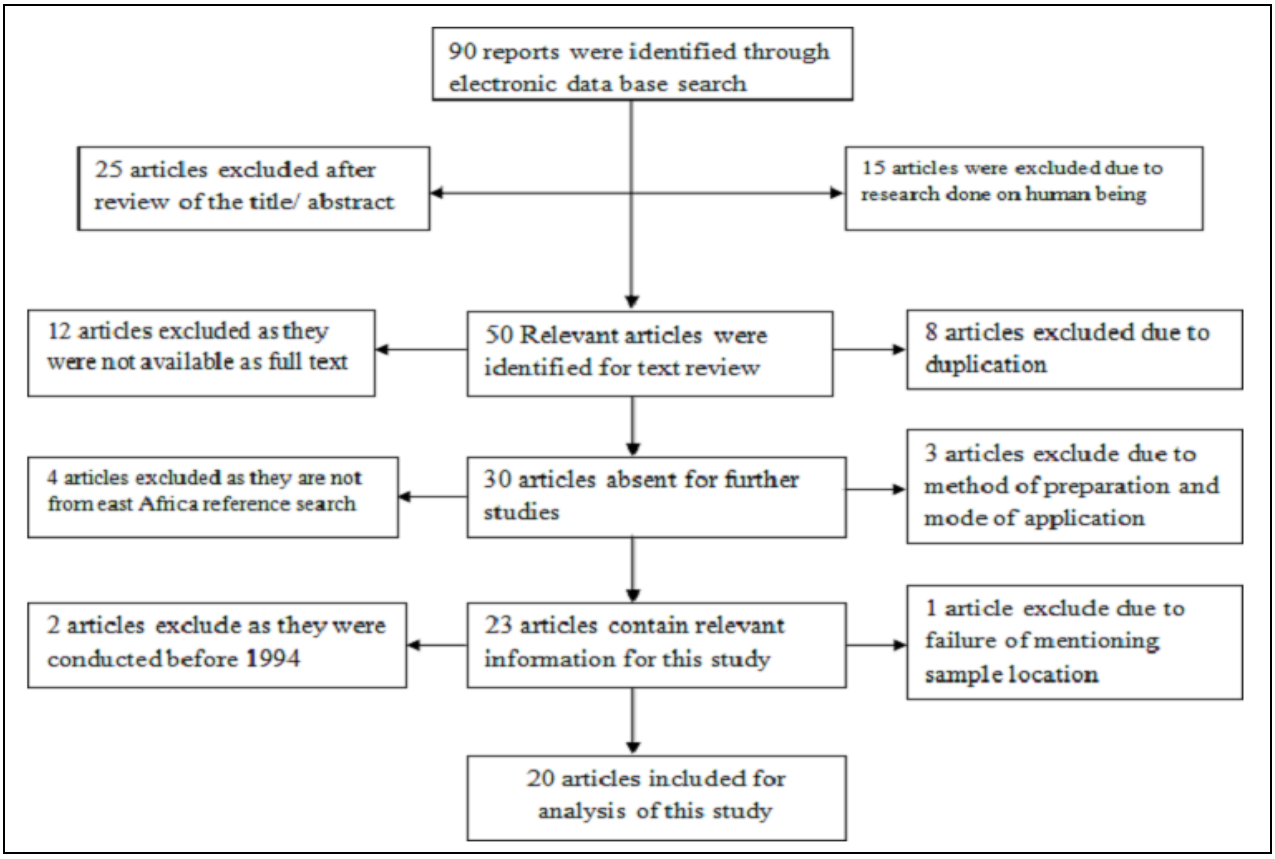

FIG. 3: FLOW CHART SHOWING SELECTION OF RESEARCH PAPER

4.2. Characteristics of the Studies: The studies included for this systematic review were conducted between 1994 and 2017 in East Africa. In Ethiopia, this review was performed in 4 regional and in 2 administration cities: namely Oromia, South Nations Nationalities and Peoples of Region (SNNPR), Tigray, Amhara, Addis Ababa, and Dire Dawa. From East Africa next to Ethiopia, Kenya and Tanzania were countries included in this study. The detailed characteristics of the studies were presented below.

