World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 4.223

KAMPILLAKA (MALLOTUS PHILLIPENSIS): A WONDER DRUG IN AYURVEDA- A REVIEW

Dr. Sonali Bihana*[1] and Dr. Shweta Dewan[2]

[1]Assistant Professor, Department of Dravya Guna, LBS Ayurveda Medical College, Bilaspur.
[1]Assistant Professor, Department of Basic Principles, LBS Ayurveda Medical College, Bilaspur.

***Corresponding Author: Dr. Sonali Bihana**
Assistant Professor, Department of Dravya Guna, LBS Ayurveda Medical College, Bilaspur.

Article Received on 21/04/2017 **Article Revised on 10/05/2017** **Article Accepted on 01/06/2017**

ABSTRACT

Introduction: *Kampillaka (Mallotus philippensis Muell Arg)* is the native of North West region. *Kampillaka* is one of the herbs mentioned in all ancient scriptures of Ayurveda. It has various synonyms like *ranjana* (colouring agent), *recanaka* (purgative), *raktacurnaka* (red powder), *karkasa* (rough) etc. It was used as a medicine from Vedic period as Takma Nashan. It is observed that the drug is used in 44 formulations, indicated in more than 20 disease conditions including *krimiroga* (worm infestation), *twacha roga* (skin disease),*vibandha, gulma, vruna, shleshmodara, arsha, shula, jwara, prameha* etc. Useful part of the plant is phalaraja and it should be administered internally after passing through shodhana procedures. It is used in various dosage forms such as *churna, vati, varti, kalka, taila, ghruta,* and *malahara. Kampillaka*, as one of the audbhida dravya, can be traced since samhita period for its use in virechana. In higher doses *kampillaka* is found to produces nausea, purging and severe spasmodic pain. . In ancient times, its leaves were used in yagya and its wood was used to make wooden mixer Acetylaleuritolic acid,Coroglaucigenin, Sitosterol, Octacosanol,β –Sitosterol, glycoside, Isorotrlerin. **Materials and methods:** The concerned classics were explored and the subject matter was compiled and analyzed. **Discussion**: Fruit and bark of plant contain condensed tannins responsible for antioxidant activity. Some novel chalcone derivatives, mallotophilippens C, D, and E, were isolated from the fruits of M. philippinensis. Mallotoxin or rottlerin has great anticancerous potential. Among the ever-anticancer agents, rottlerin appears to have great potentiality for being used in chemotherapy. **Conclusion:** The great potential of Mallotus philippinensis cannot be overlooked. There are many medical fields like cancer department where with help of this wonder drug more advances can be expected and the contribution of Ayurveda in the global health segment can be recognized.

KEYWORDS: *Kampillaka, Mallotus phillepensis, ranjana, rechaka.*

INTRODUCTION

Kampillaka (Mallotus phillipensis): Acharya Charaka has mentioned it as one of *phalini dravya,*[1] whereas Acharya Sushruta quoted it in *Shyamadi varga*[2] Acharya Vagbhata also mentioned it in *virechana.* Bhavaprakasa has cited it to be useful in bleeding, diabetes and urinary stones. Dhanvantari Nighantu has praised it as a valuable remedy for flatulence, worms, constipation, ascites due to kapha and cough etc A small much branched tree, young leaves and inflorescence tawny or rusty pubescent. Natural reproduction takes place by seeds which fall to the ground in the beginning of the hot season and germinate in the ensuing rainy season. Artificial propagation is done by sowing fresh seeds in the April. Vegetable adulterants commonly used are powdered stem bark of Casearia tomentosa, powdered fruits of *Ficus bengalensis*, ground safflower (*Carthamus tinctorius*) and fruit hairs of *Flemingia macrophylla*.The major chemical constituents of *Kampillaka* are Acetylaleuritolic acid, Cortotoxigenin, αamyrin, Coroglaucigenin, Sitosterol, Octacosanol, βSitosterol, glycoside, Isorotrlerin. Varoius preparations like Kanakakshiri Tailam, Patolamuladya Churna, Mahavajraka Tailam, Dhanvantram Ghrutam, Bindu Ghrutam, Mahabindu Ghrutam are commonly used in various diseases like *Bhedi, Deepana, Hridya, Kaphahara, Kasahara, Pittahara, Raktadoshahara, Vatahara, Vrana Nashana, Virechana, Visha hara.*

MATERIALS AND METHODS

The concerned classics were exhaustively studied and the compilation was analysed and written in a vernacular manner for easy understanding of the subject.

