



## Original Research Article

# In vitro anthelmintic effect of *Balanites aegyptica* on *Paramphistomum cervi* in Buffalo (*Bubalus bubalis*) of Udaipur

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## ABSTRACT

### Keywords

*Paramphistomiasis*,  
Buffalo,  
Alcoholic  
extract,  
*Paramphistomum cervi*,  
*Balanites aegyptica*

Main purpose of this study was the investigation of helminth's prevalence is very high in Buffalos. Paramphistomiasis is one of the major problems in the productivity of buffalo and health of human being throughout the world. This disease causes loss of life of cattle, reduction in milk, meat and wool production. *Balanites aegyptica* is commonly known as hingot. The fruits, leaves and seeds of hingot are known for their medicinal value. The present study was designed to evaluate the *in vitro* anthelmintic activity of alcoholic extract of *Balanites aegyptica* on amphistome *Paramphistomum cervi*. 125 mg/ml concentrations of alcoholic extract gave total mortality at 5 hours. The treated and control *Paramphistomum cervi* was observe and compared by Light microscopy. The alcoholic extract of hingot showed discontinuous, damaging cells of tegument, vacuolization & breakage in oral sucker and acetabulum of *Paramphistomum cervi*. This study revealed that the potential role of hingot fruit extract as an anthelmintic activity against *Paramphistomum cervi*.

## Introduction

Helminths are major cause of reduced production in livestock. Rajasthan is the largest state of India having maximum number of livestock or domestic ruminants. The economy of rural people largely depends on domestic ruminants like cow, buffalo, goat and sheep. The prevalence of amphistome parasites is very high in domestic ruminants and spread all over the world, which cause the disease paramphistomiasis (Qadir *et al.*, 2010 and Swarnakar & Kumawat, 2013). The disease

causes high morbidity and mortality resulting in great economic losses through reduced productivity to poor farmers. Chemotherapy is the only efficient and effective tool to cure and control the helminth infection, as efficacious vaccines against helminth have not been developed so far.

Development of resistance in most of the commercially available anthelmintic drugs becomes severe problems worldwide. These

drugs are unaffordable, in accessible or inadequately available to resource-poor farmers of developing countries. The use of medicinal plants for the prevention and treatment of gastrointestinal parasitism has its origin in ethno veterinary medicine. Some anthelmintic herbal drugs prepared by the medicinal plants, they are effect on helminths parasites and killing them (Ghangale *et al.*, 2009; Bashtar *et al.*, 2011; Jeyathilakan *et al.*, 2010 & 2012; Nahla *et al.*, 2012; Ahmed *et al.*, 2013 and Scantlebury *et al.*, 2013).

*Balanites aegyptica* is medicinal plant and commonly known as hingot or desert date belongs to Zygophyllaceae or Balanitaecae family. This plant is an evergreen xerophyte tree distribute in the drier states of India: Rajasthan, Gujrat, and Madhay Pradesh (Yadav & Panghal., 2010; Dubey *et al.*, 2011; Kumawat *et al.*, 2012 and Saboo *et al.*, 2014).

The Fruit of *Balanites aegyptica* contains many valuable nutrients, is used for preparing beverage, cooked foods & medicines and the seed kernel, which is rich in oil, is used as a source of edible oil (Kumawat *et al.*, 2012). The fruit extract of *B. aegyptica* and *Artemisia* found effective against helminth parasites (Koko *et al.*, 2000 and Iqbal *et al.*, 2004). The extract of *B. aegyptica* fruit mesocarp, root bark, leaves and seeds kernels shows larvicidal, vermifidal, antibacterial, wound healing activity and use as an alternative protein source in animal feeding. (Chapagain & Weisman 2005; Dwivedi *et al.*, 2009 and Yadav & Panghal., 2010). *B. aegyptica* have some properties such as anti-inflammatory, anthelmintic, antioxidant, antinociceptive, antiviral, antimicrobial, anticancer, antidiabetic and antiasthmatic effect in various animals. (Dubey *et al.*, 2011; Suky *et al.*, 2011; Abdallah *et al.*, 2012; Lohlum *et al.*, 2012; Shalaby *et al.*,

2012; Kommu *et al* 2013; Gajalakshmi *et al* 2013; Intisar *et al.*, 2013; Ajayi and Ifedi 2014 and Saboo *et al.*, 2014).

