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Preliminary survey on the Indian wild boar damage in agricultural lands using ITKs in adjoining Tiger reserve of Tamil Nadu, India

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Abstract
The Indian Wild Boar (*Sus scrofa cristatus* L.) is a widely distributed animal in India. The incidence of Indian Wild Boar (*Sus scrofa*) and its harm to agricultural crops were investigated in a preliminary survey. The survey included the major agricultural crops that were damaged by the wild boar and the preventive measures that the farmers have taken to protect the crop from the raiding of wild boar. The study was taken up from the months of December to February (2021-2022) in and around three Tiger Reserves (Mudumalai, Anamalai and Sathyamangalam) with the help of Tamil Nadu Forest Department. With this outline, the purpose of this study is to highlight and record in detail about the tribal communities traditional knowledge on the plants that are not preferred by the wild boar. The survey was conducted in tribal hamlets encompassing the tiger reserves. Through the semi-structured informal interviews, Questionnaire, Interactions during on farm fields, the study has recorded that the wild boar has an aversion to eight plant species and eight traditional methods (five physical method and three biological method) were identified.

Keywords: Traditional knowledge, wild boar, agriculture, crop damage

1. Introduction

Human Wildlife Conflict (HWC) is a prime illustration of the escalating rivalry for space and resources between people and wildlife (Di Fonzo, 2007) [3]. The *Sus scrofa cristatus* (Indian wild boar) is a subspecies of wild boar, native to India, Nepal, Burma, Western Thailand and Sri Lanka. The animal is medium in size and belongs to the family – Suidae, Order – Artiodactyla, Class – Mammalia. The wild boar has a very poor hearing ability and due to the presence of small size of eyes, the sight is poorly developed, however the wild boar has an extraordinary Olfactory system and thus it has a stronger scent of smell (Singh and Kumar, 2018; Baskin and Danell, 2003) [14, 2].

The insect pests, plant diseases and weed plants have a greater impact on agricultural crops in India. Globally, mammals like Elephants, wild boars, Nilgai, Monkeys, Rein deer are considered a major threat to agricultural crops and human beings. Unlike other pests, wild boar generally causes damage right from seedling to till the maturity of the crop (Roberts, 1977) [12]. The general reason for such unexpected rapid rise in their populations can be attributed to the increased rate of deforestation, which is considered to be the natural habitat of the wild boar (Moreira *et al.,* 1996) [10]. Deforestation is also a major reason for the decline of carnivores like Tigers, Leopards, Panthers, Wild dogs, Wolf, and Jackal, which are the natural predators for Wild Boar (Khokhar & Rizvi, 1998) [8] there by indirectly paving way to the phenomenal raise in the wild boar populations. Several studies have suggested the relationship between crop damage and increase in wild boar population, such as the edge effect of the forest, ditches, stone walls, bushes or rows of trees that are located close to the agricultural fields, which increases the probability of crop damage and also other authors have suggested that some agricultural crops are more susceptible to wild boar damage because of the stage of maturity and the extent of the cultivable areas or owing to the nocturnal activities of this species (Schley *et al.,* 2008, Keuling *et al.,* 2009; Thurfjell *et al.,* 2009 and Amici *et al.,* 2012) [13, 7, 15, 1]

The tribal communities make up the majority of forest residents, and their day to day activities depend on the agricultural farming practices and collection of non-timber forest produces for consumption and income generation purpose. Though the tribal communities have an impact of modernization and changing world, certain beliefs, values, customs and institutional systems still exist in the tribal groups (Kala, 2005 & 2009) [4, 5].

As a result, this paper aims to conserve and record in detail the Indigenous
Traditional Knowledge (ITKs) of the tribal community about the plants not preferred by wild boar and the traditional knowledge that is lessening due to modernization.

2. Methodology
2.1 Study area
In this study, three tiger reserves were selected for studying about the traditional knowledge of the tribals against the control measures for crop damage by Indian Wild Boar.

The Anamalai Tiger Reserve is designated as one of the 25 global biodiversity hotspots and one among the five tiger reserves found in Tamil Nadu. The total area of ATR is around 1479.87 square kilometre. A biodiversity hotspot in western ghats (Anamalai Tiger Reserve) is home to six indigenous people and is suitable for designation as an Anthropological reserve. The noted tribes present in ATR are Malasar, Kadar, Muduvan, Malai Malasar, Pulayar and Eravallar.

