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Review Article

Phytochemical and Pharmacological Properties of *Calpurnia Aurea*, Review

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Abstract

Calpurnia aurea plant belongs to in the fabaceae family and in the general of Calpurnia is a widely consumed medicinal plant in east Africa such as Ethiopia and Eritrea. It used to treat diseases like amoebiasis, giardiasis, dysentery, syphilis, malaria, exoparasite, diarrhea and snake bite. Many scientific papers available about it's phytochemical and pharmacological activities. This review was focused on the Ethnobotay, phytochemistry and the biological activities of Calpurnia aurea plant using different scientific articles, books and reports available online in academic searching sites such as Google scholar, PubMed, Scoups, ProQuest and Web of science. Based on the review all parts of the plant reported to have secondary metabolites such as flavonoids, terpenoids , alkaloids, glycosides, tannins and steroids and, biological activities such as antioxidant, antibacterial, anticancer, antimalarial, anti-diarrheal, antiextoparasite and insecticidal activities. Bioactive chemical compounds also reported from stem, leaves, bark and seeds of Calpurnia aurea plant in different classes such as alkaloids, flavonoids, glycosides and terpenoids. Based on the information gathered from the chemical constituent and pharmacological properties of the plant part Calpurnia aurea is confirmed the traditional medicinal use but further work is required related to isolation of more bioactive compounds and to investigate biological activities in advanced techniques including Insilco methods to contribute for modern drug discovery.

Keywords

Calpurnia Aurea, Phytochemistry, Medicinal Plant, Pharmacology, Bioactive Compound

1. Introduction

1.1. Background

The plant *Calpurnia aurea* is very important medicinal plant to treat various infectious diseases in Ethiopia such as malaria, snake bite, dysentery and cancer [44], The plant has investigated chemical compositions and biological activities *in vitro* and *in vivo* and reported as good activities and reach in secondary metabolites [45, 10, 47], however no more information available about the plants phytochemical composition as well as pharmacological activities. Therefore this review aimed to gathered and revised all scientific paper related to the plant ethnobotany, phytochemistry, and biological activities in all academic searching sites like googlescholar, pubmed, sciencedirect and proquest and all relevant articles in these site were included in the review.

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1.2. Plant Botany

Calpurnia aurea is a small tree or shrub with green leaves and yellow flowers widely distributed to Africa from Cape provenance to Eritrea and in southern India [15]. In Ethiopia, this plant is known to several names, in the local language, such as *Cheka* in Afaan Oromo and *Digita* in Amharic [35]. It is growing in forest, be a 9 to 15 m tree while in the open, it is more often a shrub or small tree 2 - 4 m tall. Three subspecies are recognized like *Calpurnia aurea ssp. aurea*, *C. aurea ssp. sylvatica* and *C. aurea ssp. indica*, [5].

Figure 1. *Picture of Calpurnia aurea plant.*

1.3. Ethnobotany of the Plant

Calpurnia aurea is described in many reports as it used to treat a several human and animal diseases. In Ethiopia, the fresh leaves used to treat liver, the fresh root used to treat stomach-ache and the fresh root is used to treat the ecto-parasite [49], Root to treat amoebiasis and giardiasis, leaf used to treat malaria, diarrhea, rabies and diabetes, seed also used for treatment of hypertention, rabies, diahrea and diabetes [36], root chewed to treat snake bite, and the leaves decoction is taken to treat *qurba (Amharic)* or dysentery [12], root and bark as treatment of amoebic dysentery and Stomachache [9], leaves mixed with milk are used for the treatment of snake bite by oral intake and for eye disease treatment by dermal usage, root treats vomiting, and the bark for stomachache [23] and root treatment of bacteria and leaf ticks, and lies [50] and also It is used to treat gastritis, stomachache, and toothache by chewing, rubbing and powdering grinding respectively [46]. The leaves used to treat Diarrhea, leech, snake bite [29, 27, 4, 24], Ectoparasite [8], lice in cow and ox [4], jaundice, gonorrhea, vomiting, syphilis, rabies, poison, and detoxification [35], gonorrhea and snake bite [32], Amebiasis [26], treat Prolonged embryo in uterus [17], Excessive bleeding after birth [16]. The leaves of the plant in fiche district in Ethiopia used to treat rabies, wound, skin infection, and abdominal pain [20].