Little research work has been reported on extract of few medicinal and indigenous plants tested against different species of amphistomes (Veerakumari and Munuswami, 1999; Singh *et al.*, 2008; Jeyathilakan *et al.*, 2012; Veerakumari *et al.*, 2012 and Saowakon *et al.*, 2013).

However, no research work has been carried out so far to study the effects of *Balanites aegyptica* extracts on *Paramphistomum cervi* by light microscope. So the aims of this study have to test the anthelmintic activity of the alcoholic extract of the fruits of *Balanites aegyptica* against *Paramphistomum cervi* in buffalo.

## Material and Methods

**Collection of parasites:** Live amphistome *Paramphistomum cervi* were collected from the rumen of the freshly slaughtered buffaloes (*Bubalus bubalis*) at local Zoo abattoir in Udaipur. After through washing with physiological saline solution (0.7 percent, NaCl), they were divided into three groups:-

- a) **First group:** Collected *Paramphistomum cervi* were used for identification of species of amphistomes, with the help of whole mount preparation of amphistome as described by Dutt, 1980.
- b) **Second group (Control):** Untreated *Paramphistomum cervi* amphistomes served as Control group.
- c) **Third group (In vitro treatment with medicinal plant extracts):** Third group of *Paramphistomum cervi* amphistomes were incubated in different concentrations of the plant

extracts with a volume of 10 ml in the petri dish for five hours. Then *Paramphistomum cervi* were fixed in Bouin's fixative for histological studies by Light microscopy.

### **Preparation of fruit extracts**

Fresh *Balanites aegyptica* fruits were collected from the desert areas: Udaipur, Jodhpur, Jaisalmer, Bikaner (Rajasthan). Fruits were washed with tap water and distilled water then the fruit was kept in dry (oven at 40 °C for 3-4 days) and pulverized with grinder into a powder. The powder was refluxed in 70% alcohol for 72 hrs. at 60° C and occasional stirring with a glass rod manually at regular intervals.

After 72 hours the macerates solutions were filtered in separate flasks using a Whatman No 4 filter paper. Then centrifuged at x10000 g for 15 min and supernatant was dry until a constant dry weight of each extract was obtained. Then dried plant extracts were reconstituted in the respective solvents (Alcoholic) using 10% DMSO. The extracts were stored in 15 ml black cap bottle, covered with aluminium foil for the prevention of *Balanites aegyptica* fruit extract directly from light. The residues were stored at 4 °C for further use.

### **Histology by Light Microscopy (LM)**

*Balanites aegyptica* fruit extracts were tested *in vitro* against *Paramphistomum cervi*. Treated and control parasites were fixed in Bouin's fixative for histological studies by light microscopy (LM) for 24 hours. Then they were washed in running tap water for at least 24 hours. These *P. cervi* were dehydrated in ascending series of alcohol, cleared in xylene, blocks were prepared in paraffin wax, and sections were cut at 6µ on rotary microtome then

dehydrated, stained with Haematoxylin and Eosin, cleared in xylene and mounted in DPX (Bancroft & Stevens, 1977). Sections were examined under light microscope.

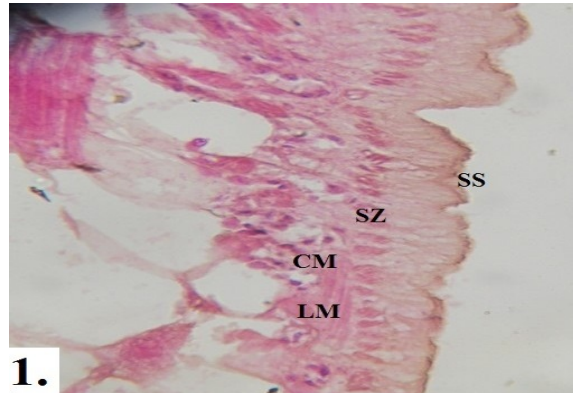
### **Result and Discussion**

In this investigation *P. cervi* were treated with the extract of *B. aegyptica*. After the treatment body size of *P. cervi* were decreased, shrunken, paralysed and dead after 5 hours at 125 mg/ml concentrations. *In vitro* toxicity study revealed that anthelmintic components of alcoholic fruit extract of *B. aegyptica* shows good anthelmintic activity and caused deformation of tegument and suckers (Fig. No: 2, 4 & 6).

