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ANTHELMINTIC PROPERTY OF ARECANUT (*Areca catechu* Linn.) - A REVIEW

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INTRODUCTION

Areca palm, *Areca catechu* Linn., belongs to the family Arecacea is mainly distributed in South and South East Asia, especially in India, China, Bangladesh, Indonesia, Myanmar, Thailand, Malaysia, Vietnam, Philippines, etc. (Arjungi, 1976). It is an evergreen palm with an erect stem reaching more than 20 m height. The fruit is a drupe, round or ovoid in shape with 3 - 4 cm diameter when fully grown. There is a central ruminant endosperm or seed covered by a thin pericarp or husk. The pericarp is green in colour when immature and yellowish brown when ripe. The seed or nut is hard and light brownish in colour when mature. It has a characteristic astringent and slightly bitter in taste (Ananda, 2004).

The endosperm of areca fruit, which is commonly called as arecanut or betelnut or supari, is generally marketed after processing. In India, two types of processing, one called as 'red supari' and another as 'white supari' are in vogue. The former type is obtained by boiling and drying dehusked unripe arecanuts at different stages of maturity, whereas the latter type is obtained by drying ripe arecanuts and dehusking afterwards (Selvan *et al.*, 2004).

Among several diseases and parasitic infestations, helminth parasites cause considerable problems for human beings and livestock including poultry. The helminth parasites which infest the intestine are Cestodes (tapeworms); Nematodes (hook-worms and roundworms) and Trematodes (flatworms or flukes) (Mali and Mehta, 2008). Many modern synthetic medicines though very effective against these parasites, they also cause a number of side effects. Moreover, indiscriminate use and incorrect dosage of such drugs lead to the development of resistance to such compounds (Borgsteede, et al.,1997; Gill, 1996; Yadav, 1990; Easwaran *et al.*, 2009).

Since ancient times, arecanut is being used for mastication in several countries as it is believed to have numerous medicinal and anthelmintic properties (Aman, 1969; Rao,1982; Oxenham et al., 2001; Jaiswal *et al.*, 2011; Peng *et al.*, 2015). World Health Organization (2009) has listed out as many as 25 different beneficial effects of A. catechu on mankind. Amudan et al. (2012) have reviewed the phytochemical and pharmacological potential of the seeds of A. catechu and suggested for further detailed studies to identify the biochemical compounds responsible for such actions. Tagboto and Townson (2001) have reviewed the antiparasitic properties of several medicinal plants and suggested to validate and work further on those aspects.

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Chemical constituents of arecanut

Shivashankar *et al.* (1969) reported that the nuts or the endosperm of arecanut contains: Polyphenols (including flavonoids and tannins) 11.1 - 29.8%; Polysaccharides 17.3 - 25.7%; Proteins 6.2 - 9.4%; Fats 8.1 - 15.1%; Fibres 8.2 - 15.4%; Alkaloids 0.11 - 0.24% and Minerals 1.1 - 2.5% (including calcium 0.05%, phosphorous 0.13% and iron 1.5 mg/100 g). Arecanut also contains Vitamin B6 (286.9 mg%) and Vitamin C (416.2 mg%). The alkaloid fraction of arecanut contains: arecoline, arecaidine, guvacoline and guvacine, the first one being the primary pharmacologically active component. Polyphenols decrease with maturity, whereas polysaccharides, fat, fibre and alkaloid contents increase with maturity of the nuts (Mathew *et al.*, 1964).

The Fatty acid composition of arecanut are: lauric acid (19.5%), myristic acid (46.2%), palmitic acid (12.7%), oleic acid (6.2%), linoleic acid (5.4%), hexadecenoic acid (7.2%) and minor proportions of stearic acid, decanoic acid and monoethylenic acids (Pathak and Mathur, 1954).