2. Phytochemistry and Biological Activities Profile

2.1. Phytochemistry

2.1.1. Major Secondary Metabolites

Table 1. *Phytochemical screening profile of Calpurnia aurea.*

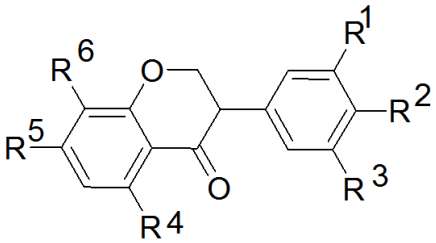
P.U		Phytochemicalcontent						Ref
		Alkal	Tannins	terpen	Sapoins	Steroids	Flavono	
L	70% MEOH	+	+	+	+	+	+	[40]
	PE, CH ET, ETH	+	+	+	+	+	+	[11]
S	ET. AC DCM HE	+	+	+	+	+	+	[41, 10]
R	AC, HE, ME	+	+	+	+	+	+	[19]
S B	HE	+					+	[30]
R B	AC, ME, ET, HE	+	+	+	+	+	+	[45]

Key: PE: petroleum ether, ET: ethyl acetate, DCM, dichloromethane, AC: acetone, ME: methanol, HE: hexane CH: chloroform, L: leave, S: seed, R: root, SB: stem bark, RB: root bark

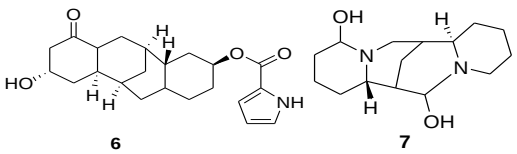
The phytochemical investigation conducted on the hydromethanolic extracts of leaves and seeds of *Calpurnia aurea* showed the presence of tannins, flavonoids, terpenoids, saponins, steroids, glycosides, and alkaloids, and seed containing more tannins and alkaloids than the leaves. Flavonoids and polyphenol levels are found more in leaves than the seeds [40]. The root extract of this plant also possess cardiac glycosides, tannins, flavonoids, phenolic compounds, alkaloids, steroids and saponnins [19]. The extract of *Calpurnia aurea* leaves with petroleum ether, chloroform ethyl acetate and ethanol in increasing order of polarity contains cardiac glycosides, carbohydrates, phenolic compounds and tannins, flavonoids, fixed oil & fats, proteins, terpenoids, saponins, steroids and alkaloids, even the strength and quality of results in which, phenolic compounds and tannins, fixed oil and fats, steroids and cardiac glycosides were present in both petroleum ether and chloroform solvents; alkaloids, flavonoids, phenolic compounds and tannins, fixed oil and fats, amino acids and proteins, terpenoids, saponins and steroids were present in ethyl acetate solvent; carbohydrates, phenolic compounds & tannins, flavonoids, amino acids & proteins, terpenoids, saponins, steroids and alkaloids present in ethanol solvent [14]. The stem bark hexane extract of this plant found to contain the widely studied phytochemicals like isoflavonoids and alkaloids [30]. The leaves aqueous extract is confirmed the presence of tannins, flavonoids, terpenoids, saponins, glycosides, alkaloids [11]. Seed extract with methanol solvent have phytochemicals like alkaloids, tannins, flavonoids and saponins, terpenoids, phenols and anthraquinones according to [41] and also seed crude extract of the solvent ethyl acetate, dichloromethane, and n-hexane conducted in standard method. It also shows positive result for tannins, saponnins, alkaloids, phenols, terpenoids and steroids but negative for antraquinone and glycosides [10]. The root bark of *Calpurnia aurea* also confirmed to have similar phytochemical constituents with other part of *Calpurnia aurea* and crude extracts of solvents such as. N-hexane, ethyl acetate, acetone and methanol can confirmed the presence of alkaloids, tannins, flavonoids, saponinis, terpenoids, anthocyanins and antraquinones [45].