Vernacular Names

Indian language

Assam : Lochan, Gangai, Puddum
Bengali : Kamlagudi, Kamala gundi
Gujarati : Kapilo,
Hindi : Kabila, Sindur, Kamala, Kambhal, Kambila, Raini, Rohni, Roini,
Kannada: Chandrahettu, Kapila, Kapilathettu
Kashmiri: Kaimbil, Kameelak
Malayalam: Kampippala, Kampipalu, Kapila, Chenkolli, Kuramatukka, Ponni
Marathi : Sinduri, Shendri, Kapila
Orissa : Kmalagundi
Punjabi : Kamila, Kambal, Kumila, Kampila
Tamil : Kungumam, Kurangumanjanatti, Kabilam, Kopilapodi
Telugu : Kampillamu, Chendiramu, Kunkuma
Tulu : Ponne
Urdu : Kamila, Kalileh

Foreign language

Arabic : Kampileh
Burma : Tanthieden, Tawtheeteng, Tawthidin
Ceylon : Kapila
English : Kamala, Monkey face Tree
Nepal : Safed mallata, Sinduria
Persia : Kampileh, Kanbela

Morphological Characters OF *Mallotus philippensis Muell. Arg.*

A small much branched tree, younf leaves and inflorescence tawny or rusty pubescent.

Leaves: alternate, variable, 7.5-15cm by 3.2-7.5cm, ovate or ovate lanceolate, acuminate, entire or slightly toothed, glabrous above, pubescent and with numerous orbicular red glands beneath, base round or acute, reticulately veined, strongly three nerved at the base and with 4-7 pairs of nerves above the basal ones.
Petiole: 2.5-5 cm long, cylindrical, fulvous-pubescent, with two small sessile glands one on each side of summit.
Flowers: dioecious, small.
Male Flowers: clustered, sessile or very shortly pedicellate, in erect terminal spikes which are usually several together and often longer than the leaves.
Sepals: 4(rarely5), 3mm long, lanceolate acute.
Stamens: numerous.
Bracts: 1.5mm long, broadly ovate, acute. Buds are globosely ovoid.
Female flowers: sessile or nearly so, in short spikes.
Calyx: divided nearly to the base.
Sepals: 3or4, thicker than in the male, ovate-lanceoalte.
Ovary: with red glands, three-celled.
Style: 3, simple, papillose.
Fruit: is a capsule. 8-13mm in diameter, three lobed, loculicidally 3-valved and covered with a bright red powder consisting of minute stellate hairs and fine grains of a red resinous substance soluble in alcohol and ether.
Seeds: 4mm in diameter, subglobose, black.

Flowering and Fruiting

It flowers in September - November and fruits in February – March. Flowering and fruiting stage fall during post rainy season to summer.

Propagation and Cultivation

Natural reproduction takes place by seeds which fall to the ground in the beginning of the hot season and germinate in the ensuing rainy season. Artificial propagation is done by sowing fresh seeds in the April. The more vigorous seedlings are ready for transplanting during the first year. Smaller ones may be kept for another year in nursery. The tree also reproduce from root suckers but the growth is very slow. The tree can stand considerable shade and is frost-hardy and drought resistant. It coppices well.

The tree is not cultivated on a plantation scale anywhere at present. It is widely distributed in forest lands throughout India and collection of ripe fruit is not organized.

Collection

The red pubescence is separated from ripe fruit by beating and shaking; it may be obtained also by stirring the fruits vigorously in water, when the dye settles down as a sediment; the sediment is collected, dried and pieces of pericarp and other refuse separated by sifting.[3]

Controversies

No controversy as such. Some people may take '*Euphorbia tirucallai'* plant (indian tree spurge; milk bush- English) known in Gujarati as kharsandi or dandalio thor as *kampillaka.* The whole plant is full of latex and is poisonous. This plant is known as 'kampipala' in Malayalam. So thinking it to be apbhrashta of *kampillaka*, they have made this mesh.

