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Farmers' knowledge, attitudes and practices with respect to rodent management in the agricultural ecosystem of Tamenglong district, Manipur, North-East India

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Abstract
A survey of 110 farmers in the four sub-divisions of Tamenglong District, Manipur, India was carried out in between January and December 2015, to assess the farmers' knowledge, attitudes and practices with respect to rodent management. The survey was conducted in 11 villages across the subdivision of Nungba, Tousem, Tamei and Tamenglong headquarters of Tamenglong District. Ten farmers from each village were interviewed. Majority of the indigenous tribal farmers followed the traditional practice of shifting cultivation from time immemorial. The farmers practice multiple cropping of monsoon i.e. rice, maize, chili, turmeric, brinjal and yam etc. The major constraints upon production were identified as pest (65%), weeds (25%), and soil condition (10%). The main pests were rat (60%), insects (22.7%), birds (10.10%) and wild animals (7.2%). Farmers believed that the rodent outbreak (78.10%) is due to the flowering of certain bamboo species followed by no opinion (14.30%) and heavy rainfall (7.6%). The field damage caused by rodent was recorded to be (8.8%) in periphery, centre (7.8%), random (30.10%) and (52.6%) in the area where the crop grows densely. Farmers used trap (58.6%), rodenticides (29.7%), hunting (5.9%) and biocontrol (5.8%) as control measures. The rodent problem occurred in regular (55.2%), occasional (33.6%), rare (11.2%). Farmers believed that rodenticides (71.81%) were harmful to the environment, no harmful (8.16%) and no opinion (20.3%). Farmers estimated that (19.85±5.74) normal yield loss per year. With the understanding of the main crop damage by the rodent pest, management strategies of rodent in the Tamenglong district can be developed.

Keywords: farmers, rodent management, survey, crops, Tamenglong

1. Introduction
Rodents are the most destructive vertebrate pests and they damaged crops, household articles and spread various diseases. However, all the rodent species are not pest; only 5-10% is major agricultural pest (Singleton *et al*. 2009)[2]. They are notorious public health pest and frequently cause severe damage to almost all standing crops and other commodities (Azad *et al*. 2013)[7]. The impact of rodents and its relationship between abundance and damage to agricultural crops of Laos was studied by Brown *et al*. 2007 [4]. In Mizoram, the rodent outbreak and its impact were studied by Aplin and Lalsiamliana (2010).[11] The farmers in the west Godavari district of Andhra Pradesh opined that rodent were one of the main biological constraints in the paddy cultivation, since it was a detrimental pest causing an average of 10-15% yield losses every season and thereby increasing the cost of cultivation (Sudha *et al*. 2014)[19]
Rodents are the major pests, causing considerable damage to the field crops of Tamenglong District, Manipur. The frequency of famine occurrence is very high in some parts of the district due to rodent outbreak. However, the problem remains unsolved due to lack of proper approach towards management. The outbreak of rodent is synchronized with the flowering of certain bamboo species growing naturally in the district. The usual rodent outbreak occurs every after 45-50 years of gap. The rodent problem in the agricultural field is prevailing and chronic in the district. The farmers easily differentiate between the chronic and the outbreak. The economic position of the district is not sound due to the impact of rodent. There is little known about the control measures, identification of rodent species and its distribution in agro-ecosystem. Due to the significant impact of the rodents' pest on rural livelihood in Tamenglong, a better understanding of the nature of the rodent problem from the farmers'

perspective is required. Survey has been made to ascertain farmers' knowledge, attitudes and practices with respect to rodent management. The purpose of this paper is to examine the relative importance of rodents to farmers in the upland farming systems of Tamenglong District, Manipur and also to examine farmers' perception about the causes of yield loss and the initiative of rodent management.

2. Materials and methods

A survey on farmers knowledge, attitudes and practices with respect to rodent management was conducted for 110 farmers from 11 villages (sites) across four subdivisions of Tamenglong district (four sites in Nungba, three sites in Tamenglong Headquarters and two sites each in Tamei, Tousem (Table 1). The district has a subtropical monsoon climate. The mean altitude of the studied area is 1260 m a.s.l. and it has an average annual rainfall of 3135 mm.

In each village five males and five females farmers were interviewed. The survey questionnaires were designed to gather general information on farm characteristics and farming practices and then specific information on pest problems. The questioned were also designed to understand the frequency of rodent occurrence, control practices and abundance of rodent and damage in relation to the crop developmental stages.

The data collected were coded using the spreadsheet programme EXCEL, cross tabulation and frequency distribution (mean) was employed for data analysis.

