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ANTHELMINTIC ACTIVITY OF SANSEVIERIA TRIFASCIATA LEAF EXTRACT AGAINST FASCIOLA HEPATICA

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Abstract: Helminthic infections continue to be a significant health burden worldwide and research on cheaper plant-based alternatives to synthetic anthelmintics is still of interest. The plant Sansevieria trifasciata Prain (Family: Asparagaceae) has been used ethnomedicinally for treating parasitic infections, but such activity has not been extensively validated pharmacologicallyThe anthelmintic activity of the ethanolic leaf extract was screened against adult Fasciola hepatica flukes at three concentrations (200, 400 and 800 mg/mL) using albendazole (100 mg/mL) as reference standard. For each group, time of paralysis (TOP) and time of death (TOD) were recorded. A clear concentration-dependent effect of the extract was observed, decreasing TOP from 38.59 min at 200 mg/mL to 16.59 min at 800 mg/mL and TOD from 74.33 to 34.00 min, respectively, over the same concentration range, approaching the potency of albendazole at the highest concentration tested. The results support the traditional use of S. trifasciata as an anthelmintic agent which could be due to its saponin, tannin and alkaloid contents.

Index Terms - Sansevieria trifasciata; Anthelmintic activity; Fasciola hepatica; Phytochemical screening; Time of paralysis; Time of death; Albendazole.

I. INTRODUCTION

Helminth infections, which are caused by parasitic worms, are usually classified into nematodes, cestodes and trematodes and still remain among the most persistent health burdens in humans and animals, especially in areas with poor sanitation and limited access to treatment. These infections lead to anemia, malnutrition, tissue damage and reduced productivity, and their sustained prevalence makes anthelmintic screening a priority area in pharmacological and medicinal plant research.

Synthetic anthelmintics such as albendazole remain the mainstay of treatment, acting through mechanisms including tubulin polymerization inhibition and disruption of parasite energy metabolism. However, concerns around drug resistance, cost, and accessibility in resource-limited settings have renewed interest in identifying effective, affordable, plant-derived alternatives.

Sansevieria trifasciata Prain (family: Asparagaceae), also known as the snake plant or mother-in-law's tongue, has long been used in traditional medicine in Africa, Asia and Latin America and has been reported to be effective against parasitic infections, inflammation and infections in general. Phytochemical studies have demonstrated the plant to be rich in steroidal saponins, flavonoids, alkaloids, tannins and phenolic compounds (Ansari et al.)[1], classes of compounds independently associated with antiparasitic mechanisms in other plant species, including cuticle disruption by saponins and neuromuscular interference by alkaloids.

Fasciola hepatica, a liver fluke belonging to the trematode class, is a widely used and well-accepted model organism for in vitro anthelmintic screening (Public Health Science Council)[7]. Standard evaluation relies on two endpoints — time of paralysis (TOP), the point at which a worm loses voluntary movement, and time of death (TOD), the point of irreversible cessation of movement confirmed by lack of revival in warm saline. Tannins are reported to bind surface glycoproteins on the helminth cuticle and disrupt structural integrity (Asha et al.)[6], while saponins are understood to form pore complexes with cuticle cholesterol, leading to ion imbalance and metabolic failure (Sangwan et al.)[5]. Separately, concentration-tiered screening of related Sansevieria leaf fractions against Fasciola hepatica has demonstrated scalable, dose-dependent reductions in paralysis and death times (Indonesian Research Group)[3], and liquid-liquid fractionation approaches have been used to isolate and concentrate the polar saponin fractions likely responsible for such activity (Zhuzao et al.)[2].

Despite this mechanistic plausibility and the plant's ethnomedicinal reputation, the anthelmintic activity of S. trifasciata against Fasciola hepatica has not been extensively characterized under standardized experimental conditions. The present study was therefore undertaken to evaluate the in vitro anthelmintic activity of the ethanolic leaf extract of S. trifasciata against adult Fasciola hepatica at three concentrations, in comparison with albendazole as the reference standard, with the aim of validating the plant's traditional antiparasitic use and identifying the phytochemical basis for the observed activity.

II. Type Style and Fonts

2.1 Materials

2.1.1 Plant Material

Fresh Sansevieria trifasciata Prain (Family: Asparagaceae) leaves were obtained from the garden premises of Vaageswari College of Pharmacy (Ramakrishna Colony, Karimnagar District, Telangana State). Species identification was carried out by the Botanical Survey of India (BSI), and a voucher herbarium specimen was retained for future reference.

2.1.2 Extraction Solvent

95% ethanol served as the extraction medium, chosen for its ability to recover a broad spectrum of secondary metabolites — including the alkaloids, tannins, and saponins of primary interest for anthelmintic screening — alongside its favorable safety profile for botanical extract preparation.

