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Anthelmintic Efficacy of *Sesbania grandiflora* Leaves and *Solanum torvum* Fruits against the Nematode Parasite *Ascaridia galli*

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ABSTRACT

Poultry is the fastest growing component and one of the most efficient and effective means of food supply to the society in the form of meat and egg. Parasitic infections lead to low productivity and increased mortality in poultry. Though various helminthes cause parasitic infections in poultry animals, *Ascaridia galli* is known as the largest intestinal parasite causing infections among them. Nowadays, there is a growing interest in using plant based anthelmintics for better poultry production, due to their lower side effects, when compared to the synthetic compounds. Hence, to alternate the synthetic anthelminticide, there is a need for plant based anthelminthicide, which are less toxic and more effective. *Sesbania grandiflora* leaves and *Solanum torvum* fruits are known through generations for their anthelmintic property. In view of this, *S. grandiflora* (leaves) and *S. torvum* (fruits) were selected in the present investigation to analyze their phytochemicals and to study their anthelmintic activity against *Ascaridia galli*, which is the common gastrointestinal parasite of domestic fowl (*Gallus gallus domesticus*). Phytochemical analysis of the present study reports the presence of flavonoid, alkaloid, phenol, tannin, saponin and acid in the plant extracts. Whereas, steroid and triterpenoid are present only in *S. grandiflora* and absent in *S. torvum*. The results of this investigation suggested that both the plant extracts could serve as an alternate effective herbal helminthicide replacing the synthetic anthelminticides.

Keywords- Anthelmintic activity, *Sesbania grandiflora, Solanum torvum, Ascaridia galli,* Phytochemicals.

INTRODUCTION

India, the world's second largest developing economy, now has a large and rapidly expanding poultry sector. Poultry farming has been constantly increasing over the past decades for its high demand both for nutritional supply and poverty alleviation of the poor villagers[1]. Poultry is one of the most efficient and effective means of food supply to the society in the form of meat and egg. Poultry meat is chiefly supplied by

chickens, turkeys, ducks, geese, quail, etc. Most of the people consume these meats for their high quality protein and low fat content. Of all the varieties of food available to people, the egg most nearly approaches a perfect balance of all the nutrients.

Poultry diseases often affect the success of the poultry industry and the economic and social well-being of a community. The poultry productivity, which is based on scavenging backyard systems is very low due to mismanagement, lack of feed, vitamin deficiencies and parasitic infections[2,3]. The helminth parasite problem is unquestionably being a major limiting factor in the improvement of poultry farming in developing countries[4]. Among helminths, nematodes like *Ascaridia galli*, *A. seum* and *Setaria* are considered to be common parasites that cause diseases in hens.

A. galli is the largest intestinal parasitic nematode causing diseases in poultry. High population of *A. galli* is found in deep, damp litter[5]. Country fowl – *Gallus gallus domesticus* move freely in searching for food, thereby being exposed to a wide range of parasitic infections[6,7]. *A. galli* infection is most often associated with loss of weight and decreased egg production in fowls[8,9]. This parasite is recorded to cause high economic loss in poultry systems[10].

Human history explains about the interactions of the diseases with traditional herbal treatment[11,12]. Although, commercial modern anthelminticides are available, there are many drawbacks in using them. In India, most of the villagers prefer traditional medicine, as it costs less[13] with no side effects[14,15]. Many investigators revealed the plants as a natural source of remedy for various diseases[16-18].

Just as there is a growing interest in complementary medicine for humans, there is also a growing interest in using herbs for poultry production. There have been few controlled trials in plants to investigate the efficacy of anthelmintic compounds[19-23].

Sesbania grandiflora leaves, used as greens for cattle and poultry[24], have got anthelmintic property against selected helminthes[25]. Similarly, fruits of *Solanum torvum* are known through generations to clear intestinal helminth infection in human beings[26]. Hence, in the present investigation *S. grandiflora* leaves commonly known as "Agathi" in regional language Tamil and the fruits of *S. torvum* commonly known as "Sundai" are screened for their anthelmintic efficacy against *A. galli.*

MATERIALS AND METHODS

Selection, collection and identification of the plant materials

Leaves of *S. grandiflora* belonging to the family Fabaceae and the fruits of *S. torvum* belonging to the family Solanaceae were the plant materials selected for this study. Fresh leaves and fruits of *S. grandiflora* and *S. torvum* were collected from the local market of Chennai, Tamil Nadu. Both the leaves and fruits were washed with water and the fruits were chopped into pieces. Then they were shade dried for a week, at room temperature. They were then coarsely powdered and stored in airtight containers. The fruits of *S. torvum* were identified and authenticated using the herbarium voucher specimen (L.J. Sedwick, No. 2177 dated Dec 1916) and *S. grandiflora* leaves were authenticated by Dr. A. Manoharan, Head of the Department of plant biology and biotechnology, Presidency College, Chennai, India.