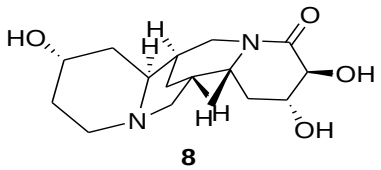
2.1.2. Compounds Isolated from *Calpurnia Aurea* Plant

Several parts of *Calpurnia aurea* investigated for their chemical composition and more compounds have been isolated from the plant such as isoflavoids such as, 4′, 5, 7-trihydroxyisoflavone (1), 7, 3′-dihydroxy-5′-methoxyisoflavone (2), 7-hydroxy-4′, 8-dimethoxyisoflavone (3), 7-acetoxy-4′, 8-dimethoxyisoflavone (4) and 3′, 7-dihydroxy-4′, 8-dimethoxyisoflavone (5) [30] and alkaloides and flavonoides such as, 4β–hydroxyl-13α-O-(2'-pyrroly l carbonyl)-lupanine (digittine) (6), 4β, 13α–dihydroxy lupanine (7), 3β, 4α, 13α-trihydroxylupanine (8), vicenin-2 (6, 8-di-β-D-glucopyranosyl-5, 7, 4'-trihydroxyflavone) (9), flavonoids, butin (7, 3', 4'trihydroxy flavanone) (10), 3'-hydroxydaidzein (7, 3', 4'-trihydroxyisoflavone) (11) and 3β, 4α-dihydroxy 13α–O-(2'pyrroly carbonyl)-lupanine (Calpaurine) (12) Angelate (13), Tiglate (14) were isolated from plant leaves and seeds as [34]. Two compounds, apigenin-7-O-β-d-glycoside (15) and and isorhoifolin (apigenin 7-O-rutinoside, 4′, 5, 7-trihydroxyflavone 7-O-rutinoside (16) from leaves [3]. Flavonoide are isolated from methanol and ethyl acetate extract of the seed and isolated compounds were identified as flavonoid compound G1 named 2-(4-(2-hydroxyethyl)phenyl)-4H-chromen-4-one (17), and, from methanol extract named compound, 1-(2-(3-((E)-buta-1, 3-dienyl)cyclopentyl)ethyl)benzene 18 and from ethyl acetate extract named compound (E)-methyl 14-hydroxy-10-methyltetradec-2-enoate (19) as [41] as reported by the same author, 1-(2, 4-bis (dimethylamino)cyclopentyl)heptan-4-one 20, reported from seed. In other report 12 phenolic compounds were isolated, rhoifolin (21), apigenin 7-O-glucoside (22), luteolin-7-O-glucoside (23), naringin (24), ononin (25), formononetin (26), 8-O-methylretusin (27), 8-O-methylretusin-7-O-β-D-glucopyranoside (28), maackiainn (29), trifolirhizin (30), medicarpin (31), and methyl (E)-3, 4, 5-trimethoxycinnamate (32) successfully from leaves and stem bark [47]. All compounds isolated from (leaves, seeds and barks of *Calpurnia aurea* are listed in Figure 2 below.



No	R_1	R_2	R_3	R_4	R_5	R_6
1) H	OH	H	OH	OH	H	
2) OH	H	OCH_3		H	OH	H
3) H	OCH_3		H	H	OH	OCH_3
4) H	OCH3		H	H	OC (O) CH_3	OCH_3
5) OH	OCH_3		H	H	OH	OCH_3