2.1.3 Chemicals and Reagents

The following materials were used, all of analytical grade: physiological saline (0.9% NaCl); albendazole (reference standard); and warm physiological saline (maintained at 37°C) for parasite transport and viability testing.

2.1.4 Biological Material

Adult Fasciola hepatica flukes, collected from the bile ducts of freshly slaughtered sheep or cattle at a local government-approved slaughterhouse, served as the parasite model for this study.

2.1.5 Equipment

The following instruments and materials were used: Soxhlet apparatus, rotary evaporator, electric grinder, No. 40 sieve (British Standard), digital stopwatch, Petri dishes, and standard glassware.

2.2 Procedure

2.2.1 Preparation of Ethanolic Extract

Harvested leaves were washed under running tap water, rinsed with distilled water, and shade-dried at room temperature for 10–14 days to preserve heat-labile phytoconstituents. The dried material was powdered using an electric grinder and passed through a No. 40 sieve to standardize particle size. Fifty grams of the sieved powder was extracted with 300 mL of 95% ethanol in a Soxhlet apparatus for 6–8 hours, until the circulating solvent ran colorless. The resulting extract was concentrated by rotary evaporation (reduced pressure, ≤50°C) and further dried in a 40°C water bath to yield a dry, dark greenish-brown residue, which was stored in airtight amber vials at 4°C until use.

2.2.2 Qualitative Phytochemical Screening

A 1% w/v ethanolic solution of the dried extract was screened for major phytochemical classes using standard tests: Wagner's reagent for alkaloids, lead acetate for flavonoids, ferric chloride for phenolic compounds, gelatin solution for tannins, Benedict's reagent for glycosides, Fehling's solution for carbohydrates, the froth/foam test for saponins, and the Salkowski reaction for terpenoids and steroids.

2.2.3 Preparation of Test and Standard Solutions

The dried extract was dissolved in physiological saline to prepare three test concentrations — 200, 400, and 800 mg/mL. Albendazole (100 mg/mL) was prepared similarly in physiological saline and used as the reference standard.

2.2.4 Collection and Preparation of Fasciola hepatica

Adult liver flukes were collected fresh from the bile ducts of freshly slaughtered sheep or cattle at a local government-approved slaughterhouse and transported in sterile containers of warm physiological saline (0.9% NaCl, 37°C) to maintain viability in transit. On arrival, the flukes were washed three times in fresh physiological saline to remove residual bile, mucus, and debris. Only actively motile, structurally intact flukes of uniform size were selected for the assay to minimize inter-group variability, and all flukes were used within 2 hours of collection.

2.2.5 Experimental Design

Table 1 outlines the five experimental groups used in this assay, each consisting of a Petri dish containing 20 mL of physiological saline with the respective test or control substance, and two adult flukes per dish.

Table 1 Experimental design for the anthelmintic activity assay

Group	Treatment	Concentration	No. of Flukes
Control	Normal Saline	—	2 per dish
Standard	Albendazole	100 mg/mL	2 per dish
Test I	Plant Extract	200 mg/mL	2 per dish
Test II	Plant Extract	400 mg/mL	2 per dish
Test III	Plant Extract	800 mg/mL	2 per dish

All Petri dishes were incubated at 37°C throughout the observation period to maintain parasite viability under control conditions.

2.2.6 Observation Criteria

The Time of Paralysis (TOP) was defined as the time, in minutes, at which a fluke showed complete cessation of spontaneous voluntary movement. Absence of movement was verified by gentle mechanical stimulation with a glass rod, and no response was taken as confirmation of paralysis. Time of death (TOD) was noted as the time when a fluke exhibited complete structural rigidity, loss of turgor, a definite color change from reddish-brown to pale, and no movement whatsoever even after transfer to fresh warm physiological saline, taken as confirmation that paralysis was irreversible. All the observations were made in triplicate and the time points were noted meticulously to develop dose dependent potency profiles.

Figure 1 Observation of paralysis and death of Fasciola hepatica during an anthelmintic activity

III. RESULTS

3.1 Phytochemical Screening

Qualitative phytochemical screening of the ethanolic leaf extract of S. trifasciata confirmed the presence of alkaloids, flavonoids, phenolic compounds, tannins, glycosides, carbohydrates, saponins, and terpenoids/steroids. Of these, alkaloids, tannins, and saponins are of particular relevance to anthelmintic activity, given their established roles in disrupting parasite neuromuscular function, cuticle integrity, and membrane permeability.