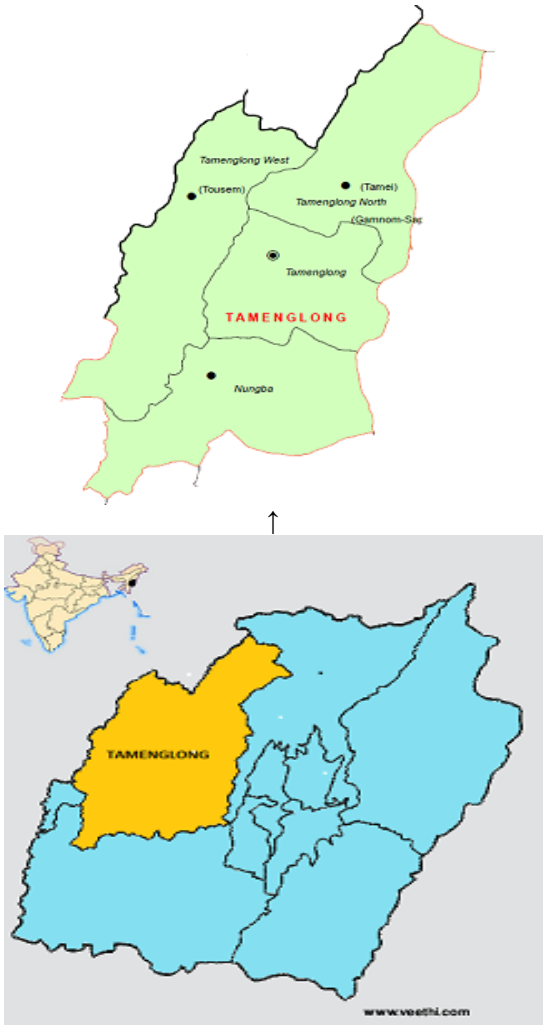

Fig 1: India map and Manipur State showing the location of Tamenglong district.

3. Result

Farm characteristics

There were three tribes represented in the survey: Rongmei, Liangmei and Zeme. Cultivation work is doing by both male and female. The mean ages of both male and female farmers were 55 and50 years. All the farmers have their own land and the major crops grown by the farmers are rice, maize, chili, yam etc.

Crop pest

The man cause of limitation to crop production was pest (65%), followed by weed (25%), poor soil condition (10%). The main pests identified by the farmers were rodents (60%), insects (22.7%), birds (10.10%), and other wild animals (7.2%). The most important pest to control was rats (60%), insects (25.6%), birds (7.8%), and other wild animals (6.6%). The most damaged crops by rats were rice (63%), maize (22.8%), yam (10.5%) and vegetables (3.7%) and the mean estimated yield loss per year due to rat was (19.85±5.74) Table 1.

Rodent management

Majority of the farmers claimed that the occurrence of rodent problem was found to be regular (55.2%), followed by occasional (33.6%) and rare (11.2%) Figure 2. The most widely used methods to control rodents were traps (58.6%) followed by rodenticides (29.7%), hunting (5.9%) and biocontrol (5.8%) figure 3. The area in which the crop most damaged is periphery (8.8%), centre (7.8%), random (31.1%) and densely growth area of crop (52.3%) figure 4.

Farmers' belief

Farmers thought that the most effective stage for rodent management is after sowing seed (3.3%), germination (3.6%), booting (51.8%), maturation (20.3%), threshing (17.4%) and storage (8.1%) figure 5. Farmers also thought that rodents are abundance at just after sowing (2%), germination (6%), booting (50.2%), maturation (27.2%), threshing (11.3%)a and storage (3.3%) and farmers also belief that the rodent most damage in the field is just after sowing (1%), germination (7%), booting (57.4%), maturation (22.7%), threshing (6.8%) and storage (5.1%) figure 6.