The Mudumalai Tiger Reserve is located in Tamil Nadu's The Nilgiri district and spans 321 square kilometres, at the tri junction of the three states viz., Karnataka, Kerala and Tamil Nadu. The elevation of MTR is around 850-1250m and it has been a part of the Nilgiri Biosphere Reserve since 1986. The tiger reserves in Tamil Nadu house various tribal groups near the forest fringe areas. Mudumalai is a tiger reserve in Tamil Nadu that is famed for its diverse Fauna and Flora, as well as the many tribes who still live there. The tribal groups that are found in the vicinity of MTR are Kattunayakas, Kurumbas, Todas and Kotas. Irular and Paniyas are two other Mudumalai Tribal communities that are small but noteworthy.

The Sathyamangalam Tiger Reserve spans around 1408.6 square kilometres at an elevation of 1790. The STR is most prone to the Man-Animal conflict, commonly Leopards, Elephants and Wild Boar. Indigenous Tribal People from the Irula tribe (also called as the Urali) and Soliga communities live in the forest fringe villages of Sathyamangalam Tiger Reserve

2.2 Survey Methods
For the purpose of this research, all the households of the villages mentioned were surveyed to know about the Farming trends, formation of farm holding sizes, Cropping pattern, Trend analysis of their crop pattern etc. In addition to the crop and their varieties used in farming, details about the damages to their crop by wild animals, percentage of crop damages and the methods or preventive measures taken by the villagers to reduce the crop damage were noted down.

In the chosen villages, a door to door questionnaire survey was undertaken. Equal contribution was given by the male and female members of the households for the interviews. The survey was conducted in various methods starting from the semi-structured informal interviews, questionnaire method to having interaction during on farm experiments, where the village farmers were able to show the extent of crop damage directly on their farmlands (Kala, 2011; Michael, 2012) [6]. Besides these methods, the local residents also shared the level of damage and the damage caused by the wild animals both on Farm crops and the farmers, this method adopted is called the hear-say method of surveying.

The main objective of this survey was to know about the nature of crop damages and the extent of crop damages by the wild animals and the measures taken by these farmers to control the crop damage. Of all these, knowing about the traditional knowledge of the local people to identify the plants that are not preferred by the wild animals was the key for the survey conducted.

Table 1: List of crops cultivated by farmers

S. No.	Name of the crop cultivated	Stage of damage in the crop
1	Potato	All stages of the crop
2	Ragi	Latex stage
3	Ground nut	Total crop damage
4	Brinjal	All stages of the crop
5	Chillies	No damage noted
6	Corn	Total stages of the crop

Table 2: Traditional methods followed by farmers to control Wild boar damage

S. No.	Physical methods	Biological methods
1	Torch	Cow dung urine + Neem leaves soaked water
2	Shade nets	Neem leaves soaked water
3	Dogs	*Ruta graveolens* plant
4	Nylon nets	Chilli powder
5	Solar fence	Opuntia as live fence
6	Sarees	
7	Fishing nets	

3. Results and Discussion
A variety of plant crops are cultivated by the farmers living around the forest fringe villages. The major crops cultivated is listed in Table 1. These plants attract the wild boar and elephants in large numbers and thus results in Human – wild animal conflicts leading to crop damages and human casualties. A range of traditional methods have been followed by farmers to control the raiding of crops by Wild boar (Table. 2). Similar results were earlier reported by Rao *et al.* (2015) in various agricultural fields of Telangana state. He identified nine methods of which six are physical methods (Human hair as deterrent, Erection of used coloured sarees, Burning of dried dung cake, Planting of thorny bushes, Use of local dogs to scare wild boars) and three are biological methods (Spraying of local pig dung solution, Arrangement of three rows in "NIWAR" soaked in Kerosene and Arrangements of Coconut ropes soaked in mixture of Sulphur + Pig oil).

3.1. Identified plant species through Indigenous Traditional Knowledges (ITKs)
Through the surveys, Eight different plant species were identified to have a potential for controlling Wild boar against crop damages in agricultural fields of forest fringe villages. The species identified are enlisted.

Table 3: Identified plant species

Sl. No	Scientific Name	Common Name	Local Name	Family
1	*Calotropis gigantea*	Giant milkweed	Erukku	Apocynaceae
2	*Vitex negundo*	Chinese chaste tree	Notchi	Lamiaceae
3	*Dendrocnide sinuata*	Elephant Fever nettle	Anai veratti	Urticaceae
4	*Ricinus communis*	Castor	Aamanaku	Euphorbiaceae
5	*Ruta graveolens*	Common Rue	Arupatham Thazhai	Rutaceae
6	*Datura metel*	Devils trumpet	Oomathai	Solanaceae
7	*Nerium oleander*	Nerium	Arali	Apocynaceae
8	*Capsicum chinense*	Habanero pepper	King Naga chillies	Solanaceae

3.2. Traditional methods adopted by villagers
The following are the traditional methods followed by the villagers to repel the wild boar from agricultural fields.