One controversy is also there whether it is a plant or mineral because it is mentioned both in Samhita text as well as in the Rasashatra books concluded that a red clay-sand obtained from Saurashtra as *kampillaka* of Rasashastra. This perfectly matches with the textual description.

Adulterants[4]

It is often impure due to careless collection, fraudulent admixture and contamination with sand and other inorganic impurities. It is commonly adulterated with Annato dye (Bixa Orellana), ferric oxide, brick dust and ferruginous sand. Vegetable adulterants commonly used are powdered stem bark of *Casearia tomentosa*, powdered fruits of *Ficus bengalensis*, ground safflower *(Carthamus tinctorius*) and fruit hairs of *Flemingia macrophylla.*

Rasapanchaka[5]

A drug perform its therapeutic actions with the help of rasa panchaka i.e. rasa, guna, virya, vipaka and prabhava. There is no controversy regarding its rasapanchaka among nighantus. They all have described it as follow:-

Rasa : *Katu*
Guna : *Laghu, Ruksha, Tikshna*
Virya : *Ushna*
Vipaka : *Katu*
Prabhava: *Krumighna (Nighantu Adarsh)*

Toxicology[6]

The approximate lethal dose of rottlerin in rat was 750mg/kg. tha plant extract was found to trematodes; alcoholic extract being most effective in vitro and in vivo. Death of worms commenced 60 and 90 min after addition of alcoholic extract (1:100 concentration) and aqueous extract (1:25 concentration) respectively.

Phytochemistry[6]

The therapeutic actions of a drug depends upon its constituents. Some of the important constituents of *Kampillaka* are as follow:

Acetylaleuritolic acid, Cortotoxigenin, α- amyrin, Coroglaucigenin, Sitosterol, Octacosanol, β –Sitosterol, glycoside, Bergenin Rottlerin, Isoallorottlerin Isorottlerin, Kamalin,1, Wax, Kamalin2, homorottlerin Phorbic acid, Gum, Bergenin, Citric and oxalic acids, Tanins, Volatile oil

Pharmacognostic Evaluation of *Mallotus philippinensis*

Morphological study shows that fruit depresses globose and is three-lobed capsule, 5–7 mm 8–10–12 mm, stellate-puberulose, and with abundant orange or reddish glandular granules. Seeds are subglobose and black in color. Organoleptic property of the red fruit shows that it is tasteless and odourless. Microscopic description showed the presence of epicarp, which contained a compactly packed layer of mucilaginous cells, and mesocarp composed of columnar cells which are closely arranged. Its polygonal cells are compactly arranged in 2-3 layers. Presence of lignified vascular arrangement has been observed in the transverse section.[20]

Pharmacological Activities

1. Antifilarial Activity

The effect of aqueous and alcoholic leave extracts of M. philippinensis (Lam.) Muell. was studied on the spontaneous movements of the whole worm and nerve-muscle (n.m.) preparation of Setaria cervi and on the survival of microfilariae in vitro. Both the extracts result in inhibition of spontaneous motility of whole worm and the n.m. preparation of S. cervi characterized by initial stimulation followed by depression in amplitude. The tone and rate of contractions remained visibly unaffected. Aqueous extract at higher concentration showed immediate reduction in tone. The concentration required to inhibit the movements of n.m. preparation was 1/5th for aqueous and 1/11th for alcoholic extract compared to that for the whole worm, suggesting a cuticular permeability barrier. The stimulatory response of acetylcholine was blocked by aqueous extract on whole worm movements. On the microfilariae the LC50 and LC90 were 18 and 20 ng/mL for aqueous and 12 and 15 ng/mL for alcoholic extracts, respectively.[7] Further study will be required to evaluate the same activity with its phytochemicals.