Anthelmintic properties of arecanut

Crude drugs, derived from plants, though less effective in curing the disease, are relatively safe and biodegradable compounds and cause very less harm to environment. Large number of medicinal plants (Mali and Mehta, 2008; Mohan *et al.*, 2015; Veerakumari, 2015) and their seeds (Goswami *et al.*, 2013) have been recorded to have anthelmintic properties. The endosperm of arecanut is known for its anthelmintic properties since time immemorial and is being practiced as folk medicine to expel intestinal worms in China (Hashimoto *et al.*, 1988) and India (Aman,1969; Badanaje, 2008; Murthy *et al.*, 2011).

Several researchers have reported that the condensed tannins of plant origin are having potent anthelmintic properties (Athanasiadou et al., 2001; Haslam, 1996; Klongsiriwet *et al.*, 2015; Min and Hart, 2003; Williams *et al.*, 2014a; Williams *et al.*, 2014b). Williams *et al.* (2014a) also observed that the condensed tannins cause significant damage to the cuticle and digestive tissues of the larvae of helminth parasites. Klongsiriwet *et al.* (2015) reported that the anthelmintic property of condensed tannins could be significantly enhanced by the addition of certain flavonoid monomers. Apart from tannins, arecoline is also reported to have anthelmintic property (Farnsworth *et al.*, 1985; Fabricant and Farnsworth, 2001). Mohammed *et al.* (2014) synthesized imidazole analogs of arecoline and tested their efficacy in *vitro* against the earthworm, *Eudrilus eugeniae* and found that the synthesized analogs had very effective anthelmintic properties. Several studies have been conducted on the anthelmintic properties of arecanut which has got good amount of tannin and fair amount of arecoline in it.

Valenciano (1980) studied the anthelmintic property of arecanut against the helminth parasites of dogs and found that the decoction of arecanut was very effective against these parasites. Two to four month old puppies when administered with the decoction of arecanut at the rate of 2cc per kg body weight, provided fair control against the roundworm, Toxocara canis and the tapeworm, *Dipylidium caninum* infestations in them.

Saluthan and Billacura (2005) studied *in vitro* the anthlmintic property of different solvent extracts of air dried seeds of arecanut against the common earthworm, *E. eugeniae* and found that the Hexane Extract, which contained only tannins and polyphenols, was most effective than Ethyl acetate and aqueous extracts against this nematode with a mean time for paralysis of 4.8 minutes and mean time for death of 38.8 minutes. They also reported that the Ethyl acetate and aqueous extracts contained not only tannins and polyphenols, but also alkaloids and flavonoids.

As an alternative to commercial parasiticides, Cargill *et al.* (2008) evaluated three ethnomedical plant products such as fruits of papaya, dried nuts of arecanut and leaves of pineapple to find out a cheaper and effective means of controlling the infestations of two gastrointestinal nematodal parasites such as *Trichuris* and *Ascaris* in pigs in Indonesia. They found that the pigs fed with a diet supplemented with dried arecanut powder at the rate of 4g/ 10kg live weight of pig once a week for 4 consecutive weeks eliminated *Trichuris* and *Ascaris* completely. The growth rate in pigs fed with a supplement of arecanut in their feed was increased by 82 g/day whereas in the control group the growth rate was decreased by 27 g/day.

Rajapakse, *et al.* (2009) studied the anthelmintic activity of nearly 15 medicinal plants against gastrointestinal nematodes infesting goats in Sri Lanka. Among these plants they found that the crude extracts of *A. catechu* fruit kernel and *Adhatoda vasica* leaves significantly reduced the number of worm eggs present in faecal matter of naturally infested goats. In the group treated with areca cru extract at a dose of 6 mg/kg body weight at days intervals during the test period of s months there was a significant decrease in eg counts in faecal matter from the second mon of the treatment itself, and body weigl significantly increased from the fifth mont onwards when compared with that of th control group. They also suggested that th arecanut extract could be successfull incorporated in the control programmes agains gastrointestinal nematodes infesting goats.