TABLE 1: LISTS OF STUDIES INCLUDED IN THE SYSTEMATIC REVIEW FROM ETHIOPIA

Ethiopia				
Investigator	**Year of study**	**Region/center**	**Zone**	**District/study area**
[36]	2016	Addis Ababa		Kolfekeraniho
[37]	2013	Tigray	Mekele	KilteAwulaelo
[38]	2014	Oromia	Jimma	Jimma University
[39]	2012	Oromia	East wollega	Nekemte
[40]	2009	Oromia	Western Harerge	Chiro
[41]	2015	Amhara	West Gojjam	Dega-Damot
[42]	2007	Oromia	Arsi	Dheera
[43]	2016	Oromia	Kelem wollega	Dale sadi
[44]	2015	Oromia	Guji and Borona	Liben andYabelo
		SNNPR	Sidama	wondo Genet
			Gedeon	Kochere
[45]	2014	SNNPR	Gedeon	Kochere
[46]	2014	Amhara	North shewa	Ankober
[47]	2017	Dire DawaAdministration		
[48]	2016	Amhara	North Gondar	Wogera
[49]	2015	Tigray	Southern Tigray	SehartiSamre

TABLE 2: LISTS OF STUDIES INCLUDED IN THE SYSTEMATIC REVIEW FROM OTHER COUNTRIES

	Investigator	**Year of study**	**Region**	**District**
Kenya	[50]	2015		Nairobi
	[51]	2010	Mont Elgong	
	[52]	2012	Western Kenya	Bungoma
	[53]	2011	North Kenya	Nandi
Tanzania	[54]	2017	Iringa and Nyombe	Mutindi and Makete
	[55]	1994		Mbeya

4.3. Geographical Distribution of Study Sites: The Range of distribution of study sites in East Africa is; Ethiopia (70%), Kenya (20%), and Tanzania (10%). The following table shows the distribution of the study site of *Croton macrostachyus* in East Africa.

TABLE 3: GEOGRAPHICAL DISTRIBUTION OF STUDY SITE IN EAST AFRICA

Study area	**Frequency**	**Percent**
Ethiopia	14	70%
Kenya	4	20%
Tanzania	2	10%

From the total of 20 studies included in the systematic review, 14 were from research conducted in Ethiopia. Most studies were performed in Oromia and Amhara region. While other regions, namely SNNPRS, Tigray, and the two-administration city, namely Addis Ababa and Dire Dawa were an area where a few Croton *macrostachyus* practices were conducted. From East Africa, Ethiopia is the most countries where the ethnomedicinal practice is performed, followed by Kenya and Tanzania.

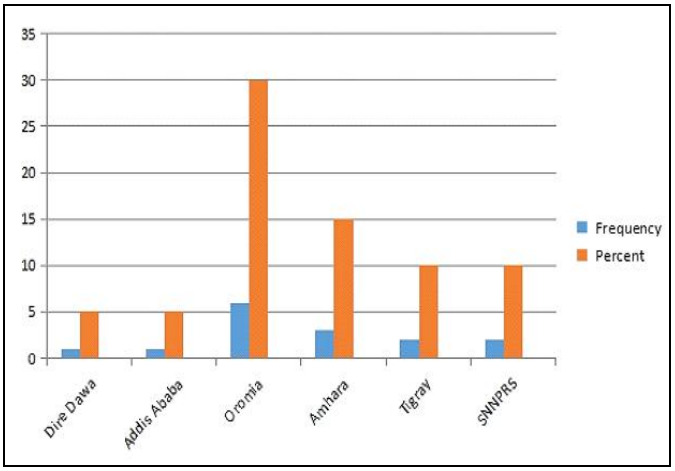

FIG. 4: SHOWS GEOGRAPHICAL DISTRIBUTION OF STUDY SITE IN ETHIOPIA

The distribution of studies sites where ethno-veterinary activity conducted on the use of *Croton macrostachyus* ranged among states are; Oromia (30%), Amhara (15%), SNNPR and Tigray (10%), Addis Ababa and Dire Dawa (5%). The rest 6 Studies were conducted in Kenya and Tanzania. The study site in Ethiopia is depicted in **Fig. 4**.

4.4. Data Analysis Results: The 20 selected study areas depict the use of *Croton macrostachyus* in ethnoveterinary practice in East Africa was reviewed in detail about method of preparation, plant parts used, ingredient added, and mode of application.