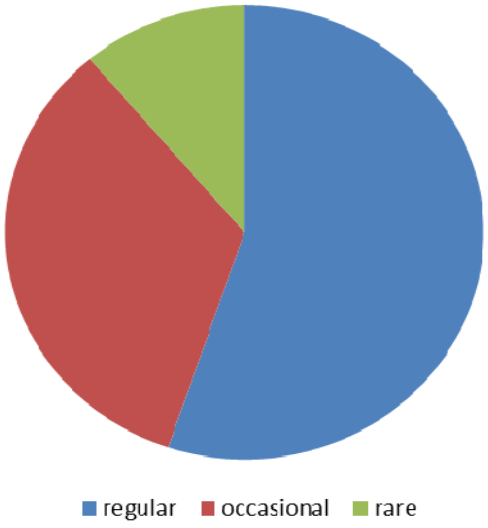

Fig 2: Frequency of rodent occurrence in study sites

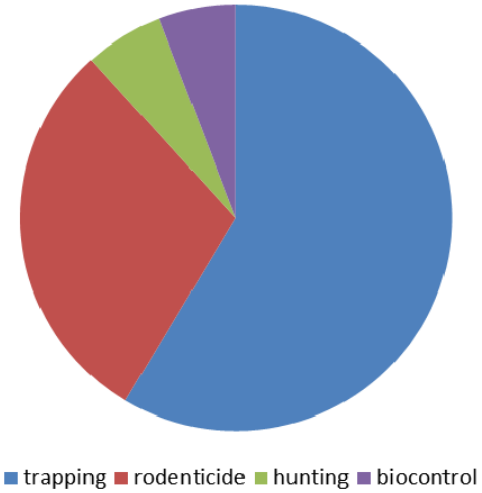

Fig 3: Rodent control techniques practice by farmers.

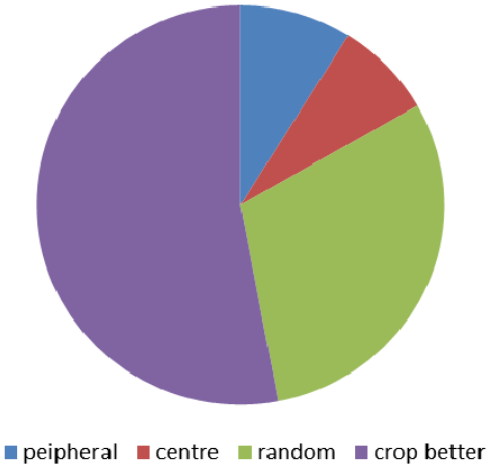

Fig 4: Area where the crop damage most in the field.

Table I: Summary of responses to questions from farmers of eleven villages, in Tamenglong District, Manipur, India.

Si. No.	Sub-division/village	Ethnic group	Most important pest	Pest that causes most damage	Most important pest to control	Rat problem	Rat in rice	Crop most damage by rat	Yield loss%
1	*Nungba* Namthanlong	Rongmei	Rat (9)	Rat (9)	Rat (10)	Yes (10)	Yes (10)	Rice (6)	18 ± 2.63
2	Noney	Rongmei	Insect (7)	Insect (8)	Insect (7)	May be (6)	Yes (5)	Rice (7)	14.4±3.26
3	Khoupum	Rongmei	Insect (7)	Insect (6)	Insect (6)	Yes (6)	Yes (7)	Rice (7)	24.5±3.26
4	Sempat	Rongmei	Rat (7)	Rat (8)	Rat (7)	Yes (10)	Yes (10)	Rice (6)	8.1±2.68
5	*Tamenglong* Sonram	Rongmei	Rat (6)	Rat (7)	Rat (8)	Yes (8)	Yes (8)	Rice (8)	24.3±3.81
6	Duilon	Rongmei	Rat (7)	Rat (8)	Rat (6)	Yes (10)	Yes (10)	Rice (8)	27.2±5.14
7	Bhalok	Rongmei	Rat (8)	Rat (7)	Rat (7)	Yes (10)	Yes (10)	Rice (7)	26±4.02
8	*Tamei* Takou Takou	Liagmei	Rat (5)	Rat (6)	Rat (5)	Yes (10)	Yes (10)	Rice (6)	16.5±4.22
9	Pallong *Tousem*	Rongmei	Rat (7)	Rat (8)	Rat (6)	Yes (10)	Yes (10)	Rice (8)	22.7±3.16
10	Thiulon	Rongmei	Rat (9)	Rat (8)	Rat (9)	Yes (10)	Yes (10)	Rice (9)	17.5±3.10
11	Anem	Zemei	Rat (8)	Rat (7)	Rat (8)	Yes (10)	Yes (10)	Rice (9)	18.6±3.16
Total	(110)		Rat (66) 60%	Rat(68) 61.9%	Rat (66) 60%	Yes(100) 90.9%	Yes (100) 90.9%	Rice (81) 73.7%	19.85±5.74

Farmers were asked the following questions: (1) what are the main pest in your farm (ranked in order of importance)? Which pest causes the most damage to your crops? (3) Which is the most important pest to control? (4) Are rat the major problems in your crop (yes, no, may be)? (5) Are rats a major pest in your rice crops (yes, no may be)? (6) Which crops suffer the most rat damage (ranked in order of importance)? (7) The perceived yield loss is shown (calculated from ratio of yield without rat damage and yield with rat damage). Only the most common response is provided. The number of farmers who responded for each category is shown in parentheses (there are 10 farmers interview per village).

