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Pest Rodent Species Composition, Level of Damage and Mechanism of control in Eastern Ethiopia

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ABSTRACT: The assessment on the current information on the species composition of pest rodents and the local communities' perception on their pest status was carried out in Dire Dawa Administration from March 2010 to September 2011. Stratified and multistage random sampling techniques were used to sample representative villages (urban and rural) and respondents (n=150). Both qualitative and quantitative data were gathered through trapping, observation, questionnaire and interview. The collected data were tabulated and organized and appropriate statistical analysis like frequency distribution, percentage and chi-square test were used. For the survey of species composition and relative abundance of pest rodents Sherman live-traps and snap traps were set in the selected standardized and variable trapping grids. Five hundred and nine new individual rodents were captured from the trap nights of 986 Sherman live-traps and 130 snap traps. Twelve species of pest rodents were recorded of which eight were trapped and the four were observed in the study grids. The present result revealed as rodents were the most noxious pests causing substantial damage to agricultural crops, household items and human health through different mechanisms like feeding, discomforting, contaminating and mechanical damage and disease transmission. Techniques like using cat, hunting and trapping, rodenticides and field sanitations were frequently used. The present records of high pest rodent species composition not only indicate as the area is highly infested but it also indicates the existence of a high stock of rodent species diversity that requires an immediate development and application of ecological based rodent pest management strategy.

KEYWORDS: Damage, Dire Dawa Administration, pest, rodents, species composition.

1 INTRODUCTION

In Ethiopia altitudinal variation and other factors are resulted in a very diverse set of ecosystems ranging from humid forest and extensive wetland to the desert [1]. As the consequence the country acquired much diversity of species and endemics [2].

Of all the mammalian orders, the rodents contain the largest number of species which were widely diversified and distributed [3], [4]. They account for near half of the known mammalian species [5], [6]. In East Africa, they account for nearly 28% of mammalian species [7]. Among the 280 mammalian species that occur in Ethiopia, 84 species are rodents forming more than 25% of the total mammalian fauna [2]. Out of these species, 15 are endemic that constitute 50% of the Ethiopian endemic mammalian fauna [2], [8].

Rodents show a great diversity in their morphology, ecology, physiology and behavior. Despite their great species diversity, all rodents share dentition as their common features [3], [9]. They have economical, ecological, social and cultural values and provide major benefits to our environment [6]. Most rodent species play great role in maintaining the ecosystem such as in seed dispersal, pollination, predator-prey relationship and in maintaining ecological balance and habitat modification [10], [11]. They are important food source for predators including the endangered and endemic Ethiopian Wolf (*Canis Semensis*) [11].

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Despite of their ecological benefits some rodent species cause major economical losses in developing country like Ethiopia. In Africa, more than 70 rodent species [12] and in Ethiopia 11 rodent species [8] have been reported to be pest species. The cultivated lands harbor higher numbers of rodent pests and the major ones are *Mastomys natalensis*, *Arvicanthis dembeensis* and *Mus musculus* [13].

In developing countries rodent infestation poses a serious threat for reduction of income and widespread of food shortage by causing substantial damage to food and cash crops worldwide [14]. In East Africa, rodent pest is mainly cause damage on cereal crops [15] and they have been ranked as major crop pest and become threat for national and international food security [16]. In Ethiopia rodents cause a great damage on cereal crops damage [17]. They adversely affect rural communities by damaging their agricultural crop in the field and in the place of storage [18]. Dire Dawa Administration (eastern Ethiopia) also experiences chronic rodent pest problems through the damage of different products and economically loss [19]. Although climate and other pest animals primarily affected the household and agricultural products of the Dire Dawa Administration about 15% of loss is occurred as the consequence of rodent damage [20].

Assessing the farmers' perception on pests status, existing control methods and costs and efficiency of controlling methods facilitate the decision made on the application of successful pest management strategies [21]. Therefore, identification of farmers' gaps in their knowledge to enhance their pest identification and management skills and identifying farm-level constraints in adapting alternative integrated pest management strategies are issues that require immediate attention. In addition to this although rodents known as pest animals in most part of Ethiopia, their economic impact is poorly documented [15]. Furthermore, in most parts of the country local communities or farmers are responsible for their effective control although it is not much surveyed in developing country including Ethiopia. This is also true for the impacts of rodents in Dire Dawa Administration. Thus, the present studies were aimed to collect information on pests of rodent species composition, local communities' perception on their pest status and to establish base line information for policy and pest management strategy development.