TABLE 4: GENERAL DESCRIPTION OF *CROTON MACROSTACHYUS*

Plant parts used	Method of preparation	ROA	Type of diseases treated	animal
Leaf	Crushing	Oral	Diarrhea	Cattle
Leaf	Decoction	Oral	Abdominal pain	undefined
Stem bark, Root, Leaf	Crushing, pounding and powdering	Oral	Rabies	Dog
Leaf	Juice	Topical	Ringworm	cattle
Leaf	Pounding, squeezing and powdering	Oral	Blackleg	cattle
Leaf	Infusion	Oral	Retained placenta	cattle
Root	Decoction	Oral	Anthrax	undefined
Root	pounding	Oral	Rectum prolapsed	Dogs, cattle, sheep goat and equine
Bark	Chopped	Oral	Equine colic	equine
fresh Leaf	Juice	Topical	dermatophytosis	undefined
Leaf	Squeezing	oral	Febrile illness	donkey
Leaf	Juice	Topical	Wound	undefined
Leaf	Crushing	dermal	Scabies	undefined
Leaf	chopped	oral	Bloat	All mammals
Youg brances	crushing	Topical	Wounds	undefined
Leaf, bark	Decoction	oral	Fever	undefined
Leaf, root, barks	Crushed	topical	Ticks	undefined
Leaf and root	Decoction	oral	East coast fever	undefined
Bark and leaf	Decoction	Topical	Ring worm	undefined
Leaf	Infusion	oral	Antihelmenthics	

Note: ROA = Root of administration

4.4.1. Parts of Plants Used for the Preparation of the Remedies: Leaves were the most frequently used plant parts and accounted for (59.26%) of the total, followed by barks and roots both are accounted for (37.04%). Young branches were utilized in rare amounts and which accounted for (3.7%). Medicinal plant parts used were presented in **Fig. 5**.

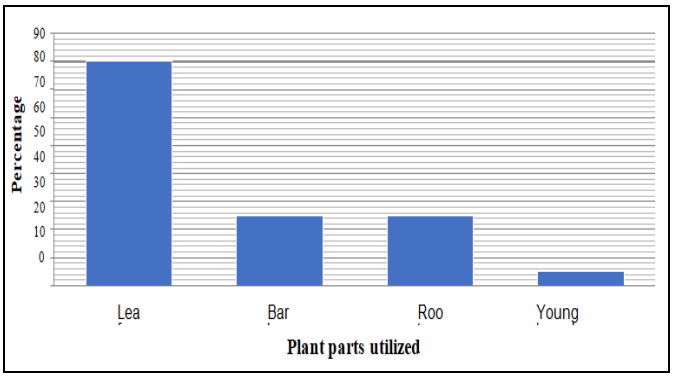

FIG. 5: PARTS OF PLANT USED FOR REMEDIES PREPARATION

4.4.2. Method of Remedy Preparation: Various method of ethnoveterinary medicinal plants preparation was documented. In this study, decoction and crushing were found to be the major method of remedial preparation, and both are accounted (25%), followed by juice (15%), infusion, chopping, and squeezing each accounted (10%), powdering was the least method of remedial preparation and accounted for (5%). Method of preparation and their frequency indicated in **Fig. 6**.

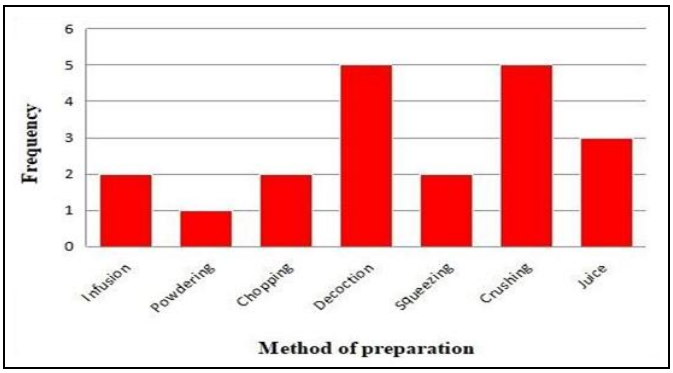

FIG. 6: METHOD OF REMEDY PREPARATION

4.4.3. Routes of Administration of Preparation: A single plant was found to be administered in different routes depending up on the preparation

and type of diseases needed to be treated. Oral administration 13 (65%) was the most frequently utilized route of administration, followed by topical 6 (30%) and dermal 1 (5%) application **Fig. 7**.