2. Antifertility Activity

Seeds extract of M. philippinensis exhibits adverse effects on different reproductive parameters of female rats. According to the study, extract reduces serum FSH and LH levels, probably by affecting hypothalamic/pituitary axis in experimental animals. This reduced level may affect follicular development, quality of ovulated eggs, corpus luteum formation, estrus cycle, and maintenance of pregnancy in rats.[8] This antifertility effect of plant extract is supposed to be caused by rottlerin, a phloroglucinol derivative. Acetyl rottlerin may be active, but isorottlerin is either inactive or slightly active. Effect of pure rottlerin can be further studied so as to clarify the potential of phloroglucinol derivatives.

3. Antibacterial and Antifungal Activity

A series of 61 Indian medicinal plants belonging to 33 different families used in various infectious disorders were screened for their antimicrobial properties. Screening was carried out at 1000 and 500 µg/mL concentrations by agar dilution method against Bacillus cereus var mycoides, Bacillus pumilus, Bacillus subtilis, Bordetella bronchiseptica, Micrococcus Luteus, Staphylococcus aureus, Staphylococcus epidermidis, Escherichia coli, Klebsiella pneumonia, Candida albicans, and Saccharomyces cerevisiae. Twenty-eight plant extracts showed activity against at least one of the test organisms used in the screening. On the basis of the results obtained, study concludes that the crude extracts of M. philippinensis exhibited significant antimicrobial activity and properties that support folkloric use in the treatment of some diseases as broad-spectrum antimicrobial agents. Steam bark of plant and its chloroform fractions and the methanolic extract significantly inhibit the pathogenic bacteria with significant zones of inhibition comparable to the standard drug used. However, the hexanic extract did not show any significant activity. Glandular hair of fruits of Mallotus exhibits significant antibacterial activity against human pathogenic bacteria with MIC ranging 15–20 mg/mL. This extract does not show any inhibition against different species of candida. This shows that fruit extract possesses antibacterial activity without any antifungal potential. The results of the study may justify the use of the plant against bacterial pathogens. This probably explains the use of these plants by the indigenous people against a number of infections.[9]

However, ethanolic extract shows potent anti-Helicobacter pylori activity at the concentration of 15.6–31.2 mg/L against eight H. pylori strains. Further purification of extract revealed that rottlerin exhibits potent bactericidal effect with minimal bactericidal concentration (MBC) of 3.12–6.25 mg/L against different resistant strains of clarithromycin and metronidazole including Japanese and Pakistani strains.

4. Anti-Inflammatory and Immunoregulatory Activity

Chalcones derivatives from the fruits of M. philippinensis and mallotophilippens C, D, and E (Figures 12, 13, and 14) inhibit nitric oxide (NO) production and inducible NO synthase (iNOS) gene expression by a murine macrophage-like cell line (RAW 264.7), which was activated by lipopolysaccharide (LPS) and recombinant mouse interferon-gamma (IFN-gamma). Further investigations suggest the downregulation of cyclooxygenase-2 gene, interleukin-6 gene, and interleukin-1b gene expression. The above results show that these chalcones have good anti-inflammatory and immunoregulatory effects.[10]

5. Antioxidant Activity and Antiradical Activity

Different fractions of bark and fruit of Mallotus were studied for its total antioxidant activity (TAA) and antiradical activity against DPPH on a Sephadex LH-20 column using ethanol and acetone-water as mobile phase. Among different extracts, bark fraction showed the strongest antiradical activity (TAA value—5.27 mmol Trolox equiv./g) and reducing power. Another extract, that is, phenolic fraction, shows TAA ranging from 0.58 mmol Trolox/g (fraction I) to 6.82 mmol Trolox/g (fraction IV); this is the strongest fraction showing antiradical activity against DPPH and reducing power. TAA of other extracts ranged from 0.05 to 1.79 mmol Trolox equiv./g.[11]

6. Protein Inhibition Implicated in Cancer Processes

Protein kinase is inhibited with some specificity for PKC by rottlerin, a compound isolated from Mallotus. Inhibition of PKC appears due to a strong competition between rottlerin and ATP. CaM-kinase III is suppressed by rottlerin as effectively as PKC δ, among different protein kinases tested. Novel inhibition property and improved selectivity for a distinct PKC isoenzyme of rottlerin are suggestive from its chemical structure. Rottlerin is also very potent in blocking other kinases including Akt/PKB.[12]