Jeyathilakan *et al.* (2010) evaluated *in vitr* the anthelmintic properties of three plan extracts such as *A.catechu, Erythrina indica* and *Zingiber officinale* against the liverfluke (trematode) *Fasciola gigantica* which infests domestic livestock in India and other tropical countries and compared the results with that of the common anthelmintic/flukicide drug Oxyclozanide. They found that the arecanu extract had 100% lethal effect at a concentration of 1% and above. Further, arecanut extract was found even better than Oxyclozanide in the treatment against *F. gigantica.* At 1% concentration of arecanut extract, the flukes died after 2 min of exposure, whereas at the same concentration of Oxyclozanide the flukes died only after 4 min of exposure. Other two plant derivatives were found to be less effective

Tangalin (2011) studied the anthelmintic property of mature arecanut to chickens, sheep and goat and compared the results with that of commercial dewormers. The study conducted on chicken revealed that adult roundworms, tapeworms and parasite eggs were expelled successfully with a dose of 1 g of processed arecanut/kg body weight of the animal. In goat

and sheep, a dose of 1.5 g processed arecanut/ kg body weight of the animal showed good results against parasitic worms. The results further revealed that the arecanut expelled both eggs and adults of roundworms and tapeworms, whereas the commercial dewormers such as Albendazole and Valbazen expelled only the adults of roundworms.

Not only the nuts, but also the roots of arecanut are having anthlmintic properties. Baby and Raphael (2014) evaluated *in vitro* the anthelmintic property of the roots of arecanut against the Indian common earthworm, *Pheretima posthuma* and compared the results with that of the standard drug Albendazole. They found that the ethanolic extract of the roots of arecanut were found to be even more potent than that of the standard drug Albendazole against *P. posthuma*. At a concentration of 25 mg/ ml the arecanut extract induced paralysis after 24 minutes of exposure, whereas with the same concentration of Albendazole the time for inducing paralysis was only after 32 minutes of exposure. With arecanut extract, the time for death was after 36 minutes of exposure but with Albendazole death was not observed during the experimental period of 4 hours.

The major constituents of the larvicidal principles in the endosperm of arecanut were identified to be a mixture of fatty acids such as lauric, myristic, palmitic and oleic acids (Kiuchi, *et al.*,1987). In *in vitro* studies conducted by them they also found that the combination of fatty acids and tannins of arecanut had strong larvicidal activity against dog roundworm, *T. canis*. According to them the widespread habit of betel chewing may be effective in the prevention of parasitic diseases in man.

The anthelmintic action of arecanut extract was mainly due to its ability to inhibit the formation of glutathione S-transferase in the body of the parasite which lead to the accumulation of toxic metabolites leading to paralysis and death of the parasite (Dhanraj and Veerakumari, 2015). In their study conducted on the trematode (fluke) parasite, *Cotylophoron cotylophorum* of sheep and goat, maximum level of such inhibition was observed at a concentration of 0.5 mg/ml after 8 hrs of exposure to the ethanol extract of arecanut.

Arecanut extract is also having ovicidal properties against nematode eggs. Such studies were done by Barbieri *et al.* (2014) on the eggs of the sheep gastrointestinal nematode, *Haemonchus contortus*. In *in vitro* trial conducted by them using the acetone extract of arecanut seed they found that the hatchability of the eggs was inhibited by 50 % at a dose of 7.45 mg/ml of the extract.

CONCLUSION

Plants are being used for the treatment of several diseases all over the world since the beginning of human civilization. In recent years, there has been growing interest in the pharmacological and therapeutic uses of medicinal plants because of their effectiveness, safety and easy availability. The therapeutic uses of arecanut as anthelmintic are reviewed in this paper. The literature shows that there is ample opportunity for scientists and pharmacologists for further studies in this field and isolate and synthesize the active principles actually responsible for anthelmintic properties from this plant which is abundantly grown in India and several other countries.

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