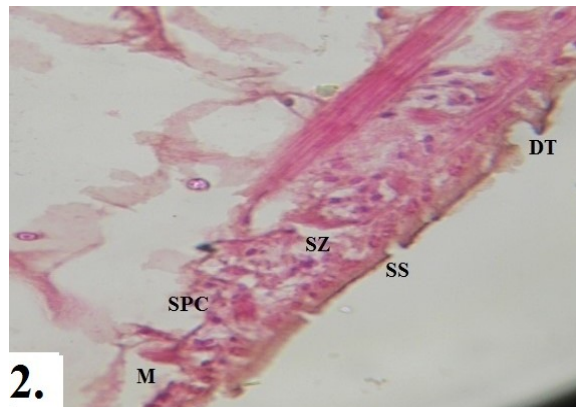
The control untreated and treated *P. cervi* were compared by light microscopy. When treated parasites were examined under the light microscopy. Present study revealed that the easy entry routes of fruit extract in the body *P. cervi* which is ultimately caused paralysis and mortality of the amphistome and many changes were observed that the *P. cervi* became small, shrunken and also found architectural alteration in tegument and suckers. All morphological structures play a very important role in the systematic classifications of Amphistomes. These characters include; body position and shape, presence of tegumental folds, suckers, and tegumental structures.

The tegument acts an important role in protection, absorption, excretion, transport and osmoregulation, which is in direct contact with host's tissue along with the body fluids. The anthelmintic activity of treated parasites shows swelling of the body, disruption and detachment of tegument (Veerakumari & Paranthaman 2004 and Veerakumari *et al.*, 2012).

**Fig.1** A portion of tegument of control untreated *P. cervi* showing surface syncytium (SS), sub syncytial zone (SZ), longitudinal muscles (LM) and circular muscles (CM) x 110



**Fig.2** Photograph of tegument of treated *P. cervi* showing detachment in surface syncytium (SS), breakage in sub syncytial zone (SZ), scattering in parenchymatous cell (SPC) & muscles (M) and discontinuation in tegument (DT) x 110

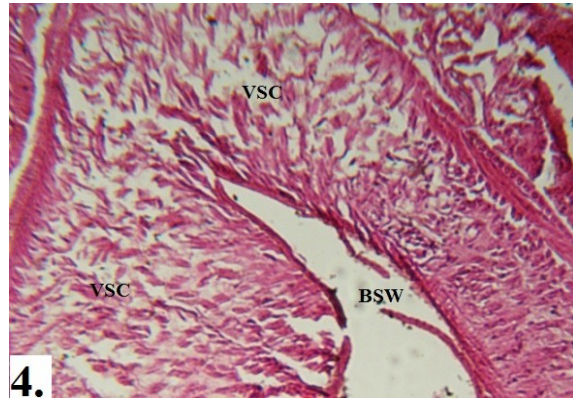


**Fig.3** A portion of posterior sucker (Acetabulum) of control untreated *P. cervi* showing sucker cell (SC) and sucker wall (SW) x 110