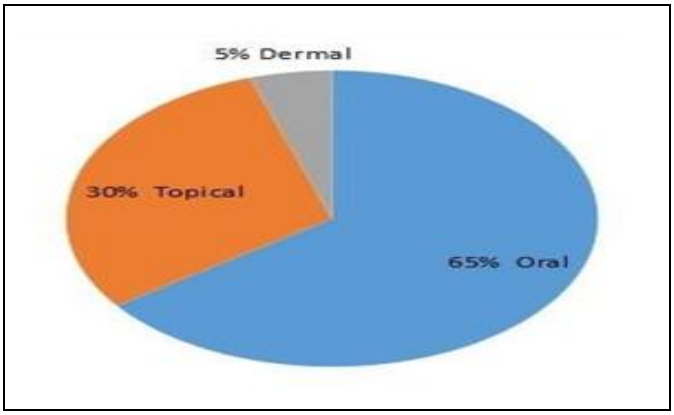

FIG. 7: ROUTE OF ADMINISTRATION

4.4.4. Major Animal Diseases treated using *Croton macrostachyus*: In this study, a total of 23 major animal diseases and others that can be treated by *Croton macrostachyus* were reported. Wound and rabies problems have the highest proportion both accounts (13.04%) followed by Ringworm, Blackleg, Abdominal pain, Bloat each accounted (8.69%). The rest of the animal diseases and their proportion and frequency are depicted in below were depicted under **Table 5**.

TABLE 5: MAJOR ANIMAL DISEASES TREATED USING *CROTON MACROSTACHYUS*

Type of Diseases Treated	Frequency	Percentage (n=23)
Wound	3	13.04
Rabies	3	13.04
Ringworm	2	8.69
Abdominal pain	2	8.69
Bloat	2	8.69
Retain placenta	1	4.35
Dermatophilosis	1	4.35
Scabies	1	4.35
Anthrax	1	4.35
Rectum prolapse	1	4.35
Equine colic	1	4.35
Tick control and prevention	1	4.35
East coast fever	1	4.35
Helminthes	1	4.35
Laxative	1	4.35
Fever in cows	1	4.35

4.5. Phytochemical Analysis of *Croton macrostachyus*: The phytochemical screening of the 80% ethanol, Chloroform, 0.1%Ferric chloride, 2ml Glacial, Nacl, Hcl, acetic acid, H_2SO_4 and distilled water extract of leaf of *Croton macrostachyus* revealed the presence of various phytochemical compounds such as terpenoids, flavonoids, saponins, cardiac glycosides, and phenols. Whereas tannins were not detected in these plant extracts **Table 6**.

TABLE 6: PHYTOCHEMICAL ANALYSIS OF *CROTON MACROSTACHYUS* LEAF EXTRACTS

Phytochemical compounds	Observation
Terpenes	+
Flavoinds	+
Tannins	–
Saponins	+
Cardiac glycosides	+
Phenols	+

Note: (+) indicates the presence of the compound and (-) Indicates absence of compound

DISCUSSION: The present systematic review indicates the medicinal importance of *Croton macrostachyus* in East Africa. This review depicted that a major portion of the population of East Africa relies on ethnoveterinary practice and locally available materials, primarily medicinal plants used to cure and prevent livestock health problems. A total of 20 studies area were reviewed and analyzed in detail on their distribution among region and countries, Method of preparation, Route of administration, and parts of Plant used.

From this systematic review, there is a difference in the distribution of medicinal plants among region and countries. The variation between the distribution of this medicinal plant depending on soil fertility, suitable climatic condition and good conservation strategy. Analysis of the data revealed that the highest proportion of ethnoveterinary practice was conducted in the Oromia region among Ethiopia states. Similar results were reported by [39].

From East Africa, Ethiopia was the area where ethnoveterinary practice was predominantly performed. This indicated local people do not rely only on modern drugs, the existence of abundant medicinal plant species, and the prevalence of the diseases. Next to Ethiopia, Kenya, and Tanzania, a country participated in ethnoveterinary practice in the least proportion. Analysis of data in this study indicated that the most commonly used plant parts for remedy preparation and widely employed by local healers were leaves, followed by roots and barks.

Similar findings have been reported by [56] from South Africa, [57] from Brazilian reported that leaves were the most dominant plant part in their studies. However, in contrast to this study, [58] from Mozambique have found that root was as the most part in their studies. In most of the studies, leaves were widely used plant parts than roots. The main reason of many traditional medicine practitioners used the leaf part for remedial preparation is due to its accessibility and to prevent the plant from extinction. According to [59], the leaf is an easily renewable part of the plant, and using plants for medicinal purposes may not affect the survival of a plant and does not cause a serious challenge of a stress factor for plants.

Other studies conducted in Ethiopia revealed leaf was indicated to be the most frequently sought plant part to treat livestock ailments due to the presence of pharmacologically active phytochemicals that are capable of eliciting biological activity [60].

Medicinal plants have various preparation methods for different ailments, and they have various preparation forms like decoction, crushing, juicing, infusion, chopping, powdering, and squeezing. Crushing and decoction were the most frequently used ways of remedy preparation, followed by juicing **Fig. 5**. Powdering was the least method of remedy preparation in the study area. The utilization and administration of the medicinal plants vary depending on the type of diseases [39]. A similar practice was carried out in research by [61], which stated that crushing was the most common method of remedy preparation in Pakistan. However, in contrast to this study [62] reported that powdering was the most frequently used method in remedy preparation. These all indicated that the method of remedial preparation for traditional medicinal plants were not common throughout the country.

