Evaluation Of Medicinal Uses, Phytochemistry And Pharmacological Properties Of Strychnos Henningsii Gilg (Strychnaceae)

Alfred Maroyi

Abstract: Strychnos henningsii is a small to medium-sized tree widely used as traditional medicine in tropical Africa. The current study critically reviewed the medicinal uses, phytochemistry and pharmacological properties of S. henningsii. A systematic review of the literature was carried out to document the medicinal uses, phytochemistry and pharmacological properties of S. henningsii. The results of the current study are based on literature survey conducted using various search engines such as Web of Science, Elsevier, Pubmed, Google scholar, Springer, Science Direct, Scopus, Taylor and Francis, and pre-electronic sources such as books, book chapters, scientific journals, theses and other grey literature obtained from the University library. This study revealed that S. henningsii is used as an anthelmintic, appetizer, blood cleanser, purgative, tonic and ethnoveterinary medicine, and traditional medicine for abdominal pain, bilharzia, colic, diabetes mellitus, gastrointestinal problems, headache, malaria, menstrual problems, pain, respiratory diseases, rheumatism, snake bite and syphilis. Pharmacological research identified alkaloids, anthraquinones, cardiac glycosides, chalcones, flavonoids, phenolics, proanthocyanidins, saponins, steroids, tannins and triterpenes. The crude extracts of S. henningsii and phytochemical compounds exhibited analgesic, antibacterial, anti-diabetic, anti-inflammatory, antioxidant, antiplasmodial, antiprotozoal, antispasmodic and cytotoxicity activities. Strychnos henningsii crude extracts and phytochemical compounds isolated from the species should be subjected to detailed phytochemical, pharmacological and toxicological evaluations aimed at correlating its medicinal uses with its phytochemistry and pharmacological properties.

Keywords: Ethnopharmacology, herbal medicine, indigenous pharmacopeia, Loganiaceae, Strychnos henningsii, Strychnaceae

1 INTRODUCTION

Strychnos henningsii Gilg is an evergreen to semi-deciduous small to medium-sized tree belonging to the Strychnaceae family but included in the family Loganiaceae in earlier literature. The genus name Strychnos L. is derived from the Greek word for deadly in reference to the alkaloid strychnine isolated from several Strychnos species which is known to be poisonous [1,2]. The species name henningsii is in honour of Prof Paul Christoph Hennings (1841-1908), a German botanist and mycologist who was based at the Royal Botanic Gardens at Berlin-Dahlem [3]. The synonyms of S. henningsii include S. albersii Gilg & Busse, S. barbata Chiov., S. elliottii Gilg & Busse, S. ligustroides Gossw. & Mendonca, S. myrcioides S. Moore, S. pauciflora Gilg, S. procera Gilg & Busse, S. reticulata Burtt Davy & Honoré, S. sennensis Baker and S. utilis Sim [4,5]. The English common names of S. henningsii include “Natal teak”, “coffee hard pear”, “Panda’s walking stick” and “red bitterberry” [2,3]. The crown of S. henningsii is wide-spreading, particularly dense, branch terminals pendent, stems long, upright, bare, fairly smooth, pale buff-grey but brown where the bark peels off in irregular sections. The leaves of S. henningsii are simple, borne in decussate pairs, elliptic to broadly ovate in shape, thinly leathery to brittle, slightly conduplicate upwards, glabrous, dark green, particularly glossy, marginally entire with three large veins originating in the leaf base. The flowers of S. henningsii are simple, yellow to orange in colour and borne in short cymes in the leaf axils in dense branched heads.

The fruits of S. henningsii are small, slightly ovoid, glabrous, glossy, exocarp and fruit pulp firm. Strychnos henningsii has been recorded in Angola, Democratic Republic of Congo (DRC), Esatwini, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, South Africa, South Africa, South Sudan, Sudan, Tanzania, Uganda, Zambia and Zimbabwe [6-11]. Strychnos henningsii has been recorded in low-lying dry areas, riverine thickets, riverine fringes, scrub on termitaria, coastal evergreen forest, mist-belt evergreen forest and dry forests at altitudes ranging from sea level to 2300 m above sea level [7,12,13].