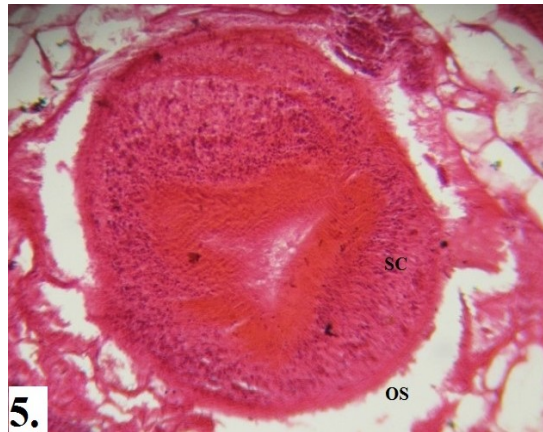




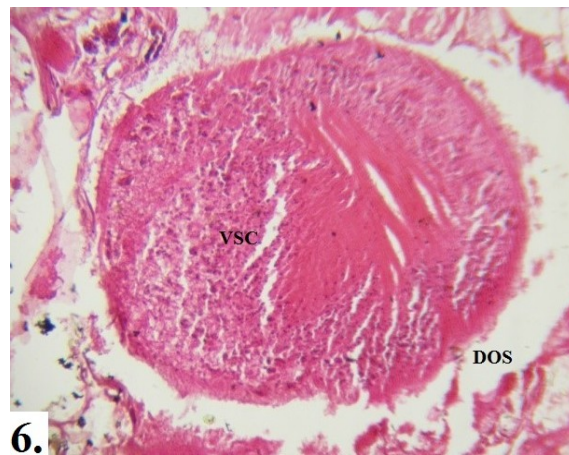
**Fig.4** A portion of posterior sucker (Acetabulum) of treated *P. cervi* showing vacualized sucker cell (VSC) and breakage sucker wall (BSW) x 110



**Fig.5** Oral sucker ( OS) of control *P. cervi* showing sucker cell (SC) x 110



**Fig.6** Oral sucker of treated *P. cervi* showing Deformed oral sucker (DOS) and vacuolized sucker cell (VSC) x 110



The control untreated *P. cervi* showed systematically arrangement of tegument, the tegumental surface is highly corrugated with transverse folds, smooth spineless, surface syncytium (SS), subsyncytial zone (SZ), longitudinal muscles (LM), and circular muscles (CM) (Fig.1). *In vitro* effect of fruit extract of *B. aegyptica* on *P. cervi* showing detachment and discontinuation of tegument showing surface syncytium (SS) and also showed vacuolization and breakage in subsyncytial zone (SZ).

Treated *P. cervi* showed significant separation of surface syncytium (SS) from the subsyncytial zone (SZ) of tegument. The bundles muscles (M) were also separate and scattered parenchymatous cell (SPC) were observed in present study (Fig.2). Similar observations were also noted in some other helminth parasites that the tegument of treated helminth parasites was wrinkled, vacuolized cells, deformed and shrunken oral & posterior sucker in. (Sharma & Hanna 1988; McConville *et al.*, 2006; Lalchandama *et al.*, 2007; Ghangale *et al.*, 2009; Dasgupta *et al.*, 2010; Bashtar *et al.*, 2011; Jeyathilakan *et al.*, 2010 & 2012; Nahla *et al.*, 2012; Panyarachun *et al.*, 2010 & 2013; Buddhachat *et al.*, 2012; Shaheen & Eman 2012; Saowakon *et al.*, 2011 & 2013; Ahmed *et al.*, 2013 and Scantlebury *et al.*, 2013).

Amphistome parasite *P. cervi* have two suckers; first is oral sucker in circular form present anterior sub terminal region and second one is posterior sucker present in posterior extremity also known as acetabulum. Control posterior sucker (acetabulum) and oral sucker shows sucker cell (SC) and sucker wall (SW), (Fig.3 & 5).

The posterior sucker (acetabulum) and oral sucker of *P. cervi* were distorted and damaged due to extract of *B. aegyptica*.

Acetabulum of *P. cervi* treated shows the vacuolization in sucker cell (VSC) and breakage in sucker wall (BSW) (Fig.4). Treated *P. cervi* also showing deformed oral sucker (DOS) and vacuolized sucker cell (VSC) in oral sucker (Fig.6).

Some studies revealed that *B. aegyptica* is multipurpose plant and it shows anti-inflammatory, antioxidant, anti-ulcer, antimicrobial activity using different techniques. (Meda *et al.*, 2010; Chotani and Vaghasiya 2011; Suky *et al.*, 2011; Motaal *et al.*, 2012; Ajayi & Ifedi 2014 and Kant & Gour, 2015). The various anthelmintic activity of *B. aegyptica* has been found against worms. (Koko *et al.*, 2000; Dwivedi *et al.*, 2009; Ebeid *et al.*, 2011; Shalaby *et al.*, 2012; and Intisar *et al.*, 2013).

In this study the anthelmintic activity of *B. aegyptica* fruit extract on *P. cervi* also showed breakage, distortion, discontinuation & detachment of tegument, vacuolization in tegumental cells & sucker cell, separation of muscles cells in tegument and oral & posterior sucker (acetabulum). This study suggests the vermifugal activity of these plants extract against *Paramphistomum cervi*. Based on the present study results the *B. aegyptica* is a safe and eco-friendly manner drug. Present research work will also provide most important ecologically sound technique for controlling *Paramphistomum cervi*.