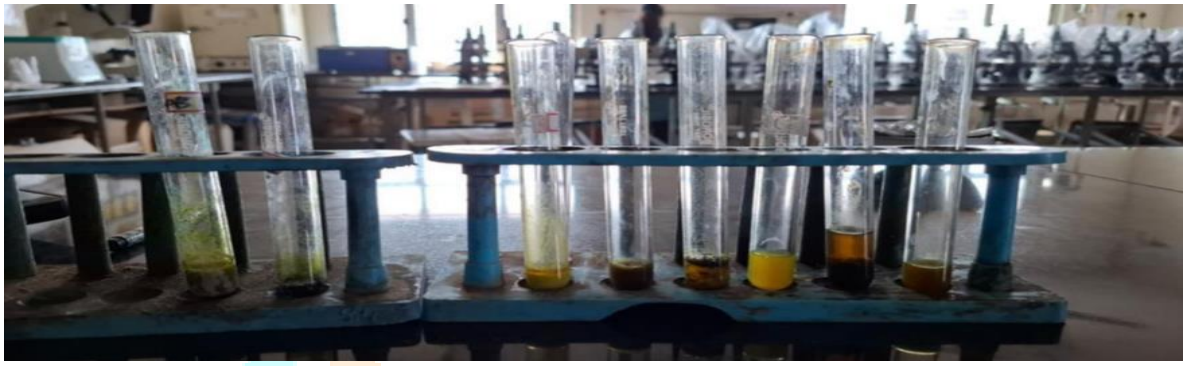

Figure 2 Phytochemical screening of S. Trifasciata

3.2 Anthelmintic Activity Against Fasciola hepatica

The anthelmintic potential of the extract was evaluated by recording the time of paralysis (TOP) and time of death (TOD) of adult Fasciola hepatica flukes exposed to the control, standard, and three test concentrations.

Table 2 Anthelmintic activity of ethanoic leaf extract of S. Trifasciata against Fasciola hepatica

Group	Treatment	Concentration	TOP (min)	TOD (min)
Control	Normal Saline	—	135.00	180.00
Standard	Albendazole	100 mg/mL	12.33	28.59
Test I	Plant Extract	200 mg/mL	38.59	74.33
Test II	Plant Extract	400 mg/mL	26.33	40.33
Test III	Plant Extract	800 mg/mL	16.59	34.00

n = 2 flukes per group

IV. DISCUSSION

The control group, exposed only to normal saline, showed no paralysis or death for an extended period (TOP 135 minutes, TOD 180 minutes), confirming that fluke viability and spontaneous movement loss over time — rather than any test substance — accounted for this baseline, and validating the overall assay conditions. Albendazole, the reference standard, produced rapid paralysis (12.33 minutes) and death (28.59 minutes), consistent with its established mechanism of tubulin polymerization inhibition and disruption of parasite energy metabolism.

The extract demonstrated a clear, concentration-dependent anthelmintic effect. At the lowest tested concentration (200 mg/mL), paralysis and death occurred at 38.59 and 74.33 minutes, respectively; both endpoints shortened progressively with increasing concentration, reaching 16.59 minutes (paralysis) and 34.00 minutes (death) at 800 mg/mL — values approaching, though not matching, those of albendazole. This consistent inverse relationship between concentration and time-to-effect indicates a genuine, dose-linked antiparasitic action rather than a non-specific or incidental effect.

The activity can be attributed to the alkaloid, tannin and saponin content of the extract as confirmed in the phytochemical screening. Tannins are reported to bind glycoproteins on the outer cuticle of helminths affecting the structural integrity and alkaloids are associated with neuromuscular blockade by inhibition of acetylcholinesterase activity [22]. Saponins, however, are thought to bind with cholesterol in the helminth cuticle to form pore complexes, disrupting the permeability of the membrane and leading to ion imbalance and metabolic failure. Since S. trifasciata is particularly rich in steroidal saponins, this mechanism provides

a plausible primary explanation for the observed activity, possibly in combination with the aforementioned tannin- and alkaloid-driven mechanisms.

Taken together, these results provide in vitro pharmacological support for the traditional use of S. trifasciata against helminthic infections, and position the plant as a reasonable candidate for further work to isolate and characterize its active antiparasitic constituents.

V. Conclusion

This study demonstrates that the ethanolic leaf extract of Sansevieria trifasciata Prain possesses concentration-dependent anthelmintic activity against Fasciola hepatica in vitro, reducing both time of paralysis and time of death as concentration increased from 200 to 800 mg/mL, with activity at the highest concentration approaching that of the albendazole standard. This effect is attributable to the extract's alkaloid, tannin, and saponin content. These findings lend scientific support to the plant's traditional use as an antiparasitic agent and suggest it as a worthwhile candidate for further bioactivity-guided isolation and in vivo validation studies.

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