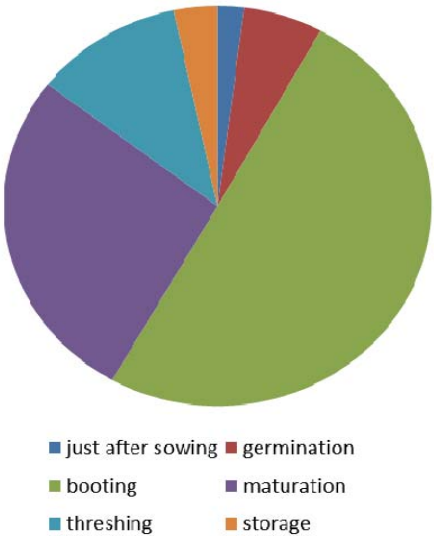

Fig 5: Effective rodent management stages in relation to crop developmental stages

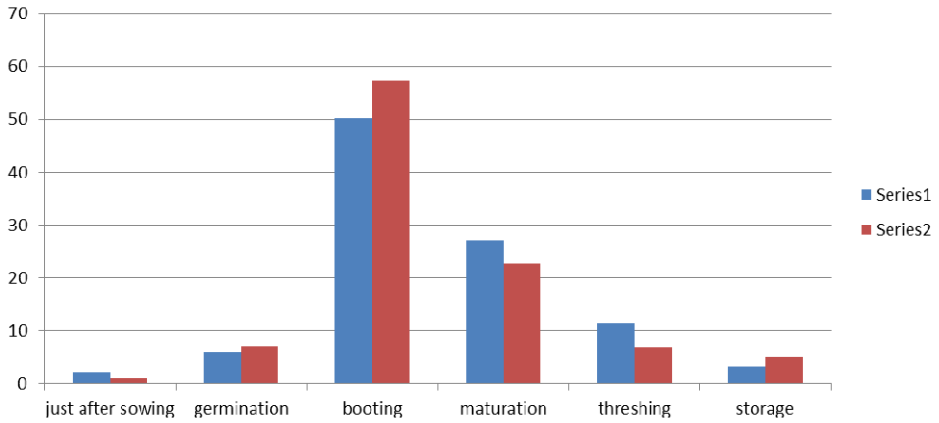

Fig 6: Abundance and damage in relation to crop developmental stages

4. Discussion

Rodents are clearly an important pest of agricultural crops for the farmers in Tamenglong district. The survey reveals that the main pest was rodent (54.5%). Rodents were thought to be the pest that caused the most damaged (60%) and the most important pest to be controlled (60%). Similar finding were reported in the Highlands of Tigray, Northern Ethiopia and Myanmar (Makundi *et al*. 2003 & Schiller *et al*. 1999) [13[20]]. In some areas the damage was found in the middle of the field producing so called 'stadium effect'. In Tamenglong, farmers reveal that rodent most damage in the site where crops grow densely (52.3%). The most damaged crop was rice but significant damaged also occurred to maize, chili, yam etc. The present estimated yield loss was generally (19.85±5.74) which is higher than the yield loss experienced in other Southeast Asian countries (5-15%) (Singleton *et al*. 2003) [1, 3, 14, 18].

In the present investigation fifty eight percent of the farmers opined that the trapping was the best control measure among the other techniques such as rodenticides, biocontrol and hunting. The farmers' belief that use of chemicals were harmful to them through food chains and food webs. Rodenticides were the most common practice in other parts of the world such as Myanmar, Laos, Andra Pradesh and Tanzania and Ethiopian and (Brown *et al*. 2008, Makundi *et al*. 2005, Joshi *et al*. 2000 and Rani *et. al* 2014) [5, 12, 9, 17]

Farmers have identified critical crop developmental stages as far as the rodent damage is concerned. The booting stage was identified as the stage where rodent abundance and damage is very high. Some crops are more damaged at certain developmental stages than others. For instance, rodent damaged to cereal crops such as wheat are later stages of crop development inflicted more significant loss on the overall production in Australia than damage early stages of crop development (Brown et at. 2007) [4]. Similarly, rodent damage in the maize field in central Ethiopia was reported to be after the seedling stage (Bekele *et al*. 2003, Mulungu *et al*. 2005) [3,15] reported that in Tanzania damage in the seedling stage will have a significant impact on the potential yield of maize crops since farmers cannot replant the seeds after the rainy season advanced.

The survey shows that farmers in the Tamenglong district experienced a severe crop damaged due to the rodent. Further, farmers were aware of the stages when severe attacks of crops occurred. The remarkable damage estimated by the farmers in crop field during booting stage could be reduced before the onset of rodent breeding season by synchronized planting for option of food. The simultaneous harvesting of rice crop would be employed because rodents were reported to migrate from early harvested field to unharvested field in search of food and shelter. The damage of crops by rodents and subsequent yield loss is economically significant since the farmers in the district were below poverty line.

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