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## References

- Abdallah EM, Hsouna AB and Al-Khalifa KS. 2012. Antimicrobial, antioxidant and phytochemical investigation of *Balanites aegyptiaca* (L.) Del. edible fruit from Sudan. *African Journal of Biotechnology* Vol. 11(52): 11535-11542.
- Ahmed M, Laing MD and Nsahlai IV. 2013. *In vitro* anthelmintic activity of crude extracts of selected medicinal plants against *Haemonchus contortus* from sheep. *J Helminthol.* 87(02): 174-179.
- Ajayi IA and Ifedi EN. 2014. Short term toxicological analysis and effect of total replacement of wheat with *Balanite aegyptiaca* seed cake on albino rats. *IOSR Journal of Applied Chemistry.*7(7): 74-79.
- Bancroft JD and Steven A. 1977. Theory and practice of histological techniques. Churchill Living stone. Medical Division of Longman Group Limited. Edinburgh London and New yark.
- Bashtar AR, Hassanein M, Abdel-Ghaffar F, Al-Rasheid K, Hassan S, Mehlhorn H, Al-Mahdi M, Morsy K and Al-Ghamdi A. 2011. Studies on monieziasis of sheep I. Prevalence And antihelminthic effects of some plant extracts, a light and electron microscopic study. *Parasitol Res.* 108(1):177-86.
- Buddhachat K, Chantima K, Chomdej S and Wongsawad C. 2012. *In vitro* effects of Some Thai Anthelmintic Plants on Mortality and Change of Tegumental Surface of *Stellantchasmus falcatus*. *J BacteriolParasitol.* 3(6): 1-3.
- Chapagain BP and Wiesman Z 2005. Larvicidal effects of aqueous extracts of *Balanites aegyptiaca* (desert date) against the larvae of *Culex pipiens* mosquito. *African Journal of Biotechnology.* 4 (11): 1209-1213.
- Chothani DL and Vaghasiya HU. 2011. A Review on *Balanites aegyptiaca* Del (Desert Date) Phytochemical Constituents, Traditional Uses, And Pharmacological Activity. *Pharmacogn Rev.* 5(9): 55–62.
- Dasgupta, S., Roy, B and Tandon, V. 2010. Ultrastructural alternation of the tegument of *Railletina echinobothrida* treated with the stem bark of *Acacia oxyphylla* (*Leguminosae*). *Journal of ethnopharmacology.*127 (2):568-71.
- Dubey PK, Yogi M, Bharadwaj A, Soni ML, Singh A and Sachan AK. 2011. *Balanites aegyptiaca* (L.)Del., a Semi-Arid Forest Tree: A Review. *Academic Journal of plant sciences.* 4(1):12-18.
- Dutt SC. 1980. Paramphistomes and paramphistomiasis of domestic ruminant in India. PAU Press, Ludhiana and published by the joint Director, Communication Center, Punjab Agricultural University, Ludhiana.
- Dwivedi A, Joshi V, Barpete PK, Akhtar AK, Kaur A and Kumar S. 2009. Anthelmintic Activity of Root Bark of *Balanites aegyptiaca*(L.) Del. *Ethnobotanical Leaflets.*13: 564-67.
- Ebeid MH, Moustafa AM, Arnaout FK, Degheidy NS, Omer EA, Shalaby HA and Abd El-Hamed AF. 2011. *In vitro* evaluation of anthelmintic efficacy of *Balanites aegyptiaca* on *Fasciola gigantica*. *Behna veterinary medical journal.* 22(2): 56-67.
- Gajalakshmi S, Vijayalakshmi S and Rajeswari VD. 2013. Pharmacological Activities of *Balanites aegyptiaca* (L.)- A