Strychnos henningsii is an important medicinal plant species in tropical Africa, listed in two monographs, “medicinal plants of South Africa” [14] and “plant resources of tropical Africa 11: medicinal plants 1” [15]. The bark, roots and root bark of S. henningsii are sold as sources of traditional medicine in informal herbal medicine markets in Kenya [16,17], Mozambique [18] and South Africa [19-21]. In Kenya, the bark, fruits, leaves and stems of S. henningsii are added to soup as a flavouring agent [22,23]. Strychnos species contain strychnine and numerous other structurally related alkaloid compounds which are known to be poisonous and used as rodent, arrow and ordeal poisons [24-26]. Research by Wink and Van Wyk [27], showed that the alkaloid strychnine is extremely hazardous, as it is a cell and neurotoxin, mind altering, inhibiting glycine receptor (Cl- channel), neurotransmitter, causing spasms, convulsions, salivation and death from respiratory arrest. It is therefore, within this context that the current study was conducted aimed at reviewing the medicinal uses, phytochemistry and pharmacological properties of S. henningsii.

2 MATERIALS AND METHODS

Several electronic databases were searched which included Web of Science, Elsevier, Pubmed, Google scholar, Springer, Science Direct, Scopus, Taylor and Francis. Additional
information was obtained from pre-electronic sources such as books, book chapters, scientific journals, theses and other grey literature obtained from the University library. The relevant term Strychnos henningsii was paired with keywords such as “medicinal uses of Strychnos henningsii”, “phytochemicals of Strychnos henningsii”, “biological activities of Strychnos henningsii”, “pharmacological properties of Strychnos henningsii”, “ethnobotany of Strychnos henningsii”, and various other synonyms and common names of the plant species. The ultimate goal of this search was to explore articles that investigated the medicinal uses, phytochemical and pharmacological properties of S. henningsii. A total of 114 articles published between 1960 and 2021 matched the inclusion criteria and were included in this review (Fig. 1).

![Flow chart showing the number of research publications used in this study](image)

**Fig. 1.** Flow chart showing the number of research publications used in this study

### RESULTS AND DISCUSSION

#### 3.1 Medicinal uses of Strychnos henningsii

The bark, leaves, roots, root bark, stems, stem bark and twigs of S. henningsii are mainly used as anthelmintic, appetizer, blood cleanser, purgative, tonic and ethnoveterinary medicine, and traditional medicine for abdominal pain, bilharzia, colic, diabetes mellitus, gastro-intestinal problems, headache, malaria, menstrual problems, pain, respiratory diseases, rheumatism, snake bite and syphilis (Table 1, Fig. 2). In Kenya, the leaves of S. henningsii are mixed with leaves of Boscia salicifolia Oliv. and root bark of Carissa spinarum L. as traditional medicine for joint pains [28]. Similarly, the leaves and stem bark of S. henningsii are mixed with leaves of Pavetta crassipes K. Schum., root bark of Carissa spinarum L. and leaves of Zanthoxylum chalybeum Engl. as traditional medicine for joint pains [28]. In South Africa, the bark of S. henningsii is mixed with roots of Turraea floribunda Hochst. as traditional medicine for rheumatic fever [29-31].