Oral was the most frequently used route of remedy administration followed by topical and dermal **Fig. 4** in this study area. Most of the drugs prescribed by traditional healers were applied orally. This was in agreement with similar studies in other parts of the country [63] from Uganda, [64] from Tanzania, have found that the oral route was the most commonly used route of remedy administration in this studies area. Contrary to present studies, [65] from central Kenya reported that topical route was the commonest way of remedy administration by the local people to treat skin diseases.

The dominance of the oral route for remedy application could be due to its rapid onset of action and sustained physiological effect. Plant-based remedies were the first-choice weapons for the livestock healthcare demand of the local community, partly because of their affordability and accessibility as compared to modern medicine in the study area. Yet standard dosage and precise measurement were the common drawbacks of traditional herbal medicine [66]. A total of 18 major livestock ailments that can be treated by *Croton macrostachyus* was documented. In this study majority of traditional healers used this medicinal plant in the treatment of rabies and wound.

Rabies is one of the most important problems in the study area **Table 5**. In line with plants used in current study for the treatment of rabies, dried root of *Croton macrostachyus* are powdered and are given to dog with enjera, which suffered from rabies [67].

The phytochemical analysis conducted on the plant extracts revealed that the presence of constituents that are known to exhibit medicinal as well as physiological activities. The experiment conducted during the current study confirms the presence of terpenoids, flavonoids, saponins, cardiac glycosides and phenols. Alkaloids and coumarins were not performed in this study area due to a lack of chemicals. But tannins absent in these plant extracts. Previous research results also showed that tannins were not present in the *Croton macrostachyus* leaves extracts [68]. Therefore, the presence/absence of phytochemicals determines the medicinal properties of plants.

CONCLUSION AND RECOMMENDATIONS:

In the present study, systematic review and phytochemical screening procedure were conducted on *Croton macrostachyus* leaves extracts. The systematic review was conducted to document the medicinal importance of *Croton macrostachyus* in East Africa used by traditional healers. The phytochemical screening procedure able to determine phytochemical constituents present in the leaf's extracts. This medicinal plant was used to treat eighteen different animal ailments in East

Africa. The peoples of East Africa were shown in this study to have a wealth of knowledge about traditional veterinary medicines for treating and controlling their livestock diseases. The phytochemical screening test of leaf extracts depicted that the presence of terpenes, flavonoids, saponins, cardiac glycosides, and phenols. Tannins were not detected in the present work.

This finding has shown that there is a lack of precision in the determination of doses and side effects in the study area since there were variations in the units of measurement and the quantity of plant parts used. Hence the precision and standardization of dosages is one of the drawbacks for recognition of the traditional healthcare systems.

Based on the above conclusion, the following recommendations were forwarded:

- Studies should be conducted to determine the optimal dose, the concentration of the preparation, and the side effect of medicinal plants.
- The documentation, efficacy, and techniques of preparation of medicinal plants are highly recommended.
- Awareness creation should be needed among the traditional healers and communities are important measures to preserve their indigenous medicinal plants.
- Further study should be needed in the determination of phytochemical compounds on this medicinal plant.

ACKNOWLEDGEMENT: First and foremost, I would like to praise Jesus Christ that he gave me the power in order to sustain in my educational life cycle. Secondly, I would like to express my deep sense of appreciativeness towards my advisor Dr. Elias Kebede, for his professional advice, encouragement, providing reference materials, and devotion of his time to correct this senior research paper for the partial fulfillment of the requirements for the degree Bachelor of Veterinary Pharmacy.

Authors' Contributions: YT and EK; designed the protocol, extracted, analyzed and interpreted the data. YT, BD, FE, AM, EK, AM and ZR, prepared the manuscript. All authors read and approved the final manuscript.