- Perspective Review. Int. J. Pharm. Sci. Rev. Res. 22(1): 117-120.
- Ghangale GR, Mahale T and Jadhav ND. 2009. *In vitro* anthelmintic activity of alcoholic extracts of *Allium sativum* against rumen amphistome. Journal of veterinary world. 2(10): 385-386.
- Hossain E, Chandra G, Nandy AP, Mandal SC and Gupta JK. 2012. Anthelmintic effect of a methanol extract of leaves of *Dregea volubilis* on *Paramphistomum explantum*. Journal of Parasitol. 110 (2):809:814.
- Intisar AMO, Goreish I, Shaddad SA, Elamin TH and Eltayeb IB. 2013. Anthelmintic activity of *Balanites aegyptiaca* against *Haemonchus contortus* in Goats. J Pharm Biomed Sci. 30(30): 1065-1070.
- Iqbal Z, Lateef M, Asharaf M and Jabbar A. 2004. Anthelmintic activity of *Artemisia bravifolia* in sheep. Journal of Ethno-pharmacology. 93: 265-268.
- Jeyathilakan N, Murali K, Anandaraj A, and Basith SA. 2010. *In vitro* evaluation of anthelmintic property of herbal plants against *Fasciola gigantica*. Indian Journal of Animal Sciences. 80 (11): 1070-74.
- Jeyathilakan N, Murali K, Anandaraj A and Basith SA. 2012. *In vitro* evaluation of anthelmintic property of ethno-veterinary plant extracts against the liver fluke *Fasciola gigantica*. J Parasit Dis. 36 (1): 26-30.
- Kant T and Gour VS. 2015. *Balanites aegyptiaca* (L.) Del : A Multipurpose and Potential Biodiesel Tree Species of the Arid Regions. Rep Opinion. 7(2):61-64.
- Koko WS, Galal M and Khalid HS. 2000. Fasciolicidal efficacy of *Albizia anthelmintica* and *Balanites aegyptiaca* compared with albendazole. Journal of Ethnopharmacology. 71(1-2): 247-252.
- Kommu S, Gowrishankar NL and Eswaraiah CM. 2013. Evaluation of Anti-Ulcer Activity of Methanolic Extract of *Balanites Aegyptiaca* L. Bark. International Journal of Phytopharmacology. 4(5): 308-310.
- Kumawat BK, Gupta M, Chand T and Singh Y. 2012. Preliminary phytochemical investigation on leaves of *Balanites aegyptiaca* (L.). Research Journal of Pharmaceutical, biological and chemical sciences. 3(2):0975-8585.
- Lalchandama K, Roy B and Dutta BK. 2007. *In vitro* anthelmintic activity of *Acacia oxyphylla*: changes in the levels of trace elements and activities of the tegumental enzymes of the cestode, *Rallietina echinobothrida*. Pharmacologyonline. 2: 307-317.
- Lohlum S A, Forcados E G, Agida OG, Ozele N and Gotep JG. 2012. Enhancing the Chemical Composition of *Balanites aegyptiaca* Seeds through Ethanol Extraction for Use as a Protein Source in Feed Formulation. Sustainable Agriculture Research. 1(2): 251-256.
- McConville M, Brennan G P, McCoy M, Castillo R, Hernandez-Campos A, Ibarra F and Fairweather I. 2006. Adult triclabendazole resistant *Fasciola hepatica*: surface and subsurface tegumental responses to *in vitro* treatment with the sulphoxide metabolite of the experimental fasciolicide compound alpha. Parasitology. 133:195-208.
- Meda NT, Lamien-M A, Kiendrebeogo M, Lamien CE, Coulibaly AY, Rasolodimby MJ and Nacoulma OG. 2010. *In vitro* antioxidant, xanthine oxidase and acetylcholinesterase