Preparation of aqueous extract[32]

Aqueous extract was prepared by soaking *S. grandiflora* leaf and *S. torvum* fruit powder separately in distilled water for a day. Benzene was layered to prevent fungal growth. The preparation was filtered

through Whatman filter paper and the filtrate was concentrated in a water bath at 100ºC.

Preliminary phytochemical analysis[27,28]

Organic phytochemicals like steroid, triterpenoid, flavanoid, phenol, tannin, alkaloid, saponin and acid were identified using the standard methods[27,28] in the aqueous extract of *S. grandiflora* leaves and *S. torvum* fruits.

Collection and identification of *A. galli*

A. galli, a nematode parasite is one of the most common species among poultry helminths. *Gallus gallus domesticus* is the permanent host of *A. galli.* They were collected from the gastrointestinal tracts of 400 domestic fowls (*G. domesticus*). The intestinal tracts were collected from the local markets of Chennai and Villupuram districts, Tamil Nadu. The nematodes were hand-picked from the intestinal content of the dissected tract and carefully washed several times in normal saline to clear the contamination of the host. Identification of the parasites was done based on their morphological characters[29].

Selection of the survival medium for *A. galli*[32]

In order to continue the experiment for a longer period, a suitable survival medium is required for the parasites to survive. The survival studies were conducted to select the survival medium, in normal saline (0.9%) and glucose (1%) enriched phosphate buffer saline (pH 7.2) in aerobic and anaerobic conditions. For every 10 *A. galli*, 100 ml of medium was used. Survival in every medium was tabulated (Table 1). As the glucose enriched phosphate buffer saline (pH 7.2) medium in aerobic conditions enhanced maximum survival period for *A. galli*, it was selected as the survival medium for the present investigation.

Screening of anthelmintic efficacy of *S. grandiflora* leaves and *S. torvum* fruits against *A. galli*[32]

A. galli was acclimatized in glucose enriched phosphate buffer saline (pH 7.2) for 6 hours prior to experimentation. They were then transferred to 100ml of fresh glucose enriched phosphate buffer saline (pH 7.2) in a group of ten. Different concentrations (10-130 mg) of the aqueous extract of *S. grandiflora* leaves and *S. torvum* fruits at an interval of 10 mg were separately mixed in the survival medium before introducing the experimental parasite *A. galli*. Fresh survival medium with that particular concentration of the extract was provided at the beginning of every 24 hours. The sub lethal, median and lethal concentrations of the aqueous extracts were observed and recorded. Survival of *A. galli* was noted at an interval of every 4 hours and the dead parasites were removed immediately to avoid contamination.

RESULTS

The results of phytochemical analysis on organic substances reported the presence of flavonoid, phenol, tannin, alkaloid, saponin and acid in the aqueous extracts of both *S. grandiflora* leaves and *S. torvum* fruits. Whereas, steroid and triterpenoid were present only in *S. grandiflora* leaf aqueous extract (Table 2).

The aqueous extracts of the leaves and fruits of *S. grandiflora* and *S. torvum* recorded a definite anthelmintic efficacy against *A. galli* in the present investigation (Table 3 and 4). Both the aqueous extracts exhibited dose dependency. Increasing the concentration of the extracts decreased the survival of *A. galli.*

Though both the extracts were with potent anthelmintic activity, the aqueous extract of *S. torvum* fruits were more effective as it is fatal to the parasite in a lower concentration after 36 hours of

exposure period when compared to *S. grandiflora* leaves. However, in the early exposure periods (12 and 24 hours) aqueous leaf extract of *S. grandiflora* was found to be effective (Table 5).

DISCUSSION

A large percentage of population of chickens is raised as free rangers. High prevalence of helminth infection in free ranging chickens may be due to the animal's constant contact with the soil and the intermediate host because of their scavenging habits[30]. Occurrence of *A. galli* infection from the duodenal region of *G. domesticus* in the present investigation are in accordance with the previous reports[31-33]. Nowadays, plants derived anthelmintics offer an effective, alternate and environmentally acceptable remedy because of their efficacy, which can overcome the problems of parasitic infections.