7. Hepatoprotective Activity

Methanolic extract of M. philippinensis leaves decreases the CCl4-induced elevation in biochemical parameters (SGOT, SGPT, SALP, direct bilirubin, total bilirubin, and MDA) on pretreatment at doses 100–200 mg/kg and also reversed the functional and antioxidant parameters. This study suggests that leave extract was effective in functional improvement of hepatocytes. Histopathological studies also suggest the hepatoprotective activity of plant.[13]

8. In Vitro Cytotoxicity against Human Cancel Cell

Glandular hair extract of Mallotus fruit powder was assayed against 14 human cancer cell lines among different fractions; 95% ethanolic extract showed the highest cytotoxic effect as compared to 50% ethanolic and aqueous portion. Further, the chromatographic analysis of the said fraction afforded a polyphenolic molecule rottlerin in Mallotus plant.[14]

9. Purgative Activity and Anthelmintic Activity

A significant purgative effect after an oral dose (120 mg/kg) in rats was assessed from resins isolated from plant. Its effect was evaluated from the weight of faeces as well as from surface area of blotting paper soaked by liquid faeces. The anthelmintic effect on tape worm was evaluated in albino rates, from the resin of the plant showed lethal effect of 35.69% and 78.21% respectively in small intestine in concentrations 60 and 120 mg/kg respectively.[15,16]

10. Antituberculosis Activity

Organic extract of plant after bioassay-directed fractionation yields five compounds, the most active of which against Mycobacterium tuberculosis was a new compound, 8-cinnamoyl-5,7-dihydroxy-2,2-dimethyl-6-geranylchromene for which the name mallotophilippen F is suggested. The second compound 8-cinnamoyl-2,2-dimethyl-7-hydroxy-5-methoxychromene was isolated from a natural source for the first time, while the remaining three compounds, rottlerin, isoallorottlerin, or isorottlerin and the so-called "red compound," 8-cinnamoyl-5,7-dihydroxy-2,2,6-trimethylchromene, had been already isolated from this plant. Isolated compounds were identified by 2D-NMR and C-13 NMR. Ethanolic extract of plant was assayed for antimycobacterial activity against M. smegmatis by disc diffusion assay. Further antituberculosis potential of leaves extract was identified by radiometric BACTEC assay; result revealed that ethanolic extract of M. philippensis showed antituberculosis activity against virulent and avirulent strains of M. tuberculosis H37Rv and M. tuberculosis H37Ra with minimum inhibitory concentrations of 0.25 and 0.125 mg mL−1, respectively. The inhibition in growth index values of M. tuberculosis was observed in the presence of ethyl acetate fraction at a minimum concentration of 0.05 mg mL−1. It suggests that ethanolic and ethyl acetate fraction of plant possesses significant antimycobacterial activity. Steam bark of M. philippinensis has also been reported for its antitumor promoting effect, which was due to the presence of 3α-Hydroxy-D: A-friedooleanan-2-one.

11. Antiallergic Activity

M. philippinensis fruit contains two new phloroglucinol derivatives, mallotophilippens A and B (Figures 10 and 11) which were identified, using chemical and spectral data, as 1-[5,7-dihydroxy-2,2-di-methyl-6-(2,4,6-