3.2.1. Physical Methods
3.2.1.1 Local dogs to scare Wild boars
The dogs are trained to protect the crops from wild boar as they have high sense of smell. The dogs are trained by the farmers and are on the watch day and night. This method proves to be effective and cost efficient, though this method has various disadvantages. Most of the dogs suffered severe injuries from wild boar later died. Hence this method is not much reliable.

3.2.1.2 Fencing around the crops
In all the villages surveyed, fencing was a major physical method to control crop damages. Various types of fences such as Nylon nets, fishing nets, electric fences, hanging fence for elephants were observed. Fishing nets proved to effective of all the above mentioned nets. At the end of the nets, human hair was scattered. Wild boar sniffs its way to reach the crop and thus human hair acts as natural deterrent to wild boars. Other fences like barbed wire fence and chain fence were also used by farmers.

3.2.1.3 Fires, Torches and Sounds
The farmers used fire sticks and torches as a measure to repel wild boars. Once the wild boars have entered the fields, farmers carry fire sticks and drive away the wild boars out of the field. Recently torches are also used by the farmers. Creating artificial sounds like lighting crackers and drumming is also practiced to keep the wild boars away from the field.

3.2.1.4 Live fences around the crop
The farmers plant live plants that are thorny in nature (Xerophytic plants) like *Opuntia* sp., *Zizyphus* sp., *Agave* sp., are planted outside of the fields on the bunds to prevent the wild boars from entering in the fields. This method is proven to be 60% successful in evading the wild boars from entering the agricultural fields.

3.2.1.5 Use of coloured sarees
The farmers have tried tying the coloured sarees around the fence making the wild boar to assume the presence of human beings. It is also noted that the sarees are damaged by the wild boar and very less efficient. Around 30% of the damage is being controlled through this method.

### 3.2.2 Biological Methods
3.2.2.1 Chilli Powder
The chilli powder acts as a natural repellent to elephants and wild boar. The chilli powder is mixed with water and sprayed along the fences. 100g of chilli powder is mixed with 1 litre of water. The mixture is sprayed once in a week. This method is found to be effective for controlling the wild boar. It controls crop damage upto 65 - 70%.

3.2.2.2 Cow dung urine + Neem leaves soaked water
The Cow dung and urine was collected from local cowsheds and they are made into a solution. The neem leaves collected from the locally available neem tree was soaked in water for around two days. The solution is mixed in the 2:1 ratio and sprayed at seven days interval between each spray. This method effectively controls the wild boar upto 40 - 50%.

3.2.2.3 Neem leaves soaked water
Neem leaves possess natural repelling properties and hence the neem leaves are used as a repellent for wild boar. The neem leaves are soaked for two days and the solution is sprayed once in a week. This method is not effective and controls crop damage upto 20 – 25%.
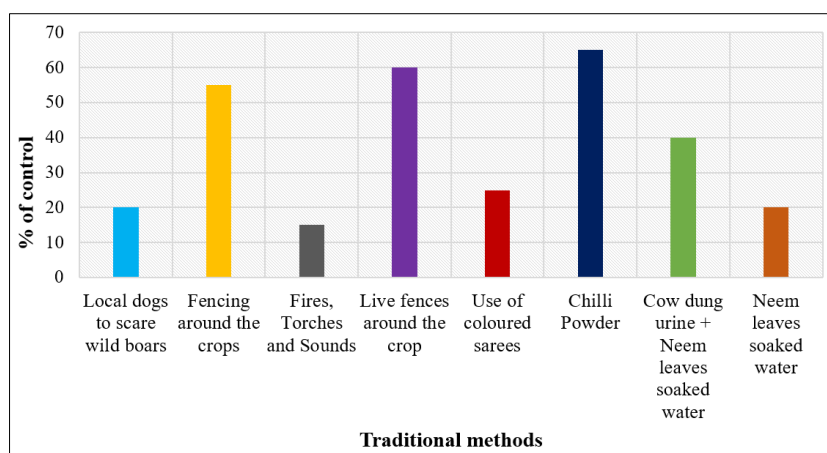
Fig 1: Percentage of control

4. Conclusion

The findings of this study reveals that the crops cultivated by farmers around the forest fringe villages attracts wild animals where the human – wild animal conflicts become inevitable leading to crop damage and casualties of human beings. The traditional methods of repelling wild boar are more or less a temporary solution to save the agricultural crops and the revenue of the farmers. Hence, this study focuses on finding a solution that is beneficial to the farmers and agricultural community to repel wild boars and this survey conducted in the forest fringe villages provided valuable results as the plant species that have the potential to drive away the wild boar has been identified.

5. Acknowledgement

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