<table>
<thead>
<tr>
<th>Medicinal use</th>
<th>Parts used</th>
<th>Country</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain</td>
<td>Roots and root bark</td>
<td>Mozambique and South Africa</td>
<td>18,32-36</td>
</tr>
<tr>
<td>Anthelmintic</td>
<td>Bark and roots</td>
<td>Kenya, South Africa and South Africa</td>
<td>3,16,37-44</td>
</tr>
<tr>
<td>Appetiser</td>
<td>Bark</td>
<td>Kenya and Tanzania</td>
<td>16,30,40,45-48</td>
</tr>
<tr>
<td>Arthritis</td>
<td>Roots and root bark</td>
<td>Kenya</td>
<td>22,49-51</td>
</tr>
<tr>
<td>Aspergilosis</td>
<td>Bark</td>
<td>South Africa</td>
<td>52</td>
</tr>
<tr>
<td>Back pain</td>
<td>Root bark</td>
<td>Kenya</td>
<td>51,53</td>
</tr>
<tr>
<td>Bilharzia</td>
<td>Twigs</td>
<td>Madagascar and South Africa</td>
<td>30,54-56</td>
</tr>
<tr>
<td>Blood cleanser</td>
<td>Bark and roots</td>
<td>Kenya, South Africa</td>
<td>16,57</td>
</tr>
<tr>
<td>Boost immune system</td>
<td>Leaves</td>
<td>South Africa</td>
<td>58</td>
</tr>
<tr>
<td>Colic</td>
<td>Bark, leaves, stems and twigs</td>
<td>Madagascar and South Africa</td>
<td>2,14,38-40,42,45,48,50,56,59,60-63</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>Bark and leaves</td>
<td>Kenya and South Africa</td>
<td>32-36,42,52,64,65</td>
</tr>
<tr>
<td>Dizziness</td>
<td>Bark</td>
<td>South Africa</td>
<td>39,42</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Root bark</td>
<td>Kenya</td>
<td>51</td>
</tr>
<tr>
<td>Gastric ulcers</td>
<td>Leaves, stems and twigs</td>
<td>Madagascar</td>
<td>56</td>
</tr>
<tr>
<td>Gastro-intestinal problems (constipation, diarrhoea, stomach ache and stomach complaints)</td>
<td>Bark, leaves, roots, root bark and stem bark</td>
<td>Kenya, Mozambique and South Africa</td>
<td>2,3,14,16,18,30,32-36,38,39,41-44,48,50,52,53,54,55,56,57,58,59,60-63</td>
</tr>
<tr>
<td>Gout</td>
<td>Root bark</td>
<td>Kenya</td>
<td>51</td>
</tr>
<tr>
<td>Headache</td>
<td>Bark and roots</td>
<td>Kenya and Madagascar</td>
<td>16,56</td>
</tr>
<tr>
<td>Internal injuries</td>
<td>Roots</td>
<td>Kenya</td>
<td>13,42,77,78,22,23,28,38,50,51,62,63,78,80</td>
</tr>
<tr>
<td>Joint pain</td>
<td>Leaves, roots and root bark</td>
<td>Kenya</td>
<td>51</td>
</tr>
<tr>
<td>Joint pains</td>
<td>Leaves mixed with Boscia salicifolia Oliv. leaves and Carissa spinarum L. root bark</td>
<td>Kenya</td>
<td>28,81</td>
</tr>
<tr>
<td>Kidney pains</td>
<td>Bark, leaves and stem bark</td>
<td>Kenya</td>
<td>76,82</td>
</tr>
<tr>
<td>Malaria</td>
<td>Bark, leaves, roots, root bark</td>
<td>Mozambique and South Africa</td>
<td>36,39,42,51-52,69,76,78,80,82-88</td>
</tr>
<tr>
<td>Menstrual problems</td>
<td>Bark and leaves</td>
<td>Kenya and South Africa</td>
<td>14,30,41,48,50,58,59,75,2,14,30,38,3,9,41,44,45,4,8,50,59,61-63</td>
</tr>
<tr>
<td>Nausea</td>
<td>Bark</td>
<td>South Africa</td>
<td>22,23,38,44,86</td>
</tr>
<tr>
<td>Pain</td>
<td>Root bark</td>
<td>Kenya</td>
<td>22,23,38,44,86</td>
</tr>
</tbody>
</table>

**TABLE 1**

**MEDICINAL USES OF STRYCHNOS HENNINGSII**
3.2 Phytochemistry of Strychnos henningsii

Several phytochemical compounds including alkaloids, anthraquinones, cardiac glycosides, chalcones, flavones, flavonoids, flavonols, phenolics, proanthocyanidins, saponins, steroids, sterols, tannins and triterpenes (Table 2) have been identified from the bark, leaves, roots, root bark, stem bark and twigs of S. henningsii. Some of these phytochemical compounds may be responsible for the pharmacological properties exhibited by the species.