- inhibitory activities of *Balanites aegyptiaca* (L.) Del. (Balanitaceae). Pakistan Journal of Biological Sciences. 13(8):362-368.
- Motaal AA, Sherif S and Haddad PS. 2012. Antidiabetic Activity of Standardized Extracts of *Balanites Aegyptiaca* Fruits Using Cell-Based Bioassays. Journal of Pharmacognosy. 4(30): 20–24.
- Nahla AR, Amal IK and Amera EW. 2012. *In vitro* evaluation of anthelmintic activity of *Allium sativum* against adult *Cotylophoron Cotylophorum* (*Paramphistomidae*). Parasitological UJ. 5(2): 135-146.
- Panyarachun B, Sobhon P, Tinikul Y, Chotwiwatthanakun C, Anupunpisit V and Anuracpreeda P. 2010. *Paramphistomum cervi*: surface topography of the tegument of adult fluke. ExpParasitol. 125: 95 99.
- Panyarachun B, Ngamniyom A, Sobhon P and Anuracpreeda P. 2013. Morphology and histology of the adult *Paramphistomum gracile* Fischoeder, 1901. J. Vet. Sci. 14(4): 425-432.
- Qadir S, Dixit AK and Dixit P. 2010. Use of medicinal plants to control *Haemonchus contortus* infection in small ruminants. Veterinary World. 3(11): 515-518.
- Saboo S, Chavan RW, Tapadiya GG and Khadabadi SS. 2014. An Important Ethnomedicinal Plant *Balanites aegyptiaca* Del. American Journal of Ethnomedicine. 1(3): 122-128.
- Saowakon N, Kueakhai P, Changklungmoa N, Lorsuwannarat N and Sobhon P. 2011. *In vitro* effect of purified *plumbagin* of *Plumbago indica* against motility of *Paramphistomum cervi* Planta Med. 77 - PF37
- Saowakon N, Lorsuwannarat N, Changklungmoa N, Wanichanon C and Sobhon P. 2013. *Paramphistomum cervi*: the *in vitro* effects of *plumbagin* motility, survival and tegument structure. Experimental Parasitology. 133(2): 179-186.
- Scantlebury CE, Peachey L, Hodgkinson J, Matthews JB, Trawford A, Mulugeta G, Tefera G and Pinchbeck GL. 2013. Participatory study of medicinal plants used in the control of gastrointestinal parasites in donkeys in Eastern Shewa and Arsi zones of Oromia region, Ethiopia. BMC Veterinary Research . 9(179): 1-12.
- Shaheen HM and Eman KB. 2012. Morphological response of *Paramphistomum cervi* to treatment with oxclozanide and niclosamide *in vitro*. J.Egypt.vet.med.Assoc. 72(4): 561-574.
- Shalaby HA, El Namaky A, Khalil FA and Kandil OM. 2012. Efficacy of Methanolic extract of *Balanites aegyptiaca* fruits on *Toxocara vitulorum*. Vet. Parasitol. 183: 386-392.
- Sharma P N and Hanna R E. 1988. Ultrastructural study of the tegument of *Orthocoelium scoliocoelium* and *Paramphistomum cervi* (Trematoda: Digenea). Journal of Helminthology. 62: 331-343
- Singh TU, Kumar D and Tandan SK. 2008. The paralytic effect of *A. sativum* and *P. longum* on *G. explanatum*. Indian Journal of Pharmacol. 40(2): 64-68.
- Suky TMG, Parthipan B, Kingston C and Mohan VR. 2011. Anti-Inflammatory Activity of Aerial part of *Balanites aegyptiaca* (L.) Del against Carrageenan induced Paw Oedema.

International Journal of PharmTech  
Research. 3(2): 639-643.

Swarnakar G and Kumawat A. 2013.  
Incidence of Pathogenic  
Amphistomes *Orthocoelium*  
*scoliocoelium* (Trematoda: Digenea)  
in Udaipur (Rajasthan). International  
Journal of Scientific Research.  
2(3):70-71.

Veerakumari L and Munuswamy N. 1999.  
*In vitro* studies on the effects of  
some anthelmintics on *Cotylophoron*  
*cotylophorum* (Digenea,  
Paramphistomidae): a structural  
analysis. *Cytobios.* 98(387): 39-57.

Veerakumari L and Paranthaman D. 2004.  
Light and scanning electron  
microscopic studies on the effects of  
niclosamide and oxclozanide on  
*Cotylophoron cotylophorum*  
(Fischoeder,1901). *Journal of*  
*Veterinary Parasitology.*18: 1-12.

Veerakumari L, Ashwini R and  
Lalhmingchhuanmawii K. 2012.  
Light and scanning electron  
microscopic studies on the effect of  
*Acacia Arabica* against  
*Cotylophoron cotylophorum*. *Indian*  
*Journal of Animal Sciences.*82 (4):  
21-24.

Yadav JP and Panghal M. 2010. *Balanites*  
*aegyptiaca*(L.) del. A review of its  
traditional uses, phytochemistry and  
pharmacological properties. *Int. J.*  
*Green Pharm.* 4:140-146.