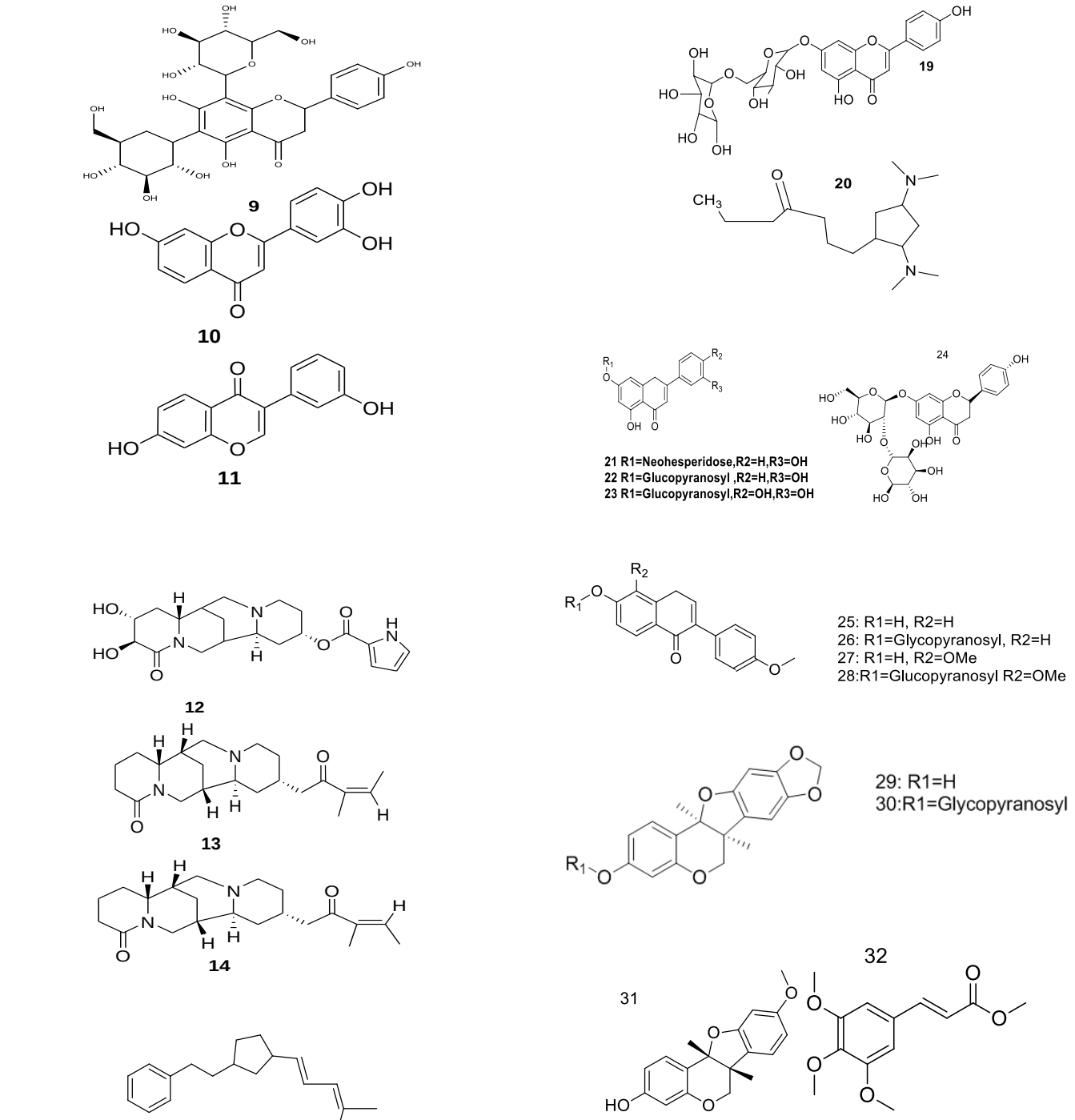


Figure 2. *All Compound isolated from Calpurnia aurea plant part.*

2.2. Biological Activities Profile

2.2.1. Antibacterial

Antibacterial activity of this plant evaluated against some human pathogens like Salmonella typhi, Salmonella paratyphi, Shigella species, Pseudomonas aeruginosa, Staphylococcus aureus and Escherichia coli with 80% hydromethanolic extract of the leaves of *Calpurnia aurea* showed moderate inhibition and relatively highest activity against Salmonella typhi and Escherichia coli [44], methanolic extract of leaves and

stems of this species also shown greater suppressions effect against growth of bacterial species of Gram positive strains Bacillus cereus, Staphylococcus epidermidis, Staphylococcus aureus, Micrococcus kristinae, Streptococcus pyogens) and the five gram- negative strains such as Escherichia coli, Salmonella pooni, Serratia marcescens, Pseudomonas aeruginosa, and Klebsiella neumonia in laboratory experiment testing. The stem extract also active against all bacteria species at higher concentration but it can only inhabit two bacterial species among the ten tested bacteria [2]. The leaves crude and fractionate especially methanol extract showed good activities against *E. coli (ATCC 25922), S. auras (ATCC 29213) and S. typhi (ATCC 6539*) [11]. The methanol and chloroform extract of leaves of Calpurnia aurea was tested for against S. aureus, P. aeruginosa, and E. coli at the concentration of (50, 100, and 200mg/ml) and The methanol extract has good activities at a concentration of 200mg/ml against S. aureus. [43].