**Table 2**

<table>
<thead>
<tr>
<th>Phytochemical Compounds Identified from Strychonos Henningsii</th>
</tr>
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<tbody>
<tr>
<td><strong>Compound</strong></td>
</tr>
<tr>
<td>3-hydroxyhenningsiine</td>
</tr>
<tr>
<td>10-methoxy-tsaline</td>
</tr>
<tr>
<td>11-methoxy-diaboline</td>
</tr>
<tr>
<td>11-methoxy-henningsiine</td>
</tr>
<tr>
<td>17,23-dihydroxyperosmoxytrchne</td>
</tr>
<tr>
<td>18-hydroxy-tsaline</td>
</tr>
<tr>
<td>19-epi-23-hydroxyperosmoxytrchne</td>
</tr>
<tr>
<td>23-hydroxyperosmoxytrchne</td>
</tr>
<tr>
<td>23-hydroxyperosmoxytrchne-N(4)-oxide</td>
</tr>
<tr>
<td>2,16-dehydrodiaboline</td>
</tr>
<tr>
<td>2,16-dehydro, 11-methoxy-diaboline</td>
</tr>
<tr>
<td>Anthraquinones</td>
</tr>
<tr>
<td>Cardiac glycosides</td>
</tr>
<tr>
<td>Chalcones</td>
</tr>
<tr>
<td>Condensamine</td>
</tr>
<tr>
<td>Cyclostyrchne</td>
</tr>
<tr>
<td>Deshydroxyacetylheningsiine</td>
</tr>
<tr>
<td>Deshydroxyacetylheningsiine</td>
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<tr>
<td>Diaboline</td>
</tr>
<tr>
<td>Flavonoids</td>
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<tr>
<td>Flavonoids</td>
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<tr>
<td>Henningsamidii</td>
</tr>
<tr>
<td>Henningsamine</td>
</tr>
<tr>
<td>Henningsiine</td>
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<tr>
<td>Henningsiine-N(4)-oxide</td>
</tr>
<tr>
<td>Henningsoline</td>
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<tr>
<td>Holsticine</td>
</tr>
<tr>
<td>Holsticine</td>
</tr>
<tr>
<td>Na-acetyl-11-methoxytrchneoplastidine</td>
</tr>
<tr>
<td>Na-desacetyl-tsaline</td>
</tr>
<tr>
<td>Na-desacetyl-18-hydroxy-tsaline</td>
</tr>
<tr>
<td>Na-desacetyl-18-hydroxy-17-O-methyl-tsalineline</td>
</tr>
<tr>
<td>O-acetyl-henningsiine</td>
</tr>
<tr>
<td>O-acetyl-henningsiine-N(4)-oxide</td>
</tr>
<tr>
<td>O-acetyl-henningsoline</td>
</tr>
<tr>
<td>O-acetyl-retuline</td>
</tr>
<tr>
<td>O-demethyl-tsaline</td>
</tr>
<tr>
<td>O-demethyl, 10-methoxy-tsaline</td>
</tr>
<tr>
<td>Phenolics</td>
</tr>
<tr>
<td>Proanthocyanidins</td>
</tr>
<tr>
<td>Retuline</td>
</tr>
</tbody>
</table>
3.3 Pharmacological properties of Strychnos henningsii
Pharmacological research revealed that different extracts of S. henningsii and phytochemical compounds isolated from the species have various biological activities such as analgesic [38], antibacterial [43,63,69,86], antiplasmodial [34,35,42,100,111], anti-inflammatory [38], antioxidant [33,42], antiprotozoal [114], antispasmodic [34,35,42,100,111], antidiabetic [34,35,62,100,101], cytotoxicity [42,111] and toxicity [32,47,62,83].

3.3.1 Analgesic activities
Tits et al. [38] evaluated the analgesic activities of the alkaloids retuline, brucine, holostine, O-acetylisoretuline and isoretuline isolated from S. henningsii using an antinociceptive effect against chemical stimulus (phenylquinone writthing test). The alkaloid isoretuline exhibited activities [38].

3.3.2 Antibacterial activities
Kareru et al. [86] evaluated the antibacterial activities of aqueous extracts of S. henningsii leaves against Escherichia coli, Bacillus subtilis and Staphylococcus aureus using the agar disc diffusion assay with streptomycin (25.0 μg), tetracycline (100.0 μg), sulphamethoxazole (200.0 μg), gentamicin (10.0 μg) and cotrimoxazole (25.0 μg) as positive controls. The extract exhibited activities against the tested pathogens with zone of inhibition values ranging from 6.3 mm to 10.5 mm [86]. Njire et al. [69] evaluated the antibacterial activities of aqueous and methanol extracts of S. henningsii bark, leaf and roots against Escherichia coli using the agar disc diffusion method. The extracts exhibited activities against the tested pathogens with the inhibition zone ranging between 12.0 mm to 24.0 mm [69]. Khumalo [43] evaluated the antibacterial activities of dichloromethane and methanol extracts of S. henningsii bark against Enterococcus faecalis ATCC 29212, Bacillus cereus ATCC 1175, Escherichia coli ATCC 8739, Shigella sonneli ATCC 9290 and Salmonella typhimurium ATCC 14028 using the micro-titre plate technique with ciprofloxacin as a positive control. The extracts exhibited activities with minimum inhibitory concentration (MIC) values ranging from 1.0 mg/ml to >8.0 mg/ml in comparison to MIC values of 0.02 μg/ml to 0.07 μg/ml exhibited by the positive control [43]. Tirop et al. [63] evaluated the antibacterial activities of aqueous extract of S. henningsii leaves and roots against Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus and Salmonella typhi with tetracycline (30.0 μg), kanamycin (30.0 μg), gentamycin (10.0 μg), chloramphenicol (30.0 μg), cotrimoxazole (25.0 μg), augmentin (30.0 μg), cefuroxime (30.0 μg) and ampicillin (10.0 μg) as positive controls. The extracts exhibited activities against the tested pathogens [63].