trihydroxy-3-isobutyryl-5-methyl-benzyl)-2H-chromen-8-yl]-2-methyl-butan-1-one and 1-[6-(3-Acetyl-2,4,6-trihydroxy-5-methyl-benzyl)-5,7-dihydroxy-2,2-dimethyl-2H-chromen-8-yl]-2-methyl-butan-1-one, respectively. These compounds inhibited the production of nitric oxide (NO) and inducible NO synthase (iNOS) gene expression by a murine macrophage-like cell line (RAW 264.7), which was activated by lipopolysaccharide (LPS) and recombinant mouse interferon-g (IFN-g). Further, phloroglucinol derivatives inhibit histamine release from rat peritoneal mast cells induced by compound 48/80. This study suggests its anti-inflammatory activity. Rottlerin has been tested in animal models of IgE-dependent anaphylaxis and the antiallergic mechanisms of action in mast cells. Antiallergic action of rottlerin has been tested in passive cutaneous anaphylaxis and passive systemic anaphylaxis mouse models and in anaphylactic contraction of bronchial rings isolated from sensitized guinea pigs. This experiments proves antiallergic effect of rottlerin by blocking IgE-induced mast cell degranulation. This report suggests the use of rottlerin in mast cell-mediated allergic disorders including urticaria and allergic asthma.[17]

12. Anti-Leukaemic Activity

Root extract of M. philippinensis was tested on human promyelocytic leukemia HL-60 cell proliferation, cell cycle regulators, and apoptosis in order to investigate its antileukemic effect. Hexane fraction showed promising toxicity against p53-deficient HL-60 cells (IC50 1.5 mg dry roots equivalent/mL medium) after 72 h and, interestingly, inhibition of cell proliferation was preceded by the upregulation of the protooncogenes Cdc25A and cyclin D1 within 24 hours suggesting its antileukemic effect in HL-60 cells. After isolation and identification by GC-MS, polyphenols were the main compounds of the hexane extract that inhibited proliferation and induced apoptosis.

13. Antiproliferative Activity

Antiproliferative effect was evaluated against Thp-1 cell lines from the isolated compounds of M. philippinensis fruit extract, in which 4′-hydroxyrottlerin showed 54% growth inhibition of Thp-1 cell line. Other isolated compounds were also tested against different fungi and were found to be very effective IC50 values.

14. Anti-HIV Activity

Four phloroglucinol derivatives, named mallotophenone (5-methylene-bis-2,6-dihydroxy-3-methyl-4-methoxyacetophenone), mallotochromene (8-acetyl-5,7-dihydroxy-6-(3-acetyl-2,4-dihydroxy-5-methyl-6-methoxybenzyl)-2,2-dimethylchromene), mallotojaponin (3-(3,3 (dimethylallyl) S-(3(acetyl-2,4-dihydroxy-5-methyl-6-methoxybenzyl)-phloracetophenone), and mallotolerin (3-(3-methyl-2-hydroxybut-3-enyl)-5-(3-acetyl-2,4-dihydroxy-5-methyl-6-methoxybenzyl)-phloracetophenone), were tested for their ability to inhibit the activity of human immunodeficiency virus-(HIV-) reverse transcriptase. The mode of inhibition of mallotojaponin was found to be competitive with respect to the template primer, (rA)n (dT)12–18, and noncompetitive with respect to the triphosphate substrate, dTTP. The Ki value of mallotojaponin for HIV-reverse transcriptase was determined to be 6.1 Mm.[18]

15. Wound Healing and Mesenchymal Stem Cell (MSC) Proliferation

Bark extract of Mallotus philippinensis has been tested in vitro for wound healing activity by examining the proliferation and migration of MSCs. KUM6 cells proliferation and migration have been enhanced at 0.16–4 μg/mL and unregulated the activity of MSCs by secreting various cytokines to wounded site from bone marrow to systemic circulation and finally remodel wounded tissues.[19]

DISCUSSION

Medicinal plants have been clinically used and its interest has been dramatically increased over the past decades throughout the world and its formulations are increasingly cited in media. Daily consumption of the natural products and their formulations by an extensive number of patients lead to serious concern for scientist to study its efficacy and safety. Because of extensive use and its benefits, natural products in many countries are regulated both as medicinal products and as food supplements, often labelled as natural food supplements. Traditional use and its growing demand for Mallotus philippinensis and its other species lead to compile this review and commented on the current knowledge provided by clinical and preclinical research on the effect of this plant.