Earlier workers have reported the anthelmintic property of *S. grandiflora* barks and seed oil against the parasites selected in their study[34-36]. *S. torvum* fruits have got multi beneficial properties and the anthelmintic property is one among them[26]. An earlier report attributes the anthelmintic activity of the extract against *A. galli,* due to the presence of phenolic compounds in them[37]. Tannin, which may be responsible for the anthelmintic activity as suggested earlier[38], is also recorded in the leaves of *S. grandiflora* and the fruits of *S. torvum* in the present investigation.

The presence of these phytochemicals in the aqueous extract of both plants may be responsible for their anthelmintic activity as reported in a previous work[39]. Varying degree of anthelmintic activity recorded in *S. grandiflora* (leaves) and *S. torvum* (fruits) aqueous extract could be due to the variations in the contents of total alkaloids[40]. Thus the present investigation suggests that the aqueous extract of *S. grandiflora* (leaves) and *S. torvum* (fruits) could serve as an effective helminthicide against *A. galli.*

CONCLUSION

Traditional herbal plants contribute in a great way to the Indian medicine. The plants in total or their products are used for a wide variety of diseases. A potent anthelmintic drug should affect the physiological activities of the worm, to eradicate them without affecting the host. Since the plant based anthelmintics are without any toxic side effect, they serve as an alternate for the synthetic anthelminthicides. According to the results of the present investigation, *S. grandiflora* (leaves) and *S. torvum* (fruits) can be used as an effective herbal helminthicide against *A. galli,* an internal parasite of *G. domesticus*. By doing so, we can uplift the poultry industry from economic loss. Further, isolation of the active anthelmintic potential of these plants may facilitate the experimentation and administration of this compound in *invivo* studies. This report may also throw light on the use of *S. grandiflora* leaves and *S. torvum* fruits as herbal anthelminticides for humans.

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Table 1. Survival of *A. galli* in different medium

Medium		Hours of exposure										
		0	12	24	36	48	60	72	84	96	108	120
Normal Saline	S	10	10	10	10	10	5	0	-	-	-	-
Phosphate Buffer Saline (pH 7.2) –Aerobic condition	S	10	10	10	10	10	10	10	10	10	5	0
Phosphate Buffer Saline (pH 7.2)- Anaerobic condition	S	10	10	5	0	-	-	-	-	-	-	-

S- Number of parasites survived

Table 2. Preliminary phytochemical analysis of the organic substances in the aqueous extract of selected plants

S. No.	Organic substances	Aqueous extract	
		S. grandiflora	*S. torvum*
1	Steroid	+	-
2	Triterpenoid	+	-
3	Flavonoid	+	+
4	Phenol	+	+
5	Tannin	+	+
6	Alkaloid	+	+
7	Saponin	+	+
8	Acid	+	+

Table 3. Survival of *A. galli* exposed to different concentration of *S. grandiflora* leaf aqueous extract for 48 hours

Concentration of extract in mg /100ml of medium/ 10 parasites	Hours of exposure					
		0	12	24	36	48
10	S	10	10	10	10	10
20	S	10	9	9	9	8
30	S	10	8	6	6	6
40	S	10	6	5	5	5
50	S	10	5	4	4	3
60	S	10	4	4	3	3
70	S	10	3	3	1	0
80	S	10	3	2	0	-
90	S	10	2	0	-	-
100	S	10	0	-	-	-

S- Number of parasites survived

Table 4. Survival of *A. galli* exposed to different concentration of *S. torvum* fruit aqueous extract for 48 hours

Concentration of extract in mg /100ml of medium/ 10 parasites	Hours of exposure					
		0	12	24	36	48
10	S	10	10	10	7	0
20	S	10	10	10	6	0
30	S	10	10	10	5	-
40	S	10	10	8	3	-
50	S	10	10	6	2	-
60	S	10	10	6	2	-
70	S	10	10	5	0	-
80	S	10	10	3	0	-
90	S	10	10	3	-	-
100	S	10	10	3	-	-
110	S	10	10	3	-	-
120	S	10	8	2	-	-
130	S	10	6	0	-	-

S- Number of parasites survived

Table 5. Efficacy of aqueous extracts of selected plants against *A. galli* for 24 and 48 hours exposure period

Extracts of the plants	Extract concentration in mg/ 100ml medium/ 10 parasites					
	Sub lethal concentration		Median lethal concentration		Lethal concentration	
	24 hours	48 hours	24 hours	48 hours	24 hours	48 hours
S. grandiflora	10	10	40	40	90	70
S. torvum	30	*	70	*	130	10

*Lower than the tested extract concentration