3.3.3 Antidiabetic activities
Ngugi et al. [100] evaluated the antidiabetic activities of the aqueous extract of S. henningsii leaves by intraperitoneally injecting varying doses of the extract into alloxanised mice. The extract exhibited activities [100]. Oyedemi et al. [34] and Oyedemi et al. [35] evaluated the antidiabetic activities of aqueous stem bark extract of S. henningsii by administering the extract at 125.0 mg/kg, 250.0 mg/kg and 500.0 mg/kg body weight in diabetic rats induced with streptozotocin-nicotinamide for 15 days. The extract decreased the blood glucose level [34,35]. Oyedemi et al. [111] and Oyedemi et al. [42] evaluated the antidiabetic activities of aqueous stem bark extract of S. henningsii by assessing the in vitro models known to target glucose homeostasis and their direct complications, including hepaticoty and adipocyte glucose utilization, intestinal carbohydrate digestion, oxidative stress and non-enzymatic protein glycation. The extract exhibited activities [42,111].

3.3.4 Anti-inflammatory activities
Tits et al. [38] evaluated the anti-inflammatory activities of the alkaloids retuline, brucine, holostine, O-acetylisoretuline and isoretuline isolated from S. henningsii using the Carrageenan-induced paw oedema assay. The alkaloids retuline and isoretuline exhibited activities [38].

3.3.5 Antioxidant activities
Oyedemi et al. [33] evaluated the antioxidant activities of aqueous stem bark extract of S. henningsii using the 2,2'-azinobis [3-ethylbenzothiazoline-6-sulfonic acid] diammonium salt (ABTS), 1,1-diphenyl-2-picrylhydrazyl (DPPH), ferric reducing antioxidant potential (FRAP), superoxide anions, hydrogen peroxide (H2O2) and nitric oxide (NO) with butyalted hydroxytoluene (BHT), rutin, Vitamin C and Vitamin E. The extract exhibited concentration dependent activities against H2O2, ABTS, NO and DPPH with half maximal inhibitory concentration (IC50) values of 0.02 mg/ml, 0.09 mg/ml, 0.5 mg/ml and 0.7 mg/ml, respectively [33]. Oyedemi et al. [42] evaluated the antioxidant activities of aqueous stem bark extract of S. henningsii by using the ferric reducing antioxidant potential (FRAP) assay with BHT and quercetin as positive controls. The extract exhibited activities which were comparable to activities exhibited by the positive controls [42].

3.3.6 Antiplasmodial activities
Frederich et al. [112] evaluated the antiplasmodial activities of ethanol extract of S. henningsii leaves and the alkaloids holostine, diaboline, strychnochromine and guianensine isolated from the root bark of the species against a chloroquine-sensitive strain FCA 20 Ghana of Plasmodium falciparum using an in vitro [3H]hypoxanthine incorporation assay with chloroquine and quinine as positive controls. The extracts exhibited weak activities against the tested pathogen with IC50 and IC90 values of 40.0 mg/ml and 200.0 mg/ml, respectively. The alkaloids holostine, strychnochromine and guianensine exhibited activities against the tested pathogen with IC50 values ranging from 3.6 μM to 80.0 μM [112]. Philippe et al. [113] evaluated the antiplasmodial activities of ethyl acetate extracts of S. henningsii leaves and stems in vitro against a chloroquine-susceptible strain of Plasmodium
falciparum. The leaf extracts exhibited weak activities with IC50 and IC90 values of 15.9 μg/ml and 44.0 μg/ml, respectively [113]. Kirira et al. [83] evaluated the antiplasmodial activities of aqueous and methanol extracts of S. henningsii stem bark against chloroquine-sensitive and chloroquine-resistant strains of Plasmodium falciparum (NF54 and ENT30) using the [G-3H]hypoxanthine incorporation assay with chloroquine as a positive control. The extracts exhibited mild activities against the tested pathogens with IC50 values ranging from 67.2 μg/ml to 190.0 μg/ml [83].