CONFLICTS OF INTEREST: No conflict of interest

REFERENCES:

1. Pankhurst R: The status and availability of oral and written knowledge on traditional health care, Conservation and Sustainable Use of Medicinal Plants in Ethiopia Proceeding of The National Workshop on Biodiversity Conservation and Sustainable Use of Medicinal Plants in Ethiopia, IBCR, AA 2001; 92-106.
2. Yirga G: Ethnobotanical study of medicinal plants in and around Alamata, Southern Tigray Northern Ethiopia Current Research J of Biological Sciences 2010; 338-34.
3. Kebebew F: The status of availability of data of oral and written knowledge and traditional healthcare in Ethiopia. In conservation and sustainable use of medicinal plants in Ethiopia 2001; 107-19.
4. Rodrigues JC, Ascensao L, Bonet MÀ and Valles J: An ethnobotanical study of medicinal and aromatic plants in the Natural Park of Serra de São Mamede (Portugal). Journal of Ethno-pharmacology 2003; 89: 199-209.
5. Abebe D: Traditional medicine in Ethiopia, the attempt being made to promote it for effective and better utilization. SINET: Ethiopian J of Science 1986; 9: 61-69.
6. Salvat A, Antonacci L, Fortunato RH, Suarez EY and Godoy HM: Screening of some plants from Northern Argentina for their antimicrobial activity. Lett Applied Microbiol 2001; 32: 293-97.
7. Demissew S and Dagne E: Basic and applied research conservation and sustainable use of medicnal plants in ethiopia proceeding of the national workshop on biodiversity conservation and sustainable use of medicinal plants in Ethiopia, IBCR, AA 2001; 29-33.
8. Ketema T, Etana D, Spiridoula A, Adugna T and Houdij GJ: Ethnomedicinal study of plants used for treatment of human and livestock ailments by traditional healers in south Oromo, southern Ethiopia. J Ethnobiol Ethno med 2013; 9: 1-5.
9. Ahn K): The worldwide trend of using botanical drugs and strategies for developingglobal drugs. BMB Reports 2017; 50(3): 111-116.
10. Mairura FS: Croton macrostachyusHochst. Ex, Delile, in Plant Resources of Tropical Africa: Medicinal Plants 2008; 11: 203-06.
11. Krishnaiah D, Sarbatly R and Bono A: phytochemical antioxidants for health and medicine: A move towards nature. Biotechnology Mol Biol Rev 2007; 1: 97-104.
12. Mahato SB and Sen S: Advances in triterpenoid research, 1990-1994.Phytochemistry 1997; 44: 1185-1236.
13. Mathappa R, Prasanth V and Varira K: Pharmacognostical and preliminary phytochemical studies of *Urena lobata* Linn. Phytomed 2010; 2: 408-411.
14. WHO: planning for cost effective traditional health service in the new centure a discussion paper 2001. htt://www.who.or.jp/t-m/research/bkg/index.html.
15. Tashale S and Merga B: Ethnoveterinary Practices of Borana Pastoralists and their possible contribution to livestock production and management. Bull. Anim. Hlth. Prod. Africa 2004; 52: 21-29.
16. Newman DJ and Cragg GM: Natural products as sources of new drugs over the 30 years from 1981 to 2010. J Nat Prod 2012; 75(3): 311-35.