The ethanol and aqueous extract of leaves, steams roots and barks, crude extracts (ethanol and aqueous) were prepared and screened for antimicrobial activities against the test pathogens such as *(S. ureus, S. pyogenes, L. monocytogenes, E. coli O157 H:7. typhi, and C. jejuni*) and the concentrations 25mg/ml and 50mg/ml shows the zones of inhibition 1.60-6.9mm and 9.63- 19.67mm for ethanol and aqueous extract respectively [22]. Based on [41], investigation the compound that purified from the crude extract by chromatography shows antibacterial properties with MIC value of pure isolated compound from the seed of Calpurnia aurea tested against seven gram –negative bacteria and shows the MIC of 25.8 to 78 mg/ml. for each tested bacteria the MIC is presented as S. typhi 26.25, E. coli 25.8, S. paratyphi 77, S. typhimurium 49.9, Shigella spps 76, P. aeuroginosa 74.5, S. aureus 78 mg/ml [41]. Another antibacterial Test conducted using the test bacterial strains*: S. aureus E. coli, E. faecalis, K. pneumonia, C. freundii, S. typhi, and E. coli* clinical isolate with Calpurnia aurea leaves extract. The MIC value is recorded in the range of 1.95 to 31.25 mg/mL for ethyl acetate fraction and 7.81 ±0.00 to 31.25 for dichloromethane fraction, and 13.02±4.51 mg/mL for n-hexane fraction of *Calpurnia aurea* leaves [10]. The leaves and barks of *Calpurnia aurea* evaluated for bacterial properties against different pathogens and Methanol extract showed highest zones of inhibition against S. aureus (22.64±0.95mm) followed by (19.18±0.66 mm) this extract against E. coli and the methanolic extract showed highest inhibition zone of 14.59±0.72 mm against E. coli. [33]. The root bark of *Calpurnia aurea* also active against different pathogenic bacteria like *Staphylococcus aureus (positive), Escherichia coli (negative), Salmonella typhirium (negative), and Pseudomonas aeruginosa* (negative) using disc diffusion methods. The ethyl acetate extract showed the highest antibacterial activities (diameter of inhibition 25 mm) against S. aureus. The most promising zone of inhibition was exhibited by methanol extracts with 20-25 mm inhibition zone in which 25 mm inhibition was recorded for Escherichia coli [45]. The leaves extract of ethyl acetate, dichloromethane and n-hexane have tested against pathogenic bacterial species such as *C. freundi, K. pneumonia, E. faecalis, S. typhi, E. coli, and S. aureus* showed good activities with average MIC value ranged from 1.95mg/mL to 31.25mg/mL, 7.81mg/mL to 31.25mg/mL and 13.02mg/mL to 62.5mg/mL respectively [10].

2.2.2. Antimalarial

Hydromethanolic extract of the leaves possesses significant suppressive effect against early Plasmodium infection, curative effect against established infection and prophylactic effect against residual infection in *Plasmodium berghei* infected mice [31]. The 80% methanol leaf extract of Calpurnia aurea tested in vivo antimalarial activity, in suppressive assay against Plasmodium berghei in infected mice and showed a significant ($P < 0.05$) antimalarial activity at doses of 400 and 600 mg/kg with 38.22±17.87% and 46.51±3.67% chemosuppression values respectively and crude extract also found free of toxicity in mice at a maximum dose of 2000 mg/kg relative to traditionally administered plant dose [13].