3.3.7 Antiprotozoal activities

Wright et al. [114] evaluated the antiprotozoal activities of the alkaloids holstine, holsine, O-acetylholstine and isoretuline isolated from S. henningsii against Entamoeba histolytica, Giardia intestinalis and Plasmodium falciparum using in vitro assays with chloroquine diphosphate, emetine dihydrochloride and metronidazole as positive controls. The alkaloids holstine and holstine exhibited activities against Plasmodium falciparum with IC50 values of 31.5 μM and 32.7 μM, respectively [114].

3.3.8 Antispasmodic activities

Tits et al. [38] evaluated the antispasmodic activities of the alkaloids retuline, brucine, holstine, O-acetylretuline and isoretuline isolated from S. henningsii by assessing the myostimulating effect of histamine and bradykinin on guinea-pig ileum. The alkaloid isoretuline exhibited activities [38].

3.3.9 Cytotoxicity activities

Oyedemi et al. [111] and Oyedemi et al. [42] evaluated the cytotoxicity activities of aqueous stem bark extract of S. henningsii in Chang liver cells using the MTT toxicity assay. The extract exhibited activities with IC50 value of 130.0 μg/mL [42,111].

3.3.10 Toxicity activities

Ogeto et al. [47] evaluated the toxicity activities of the alkaloids isolated from S. henningsii bark on mice following intraperitoneal administration of extract on isolated innervated skeletal muscles of the rat diaphragm as well as on local anatomic sites of guinea pig skin. The alkaloids induced convulsions and paralysis characteristic of strychnine poisoning [47]. Tits et al. [38] evaluated the toxicity activities of the alkaloids retuline, brucine, holstine, O-acetylretuline and isoretuline isolated from S. henningsii by administering the alkaloids to groups of Swiss A mice in different doses and mortality rates observed after 24 hours and every day for 14 days. The alkaloid isoretuline administered intravenously exhibited half maximal lethal dose (LD50) value of 70.0 mg/kg in comparison to LD50 value of 0.5 mg/kg exhibited by strychnine [38]. Kirira et al. [83] evaluated the toxicity activities of aqueous and methanol extracts of S. henningsii stem bark against brine shrimp (Artemia salina) using the brine shrimp lethality test with emetine hydrochloride as positive control. The methanol extract exhibited mild activities with LD50 value of 101.2 μg/ml [83]. Oyedemi et al. [32] evaluated the in vivo acute and sub-acute toxicity of aqueous bark extract of S. henningsii leaf and root extracts in Wistar rats. The effect of the oral administration of the extract at 250.0 mg/kg, 500.0 mg/kg and 1000.0 mg/kg body weight was investigated on the hematological and biochemical parameters in Wistar rats for 28 days. The results of this study showed that sub-acute administration of the plant extracts were non-toxic to Wistar rats [32]. Tirop et al. [62] evaluated the in vivo acute and sub-acute toxicity of S. henningsii leaf and root extracts in Swiss mice. At dosages above 750.0 mg/kg body weight, the mice showed intestinal, hepatic and renal pathological alterations [62].

4 CONCLUSION

Van Wyk et al. [14] and Van Wyk et al. [25] argued that the fruits of S. henningsii could be poisonous and therefore, there is need for detailed clinical and toxicological evaluations of crude extracts and compounds isolated from the species. Therefore, the widespread use of S. henningsii as source of traditional medicines throughout its distributional range suggest that the species is not taken at toxic dosages. But use of S. henningsii for the treatment of human diseases and ailments should be treated with caution and rigorous toxicological and clinical studies of the bark, fruits, leaves, roots and seeds, and compounds isolated from the species are necessary.

CONFLICTS OF INTEREST

No conflict of interest is associated with this work.

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