17. Owolabi MA, Coker H and Jaja SI: Flavonoid metabolites in urine after oral administration of the aqueous extract of Persea Americana to rats. J Nat Med 2007; 61: 2004.
18. Martin ME, Mathias KJ and McCorkle CM: Ethnoveterinary medicine: An annotated bibliography of community animal healthcare. ITDG Publishing, London, UK 2001.
19. Fabricant DS and Farnsworth NR: The value of plants used in traditional medicine for drug discovery. Enviromental Health Perspective 2001; 109: 69-75.
20. Leslie T: Plant Based drugs and medicines. International Journal of Herbal medicine 2016; 4940: 59-64.
21. Chopra A. and Doiphode V: Ayurvedic medicine; Core concept, therapeutic principles and current relevance medical clinics of North America 2002; 86:75-89.
22. Mendonça F: Bioactive phytocompounds. New approaches in the phytosciences. In Modern Phytomedicine Turning Medicinal Plants into Drugs (Eds. Ahmad, I, Aqil, F and Owais, M). WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim. 2006; 1-24.
23. Akerele O, Heywood V and Synge H: Conservation of medicinal plants Cambridge University Press, Cambridge UK 480pp.
24. Webster GL (1993): A provisional synopsis of the sections of the genus Croton (Euphorbiaceae). Taxon 1991; 42: 793-823.
25. Maroyi Al: Ethnopharmacological uses, phytochemistry, and pharmacological properties of *Croton macrostachyus* Hochst. Ex Delile: Evidence-Based Complementary and Alternative Medicine 2017. DOI: 10.1155/2017/1694671.
26. Mensah A, Muriuki G, Karanja G, Wandera C, Waibel R and Achenbach H: A constituent of the stem bark and twigs of *C. macrostachyus*. Fitoterapia 1992; 63(1): 81.
27. Burkill HM: The useful plants of West Tropical Africa. 2nd edition, Royal Botanic Gardens, Kew, Richmond, United Kingdom 1994; 636.
28. Kaufman PB, Cseke LJ, Warber S, Duke JA and Brielmann HL: Natural products from plants, CRC Press, Washington, D.C. 1999; 9-11.
29. Yibralign Z: Phytochemical investigation on the stem bark of *Croton macrostachyus*. In: thesis for M.SC Addis Abeba University 2007.
30. Wakjira K: Seed germination, physiology and Nursery Establishment of *Croton macrostachyus*. In graduate thesis for M.SC Addis Ababa university 2007.
31. Orwa C, Mutu A, Kindt R, Jamnadas R and Anthony S: Agroforestry Data base. a tree reference and selection guide version 4.0 2009.
32. Ayensus ES: Medicinal plants of West Africa. Alonal Michigan 48001 1978.
33. Ayoola GA, Coker HA, Adesegun SA, Adepoju AA, Obaweya K and Ezennia EC: Phytochemical screening and antioxidant activities of some selected medicinal plants used for malaria therapy in Southwestern Nigeria. Trop J Pharm Res 2008; 7: 1019-24.
34. Farnsworth NR: Phytochemical screening of the biologically active compounds from higher plants. J Pharm Sci 1996; 55: 227-76.
35. Salna K, Sreejith K, Uthiralingam M, Mithu A, John M and Albin T: Comparative study of phytochemicals investigation of *Andrographis paniculata* and *Murraya koenigi*. International Journal of Pharmacy and Pharmaceutical Sciences 2011; 3(3): 291-92.
36. Amsalu D, Ephrem E and Workineh SH: Evaluation of antidiarrheal activity of the leaf extracts of *Croton macrostachyus* hochst ex Del in mice model. Journal list of BMC medv 2016; 16: 5041311.
37. Teklay A, Abera A and Giday M: Ethynobotanical study of medicinal plants used in Kilte Awulaelo District of Tigray Region of Ethiopia. Journal of Ethyno Biology and Ethynomedicine 2013; 9(1): 65.
38. Yigezu Y, Demissew B and Wubeante Y: BMC Veterinary Research 2014, 10: 76. http://www.biomedcentral.com/1746-6148/10/76.
39. Sultan S and Alemu T: A survey on utilization of ethnomedicinal plants Nekemte town, East Wellega (Oromia), Ethiopia. Journal of Herbs, Spices & Medicinal Plants 2012; 18(1): 34-57.
40. Asayegn B and Abiy M: Ethnoveterinary practice in Chiro district Western Hararge, Ethiopia. Pharmacology Online 2009; 1: 128-39.
41. Wolde-Mariam M, Yayesh L and Shemsu U: Ethnobotanical Study of medicinal plants in Dega Damot woreda, North Ethiopia 2015; 5(2): 258-73.
42. Wondimu T, Kelbessa E and Asfaw Z: Ethynobotanical study of medicinal plants around Dheera town, Arsi zone, Ethiopia. J Ethnopharmacol 2007; 30(112): 152-61.
43. Feyissa T, Melaku M, Tilahun H, Tenna R and Nebiyu K: Ethnobotanical study of ethynoveterinary plants in kelemwollegazone, oromia region, Ethiopia. J Med Plants Res 2016; 312.
44. Eshetu G, Tewedros Y, Lidet B and Daniel F: Ethnoveterinary medicinal plants preparation and application methods by traditional healers in selected districts of southern Ethiopia 2015; 8(5): 674-84.
45. Tekle Y: An Ethynoveterinary botanical survey of medicinal plants in kochere district of Gedeon Zone Eastern Southern Nations Nationalities and People Regional State, Ethiopia. Journal of scientific and Innovative Research 2014; 3(4): 433-45.
46. Lulekal E, Asfaw Z, Kelbessa E and Van Damme P: Ethnomedicinal study of plants used for human ailments in Ankober District, North Shewa Zone, Amhara Region, Ethiopia. Journal of Ethnobiology and Ethnomedicine 2013; 9: 63.
47. Kebede A, Shimes A, Akalu M and Getachew M: An ethnoveterinary study of medicinal plants used for the Management of livestock Ailments in selected Kebeles of Dire Dawa Administration, Eastern Ethiopia. Journal of plant science 2017; 5(1): 34-42.
48. Zelalem G, Subramaniam C and Getnet M: Studies on traditional medicinal plants in Ambagiorgis area of Wogera District, Amhara Regionall State, Ethiopia. Int J Pure Biosci 2016; 4(2): 8-45.
49. Araya S, Balcha A and Giday M: Study of plants used in public and animal health management in Seharti Samre District Southern Tigray, Ethiopia. Journal of Ethnobiology and Ethnomedicine 2015; 11: 22.
50. Minang PA, van Noordwijk M., Freeman OE, Mbow C, de Leeuw J and Catacutan D: Climate-Smart Landscapes: Multifunctionality In Practice. Nairobi, Kenya: World Agroforestry Centre (ICRAF) 2015.
51. Okello SV, Nyunja R, Netondo GW and Onyango JC: Ethynobotanical study of medicinal plants used by sabaet of Mt. Elgon Kenya African Journal of Traditional, Complementary and Alternative Medicine 2010: 1-10.
52. Wanzala W, Takken WR, Pala AO and Hassanali A: Ethyno knowledge of Bukusu community on livestock tick prevention and control in Bungoma district, Western Kenya journal of Ethynopharmacology 2012; 140: 298-24.
53. Jeruto P, Mutai C, Ouma G and Lukhoba C: An inventory of medicinal plants that the people of Nandi used to treat malaria. Journal of Animal and Plant Science 2011; 9: 1192-1200.