2.2.3. Antioxidant

The extracts of both leaves and seeds of the plant indicates strong antioxidant activities when test with DPPH scavenging ability [40]. The leaves and stem extract of *Calpurnia aurea* also shows high DPPH scavenging activity when test relative to the standard reference of ascorbic acid and BHT (butylated hydroxytoluene) [2]. In similar way, the antioxidant activity of *Calpurnia aurea* root extract shows good DPPH scavenging activity. The test which conducted relatively with a standard of ascorbic acid with 86.88%, ethanol root extract showed a good antioxidant activity of 81.63% at 100µg/ml. As compared to others extracts (chloroform, methanol, and n-hexane i.e., 71.72%, 36.40% and 26.14%) DPPH scavenging capacity respectively ethanol is the best to approach to the standard reference. Each solvent extracts have the order of ethanol> chloroform >methanol>hexane in DPPH (2, 2-diphenyl-1-picrylhydrazyl)scavenging activity. IC50 value of test and standard also determined from the antioxidant activity and standard ascorbic acids has IC50 value of 16.33µg/ml. The test ethanol has 23.60 which is less than the other extracts with IC50 value of Chloroform 48.46, hexane 198.14 and Methanol 141.42 µg/ml [19]. According to [10] Leave extract of *Calpurnia area* also further examined for its antioxidant properties by the methods of phosphomolybdenum reduction assay (PRA), reducing power assay and hydroxyl radical scavenging activities with standard reference of ascorbic acid according to the investigation the PRA indicates n-hexane fraction shows antioxidant activities near to ascorbic acid 2.56µg/ml and the dichloromethane and ethyl acetate is slightly lower when compared with the standard (AAE 2.33µg/mg and 1.73 µg/mg, respectively. The leaves extract also effective on hydroxyl radical scavenging activities. The n-hexane fraction shows better scavenging activities with (IC50 value 0.12mg/ml). The hydroxyl radical scavenging activities of ethyl acetate and dichloromethane fractions of *Calpurnia aurea* were observed as

IC50 value 0.61mg/mL and 0.52mg/mL, respectively. The reducing power assays also the same result for n-hexane extract near to standard reference [10].

2.2.4. Anticancer

The 80% hydromethanolic extract of *Calpurnia aurea* leaves also found to be effective in the test that conducted against castor oil induced diarrhea on experimental mice. At the dose of 400 mg/kg body weight, the extract produced a significant decrease in the severity of diarrhea in terms of reduction in the rate of defecation and consistency of faces in albino mice. At the same dose, the extract showed significant antidiarrheal activity showing 82.93% reduction in diarrhea comparable to that of the standard drug lope amide that showed 87.80% reduction in diarrhea [44].

The treatments of the flower and seed extract of *Calpurnia aurea* also showed a significant role in the reduction of HAART effect on affected rat. HAART Stands for highly active antiretroviral therapy which means treatment of patients with a very potent drug "cocktail" to suppress the growth of HIV, the retrovirus responsible for AIDS. The hepato protective activity also evaluated in HAART induced hepatotoxicity in a rat model and it shows good hepatoprotective effects by suppression of HAART-induced oxidative stress in the liver of rats, and attenuating the morphological changes caused by HAART [24]. The plant Calpurnia aurea is active against cancer. Based on the study which conduct on three anticancer sensitive cell lines such as, Breast (MCF-7), renal (TK-7) and melanoma (UACC-62) the isoflavone compounds which isolated from this plant such as, 7, 3′-dihydroxy-5′-methoxyisoflavone (2), 7-hydroxy-4′, 8-dimethoxyisoflavone (4) and 3′, 7-dihydroxy-4′, 8-dimethoxyisoflavone (5) are being most active against the melanoma (UACC-62) cell line. Compounds, 7, 3′-dihydroxy-5′-methoxyisoflavone (3) and 3′, 7-dihydroxy-4′, 8-dimethoxyisoflavone (5) are also found to be active against the breast (MCF-7) cell line. The compound 5 (3′, 7- dihydroxy-4′, 8-dimethoxyisoflavone) showed the best overall activity against all cell lines [30].

2.2.5. Anti - Diabetics

The hydromethanolic leaves extract of Calpurnia aurea was tested for anti-hypoglycemic activities in Streptozotocin-Induced Diabetic Mice. The blood glucose level was evaluated after treatment of *Calpurnia aurea* leaves extract in single 7th and 14th day. The result was not shown significant difference from base line all dosage in single day. Within a group comparison showed that there was no significant BGL reduction observed in CALE 100mg/kg, CALE 200mg/kg, and CALE 400mg/kg treated groups at all-time points compared to the baseline fasting BGL. All the three doses of CALE significantly ($P<0.05$) reduced the BGL on the 14th day of treatment compared to the diabetic control the standard drug reduced the BGL significantly ($P<0.001$) on the 7th and 14th days compared to the baseline level [38].