Mallotus philippinensis has been widely used as traditional medicine in several parts of countries including India. Every part of this plant possesses its specific medicinal properties and is used mainly in ayurveda to fight against intestinal worms in domestic and grazing animals when administered with jaggery. However, only a few reports are attributed to this plant and its different parts and there is a large scope for investigation. Hence, it is required to explore more of its potential within the field of medicinal and pharmaceutical sciences for novel and fruitful application of this plant in form of natural formulation. Along with this medicinal importance, this plant is used against human pathogens including H. pylori, anti-inflammatory activity, antioxidant, antiradical, protein inhibition, hepatoprotective, antiallergic, anti-HIV activity, and many more. Phytochemical investigation revealed that a large number phenol derivatives and several miscellaneous compounds from different classes have been isolated from this species. The phenols, diterpenoids, steroids, flavonoids, cardenolides, triterpenoids, coumarins, and isocoumarins are mostly distributed in all parts of the plant. The other major isolated pure compounds from this species mostly belong

to phenolic group exhibiting most of the biological activity. Various types of extracts from different parts and single compounds derived from this species have been found to possess biological activities, including antioxidant, antimicrobial, anti-inflammatory, cytotoxicity, and immune modulatory. Fruit and bark of plant contain condensed tannins responsible for antioxidant activity. Some novel chalcone derivatives, mallotophilippens C, D, and E, were isolated from the fruits of M. philippinensis. Mallotoxin or rottlerin has great anticancerous potential. Among the ever-anticancer agents, rottlerin appears to have great potentiality for being used in chemotherapy. Rottlerin will become a potential molecule for research in future to treat cancerous cell as it will affect cell machineries involved in apoptosis, survival, and autophage. This suggests the view that this species has potential to be a beneficial chemotherapeutic remedy.

CONCLUSION

In summarized view, this review confirms the great potential of *Mallotus philippinensis*. As very limited information is still known for this species, it leads us to continue the study on different species of Mallotus plant and its interesting pharmacological properties. Further natural product chemistry of isolated moiety and its structural analysis of compounds responsible for these activities will be an interesting field of research. Although the data and other reports provided that this medicinal plant is of great biological use in different pharmacological activities including anticancer, further research is needed in different areas regarding the toxicity and efficacy of pure phytochemicals isolated from different parts of this plant. More data will be needed from preclinical and clinical studies on humans to clarify its potency and safety, as lack of knowledge with respect to its adverse effects and methodological accuracy in the literature limits towards its standardized formulation. Furthermore, the mechanism of action of the phytochemicals and extract of *Mallotus philippinensis* is unclear; more exhaustive studies are expected in the future years to explore its mechanism and structure activity relationship among various constituents. Thus the Indian traditional medicine Ayurveda can contribute its part in the health sector at National and International level if such researches on the drug are presented in scientific manner. The world seeks the methods to invest in traditional and herbal therapies after the advent of serious side effects of allopathic drugs and invasive techniques. Ayurveda can satisfactorily filled this block if more and more researches are done in the same field so that world and the scientific community can acknowledge the unmapped power of Ayurveda.