54. Mbunde M, Ester I, Faith M and Anderson P: Ethynobotanical surveys and toxicity evaluation of medicinal plants used for remedy in the southern hign lands of Tanzani. J Intercuit Ethynophar 2017; 6(1): 84-96.
55. Minja M: medicinal plants used in the promotion of animal health in Tanzania. Rev Sci Tech of Int Epiz 1994; 3(3): 905-25.
56. Luseba D and Tshisikhawe MP: Medicinal plants used in the treatment of livestock diseases in vhembe region, Limpopo province, South Africa. J Med Plants Res 2012: 594.
57. Stasi D, Olivera LC, Carvalhaes GP, Queiroz-Junior MA, Tien M and Kakinami OS: Medicinal plants popularly usedin the Brazilian Tropical Atlantic Forest. Fitoterapia 2002; 73: 69- 91.
58. Ribeiro A, Romeiras MM, Tavares J and Faria MT: Ethnobotanical survey in canhane village district of massingar Mozambique; medicinal plants and traditional knowledge. J of Ethnobiol and Ethnomedicine 2010; 8: 6.
59. Abiyu E, Zemed A, Ensermu K and Raja N: Status of medico-cultural plants at Fiche town market, Ethiopia. Ethnobotanical study of medicinal plants in and around Fiche district, centeral Ethiopia. Curr Res J Bio Sci 2014; 6(4): 154-67.
60. Tashale S and Merga B: Ethnoveterinary Practices of Borana Pastoralists and their possible contribution to livestock production and management. Bull Anim Hlth Prod. Africa 2004; 52: 21-29.
61. Hassan H, Waheed M, Akash T and Ashaq A: Ethnoveterinary study of medicinal plants in malakand valley, Pakistan district 2014; 67: 6.
62. Mesfin F, Talemos S and Abreham A: An ethnobotanical study of medicinal plants in Amaro Woreda, Ethiopia. Ethnobotany Research and Application 2014; 12: 341-54.
63. Tabuti J, Collins B, Daniel K and Ossy MJ: Herbal medicine use in the district of Nakapiripirit, Pallisa, kanungu and Mukono in Uganda. J Ethnobiology Ethnomedicine 2012; 8: 35.
64. Amri1 E and Kisangau DP: Ethnomedicinal study of plants used in villages around Kimboza forest reserve in Morogoro, Tanzania. Journal of Ethnobiological and Ethnomedicine 2012; 8: 1.
65. Njoroge GN and Bussmann RW: Ethnotherapeutic management of skin diseases among the Kikuyus of Central Kenya. Journal of Ethnopharmacology 2007; 111: 303-07.
66. Abebe D and Ayehu A: Medicinal plant and eningmatic health practice of north Ethiopia 1993.
67. Megersa M: Ethnobotanical study of medicinal plants in wayu Tukawereda, East Wollega zone of Oromia Region, Ethiopia. Msc thesis, Addis Ababa University 2010.
68. Abebayehu A, Mammo F and Kibret B: isolation and characterization of terpenes from leaves of *Croton macrostachyus*. Journal of Medicinal Plant Research 2016; 10(19): 256-69.

How to cite this article:
Tefera Y, Dessalegn B, Endeshaw F, Mulaw A, Kebede E, Melaku A and Reta Z: A systematic review on medicinal importance and phytochemical screening of *Croton macrostachyus* leave extracts in East Africa. Int J Pharmacognosy 2021; 8(1): 1-13. doi link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.8(1).1-13.