2.2.6. Anti-inflammatory

Leaves crude extract of Calpurnia aurea tested against inflammation caused enzymes such as, 5- Lipooxygenase (5-LOX), Cyclooxygenase-1 & Cyclooxygenase 2 (COX-1 & COX-2), by ELISA method. The ethanolic leaves extract of Calpurnia aurea showed significant 5-LOX inhibitory activity of 51.07% at 100 µg/ml with IC50 of 95.30µg/ml and the Calpurnia aurea leaves acetone extract showed the selective COX2 index (2.35) inhibitory activity with an IC50 of 200.75µg/m [48]. The antiulcer activity of Calpurnia aurea hydromethanolic leaf extract and solvent fractions in rats' pyloric ligation-induced ulcers, the plant extract at 200 and 400 mg/kg significantly reduced the ulcer index, the volume of stomach secretion, and total acidity while raising gastric pH and mucus content ($P < 0.05$). Likewise, in the acidified ethanol- and acetic acid-induced ulcer models, the extract at both test doses (200 and 400 mg/kg) also displayed a substantial reduction ($P < 0.05$) in ulcer index [6].

2.2.7. Antifungal Activities

The antifungal activity of the plants was determined by agar disk diffusion technique using the concentration of 200mg/ml, 100mg/ml and 50mg/ml. The minimum inhibitory concentration assay was determined using the concentration of 200mg/ml, 100mg/ml, 50mg/ml, 25mg/ml, 12.5mg/ml, 6.25mg/ml, 3.125mg/ml and 1.56mg/ml by agar dilution method. To carry out the analysis, descriptive statistics, one-way analysis of variance, and the Tukey test were use All extracts had shown a significant antifungal activity (p-value<0.05) within the average inhibition zone ranging from 10 ± 0.000 to 20 ± 0.577. *Calpurnia aurea* seeds were shown strong antifungal activities against Aspergillus niger, Candida zeylanoides, and Candida tropicalis (12.33 ± 0.333 to 20 ± 0.577). *Calpurnia aurea* leaves were shown the highest inhibition zone against Candida tropicalis and Candida zeylanoides (17.67 ± 0.333 and 20.33 ± 0.88) respectively. *Verbascum sinaiticum* was found to be shown an average antifungal activity with zone of inhibition 11.33 ± 0.333 to 17.00 ± 0.57 against all tested pathogens [18].

2.2.8. Insecticidal Properties

As reports in ethnobotany calpurna aurea showed insecticidal activities and in this base many scholars try to investigate insecticidal activities. The leaves tested against weevils and beetles repellency activities. The polar solvent extracts showed higher percentage of repellency against both of them, of which ethanol extract showed higher percentage repellency (≥60.00%) (Class IV) and acetone extract (≥56.67%) (Class III), methanol (≥53.33%) (Class III), and water (≥50.00%) (ClassIII) [25]. *Calpurnia aurea* investigated as attractant/repellant and acaricidal effect. The leaves and flowers extract of this plant have investigated against Rhipicephalus turanicus and the acetone extract showed the best killing capacity than