REFERENCES

1. Charaka, Charakasamhita, with commentary of Chakrapanidatta, Ed. Jadavji Trikamji, chikitsasthana, 5th chapter/105, chowkambhasanskritsansthanvaranasi, 2009; 441.
2. Sushruta, sushrutasamhita, with commentary of Dalhana, Ed. JadavjiTrikamji, sutrasthana, 38th chapter/ 29, chowkambhaorientaliavaranasi, 2005; 166.
3. C. Orwa, A. Mutua, and R. Kindt, "Agroforestree Database: a tree reference and selection guide," Version 4. 0, 2009.
4. F. Ahmad and S. Hashmi, "Adulteration in commercial Kamila (Mallotus philippinensis Muell.) an anthelmintic drug of repute," Hamdard Medicus, 1995; 38: 62–67.
5. Bhavamishra Bhavaprakashanighantu, Comment ary by KC Chunekar, GS Pandey, chaukhambabharati academy varanasi, 2006; 66.
6. Sharma. P.C, Yelne.M.B, Denris.T.J. Kampillaka, Mallotusphilippinensis. In databasemedicinal plants used in Ayurveda, New Delhi, India: CCRAS, 2002; 104
7. R. Singh, K. C. Singhal, and N. U. Khan, "Antifilarial activity of Mallotus philippinensis Lam. on Setaria cervie (Nematoda: Filarioidea) in-vitro," Indian Journal of Physiology and Pharmacology, 1997; 41(4): 397–403.
8. S. C. Thakur, S. S. Thakur, S. K. Chaube, and S. P. Singh, "An etheral extract of Kamala (Mallotus philippinensis (Moll. Arg) Lam.) seed induce adverse effects on reproductive parameters of female rats," Reproductive Toxicology, 20(1): 149–156.
9. M. Gangwar, D. Kumar, R. Tilak et al., "Qualitative phytochemical characterization and antibacterial evaluation of glandular hairs of Mallotus philippinensis fruit extract," Journal of Pharmacy Research, 2011; 4(11): 4214–4216.
10. A. Daikonya, S. Katsuki, and S. Kitanaka, "Antiallergic agents from natural sources 9. Inhibition of nitric oxide production by novel chalcone derivatives from Mallotus philippinensis (Euphorbiaceae)," Chemical & Pharmaceutical Bulletin, 2004; 52(11): 1326–1329.
11. M. Arfan, K. Hazrat, and K. Magdalena, "Antioxidant activity of phenolic fractions of Mallotus philippinensis bark extract," Journal of Food Science, 2009; 27(2): 109–117.
12. Y. Choi, D. K. Kim, S. S. Kang, J. K. Sonn, and E. J. Jin, "Integrin signaling and cell spreading alterations by rottlerin treatment of chick limb bud mesenchymal cells," Biochimie, 2009; 91(5): 624–631.
13. S. Ramakrishna, K. M. Geetha, P. V. V. S. Bhaskar gopal, R. P. Kumar, C. P. Madav, and L. Umachandar, "Effect of Mallotus Philippinensis Muell.-Arg leaves against hepatotoxicity of Carbon tetrachloride in rats," International Journal of Pharmaceutical Sciences and Research, 2011; 2: 74–83.
14. V. Sharma, "A polyphenolic compound rottlerin demonstrates significant in vitro cytotoxicity against human cancer cell lines: isolation and characterization from the fruits of Mallotus

philippinensis," Journal of Plant Biochemistry and Biotechnology, 2011; 20(2): 190–195.
15. S. S. Gupta, P. Verma, and K. Hishikar, "Purgative and anthelmintic effects of Mallotus philippinensis in rats against tape worm," Indian Journal of Physiology & Pharmacology, 1984; 28(1):63–66. View at Google Scholar.
16. A. Hussain, M. N. Khan, Z. Iqbal, and M. S. Sajid, "An account of the botanical anthelmintics used in traditional veterinary practices in Sahiwal district of Punjab, Pakistan," Journal of Ethnopharmacology, 119(1).
17. T. K. Chan, S. W. David, C. Cheng, S. P. Guan, H. M. Koh, and W. S. Wong, "Anti-allergic actions of rottlerin from Mallotus philippinensisis in experimental mast cell-mediated anaphylactic models," Phytomedicine, vol. 20, no. 10, pp. 853–860, 2013T. K. Chan, S. W. David, C. Cheng, S. P. Guan, H. M. Koh, and W. S. Wong, "Anti-allergic actions of rottlerin from Mallotus philippinensisis in experimental mast cell-mediated anaphylactic models," Phytomedicine, 2013; 20(10): 853–860.
18. H. Nakane, M. Arisawa, A. Fujita, S. Koshimura, and K. Ono, "Inhibition of HIV-reverse transcriptase activity by some phloroglucinol derivatives," FEBS Letters, 1991; 286(1-2): 83–85.
19. T. Furumoto, N. Ozawa, Y. Inami et al., "Mallotus philippinensis bark extracts promote preferential migration of mesenchymal stem cells and improve wound healing in mice," Phytomedicine, 2014; 21(3): 247–253.
20. V. R. Sharma, "A review on endangered plant of Mallotus philippinensis (Lam.) M.Arg," Pharmacologyonline, 2011; 3: 1256–1265.