ethanol extract [21]. Distilled water, acetone and ethanol extract of *Calpurnia aurea* leaves at the concentration 20 g/100 ml and 30 g/100 ml were tested as protectant against maize weevils in maize grains under laboratory condition in rates of 10 and 15 ml of the two tested levels of extraction causes significantly ($p< 0.05$) higher mortality of maize weevils in dosage dependent manner and also induced significantly ($p < 0.05$) higher toxicity effect against weevils following 72h (≥ 55%) and 96 h (≥ 60%) related to exposure time. The efficacy of the tested plants also varied ($p < 0.05$) significantly with the type of solvent used for extraction; the highest being occurred in ethanol exacts, followed by in acetone and in distilled water extracts in general. Significantly ($p < 0.05$) higher mortality (>75%) of parental S. zeamais adults were also recorded in all polar extracts of the tested botanicals applied at 15 ml dosages from 30 g/100 ml extraction levels than those applied at a rate of 10 ml following 96 h treatment application, the maximum of which occurred in ethanol extract (>80%), followed by in acetone and in distilled water extracts (between 75 and 80%) in general [25]. In other work In vitro acaricidal bioassay leaves of *Calpurnia aurea* evaluated against ticks. The adult Rhipicephalus turanicus ticks in both sexes were tested against extract and isolated compound in different concentration. The chloroform fraction of *C. aurea* found the most active fraction followed by hexane fraction and butanol fraction. The LC50 and LC90 values were 28.64, 21.53, 65.09 mg/ml; 102.74, 81.23 and 173.45 mg/ml, respectively. Two flavonoid compounds, apigenin-7-O-β-d-glycoside and isorhoifolin, at a concentration of 1 mg/ml had LC50 and LC90 values of 1.35 and 0.65; 3.95 and 1.71 mg/ml, respectively, compared with the LC50 and LC90 values value of cypermethrin (0.6 and 1.09 mg/ml, respectively) [2]. The fresh leaves of *Calpurnia aurea* tested against fleas to control the free-range chickens in the Eastern Cape prominence South Africa. The contact bioassay and in vitro repellency bioassay by 100% concentration obtained by squeezing the leave of the plant and plant *Calpurnia aurea* shows some mortality in fleas [37], This leaves can also reported as active against two vectors such as Amblyomma variegatum and Rhipicephalus microplus. The ethanolic and aqueous leaf extracts caused 10±0.0% mortality in adult A. variegatum and *R. microplus*. LC50 recorded at the concentration 27 and 29 ppm and LC50 of 37 and 41 ppm, respectively for vectors. At 400 ppm, the leaf ethanolic 18.7±0.9% and 18.3±1.7%, aqueous extracts showed 18.3±1.2% and 19.7±0.3% egg hatching inhibition, respectively for above listed vectors [42]. The leave extract also reported against Anopheles stephensi with aqueous leaves extract and showed LC50 values of 38.69 ppm, respectively, against the larvae and adulticidal efficacy aqueous extract of *C. aurea* found (LC50=297.75 ppm) [39]. The leave extracts n-hexane, Dichloromethane, Ethyl acetate and Water for fractionation tested for their insecticidal activity against M. ovinus. At concentration of 6.25, 12.5, 25, 50 and 100mg/ml, all fractionates of methanol and ethanol crude extracts showed 100% effectiveness against M. ovinus within 6 hours of exposure [28]. Calpurnia aurea leaves extract showed significantly higher mortality ($p<0.05$) against A. ariegatum and The 100% mortality was recorded by 100 mg/ml and 150 mg/ml and 90% and 96.6% mortality by 25 mg/ml and 50 mg/ml concentrations after 48 hours this good evidence about insecticidal activities of *A. variegatum* cattle ticks [7]. Louscidal activity of crude methanolic extracts of Calpurnea aurea plants against the cattle lice, Linognathus vituli using the in vitro adult immersion test (AIT) tested with Six graded concentrations of the crude extracts, 6.25, 12.5, 25, 50, 100 and 200 mg/ml after 24hrs post-exposure, two higher concentrations (200 and 100 mg/ml) of *C. aurea* extract caused 100±0.0% and 96.6±3.3% lice mortality respectively [1].

3. Conclusion and Future Perspectives

This review was aimed to collect information about phytochemical constituents and pharmacological application of *Calpurnia aurea*. The result in this review showed the pharmacological potential of the plant such as antibacterial, antioxidant, antimalarial and anticancer properties with promising activities. The phytochemical constituents also showed important alkaloids and flavonoids that confirms the traditional medicinal use of the plant by the society and the plant is a good source of medicinally important pure compounds for treatment of various diseases However, further clinical trials and computed aided molecular docking should be performed to verify efficacy and any side effects or purified plant extracts.

Abbreviations

DPPH	2, 2-diphenyl-1-picrylhydrazyl
HAART	Highly Active Antiretroviral Treatment
PRA	Pawer Reducing Assay
BHT	Butylated Hydroxytoluene
COX-2	Cyclooxygenase-2
5-LOX	5- Lipooxygenase
MIC	Minimum Inhibitory Concentration
AIT	Adult Inhibition Test
LC50	Lethal Concentration 50%
BLG	Base Line Broup

Author Contributions

Gebretsadik Tebabal is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author has no any conflicts of interest.

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