2 MATERIALS AND METHODS

2.1 STUDY AREA

The current study was carried out in Dire Dawa Administration. The Administration approximately lay in between 09^0 20' - $09^0$50' N of Latitude and $40^0$50' - $42^0$05'E of Longitude in Eastern Ethiopia. The Dire Dawa town is 515 Km from Addis Ababa the capital city of Ethiopia and 333 Km from Djibouti and at center of Ethio-Djibouti railway. The total area of the administration is 128,802 ha.

Dire Dawa Administration is characterized by three broad traditional Agro-Ecological Zones mainly based on altitude, moisture and physiogeography. The topography of the area constitute from very steep high mountains to flat plains where its altitude ranges from 950 to 2,260 m a.s.l. Ecologically, the Administration is lying in a desert and semi-desert scrub and shrub land ecosystem.

Similar to other low land area of eastern Ethiopia it has arid climate (high temperature and low rain fall) with minor seasonal variation. The monthly mean maximum temperature ranges from 28.1 ^{0}c, which is recorded in the months of December and January, to 34.6 ^{0}c recorded in the month of June. Likewise, the monthly mean minimum temperature varies from 14.5 ^{0}c in December to 21.6 ^{0}c. The region has two rain seasons; that is, a small rain season from March to April, and a big rain season that extends from July to September. The aggregate average annual rainfall that the region gets from these two seasons is about 677 mm.

Most parts of the Dire Dawa Administration is covered with variable vegetation types of arid and semi-arid habitats like cactus scrub, thorn scrub and many wood and sparse grasses. However, most its vegetation is seems to be highly disturbed by anthropogenic and natural factors like overgrazing, deforestation, urbanization and soil erosion. Although the complete assessment is not carried out, the Administration is also known by possessing wildlife in dense shrubs and bushy habitats.

The current modification of natural habitat of species by the anthropogenic activities is increasing the manifestation of pest species. The impact of pest animals like rodents in such highly disturbed habitat is tremendous and requires detail study for their conservation and management.

2.2 METHODS

To select a representative villages and householders or respondents from each stratum a multistage systematic random sampling techniques were used. That means at first stage representative villages were selected then the representative

habitats and respondents were selected from each village. Based on the preliminary survey study result, 14 representative villages (nine from rural and five from urban) and 150 respondents were selected.

The survey studies on species composition of pest rodents were carried intensively by using standardized trap grids in four representative villages where as for remaining villages, grids with different size and trap stations were selected. For the selection of grid size and trap station level of perceived infestation by local community, habitat type, nature of village, type of agriculture field and surrounding habitats were used as selection criteria and four standardized trapping grids and 58 variable trapping grids were selected.

In standardized trap grids (70 m x 70 m), which were square, were used to sample rodent populations from different suitable representative habitats [11]. In each standardized sampling grids, 49 Sherman Live traps at 10 meters interval were laid [22]. To explore the remaining habitats and for the detailed identification of species two to 10 snap traps at an interval of 20 meters were used at least 200 meters away from the live trapping grids.

For the variable trapping (grids with different size and layout), the techniques applied by [23] were used. In most cases, 5 x 5 traps in agricultural field and its surrounding habitats and lines of 1 to 10 Sherman Live Traps were set along adjacent fence lines with 5 to 10 m intervals at each trap station. Sherman Live and Snap traps number ranging from1 to 6 traps were also placed inside resident home, office, shop, storehouse and mill house at different trapping places.

The trap stations were marked with the branches of the tree and by red and yellow color plastic tags tied on tall branches of the tree [11]. The traps were baited with peanut butter mixed with roasted barley flour and replenished each day if rodents or other animals (insect) ate it or dried and lost its smell. The traps were usually visited twice a day early in the morning (7:00 to 9:00 a.m.) and in the late afternoon from (4:30 to 6:30 p.m.).

The live trapped animals were removed from traps and placed in a pre-weighed polythene bag and weighed to the nearest gram. They were marked by toe-clipping and released at the point of capture after recording the location of capture, weight, species, sex and approximate age, reproductive condition. Similarly, for rodents trapped from the snap traps, information on their sex, weight, age, reproductive condition, and standard body measurements (head and body length, hind foot length, ear length and tail length) were recorded for each trapped individuals. Skins (vouchers) of the sample specimen of each species were prepared for further species identification.

The data on the level of damage and pest status of rodents were collected with the help of semi structured open and close-ended questionnaires, interview and focus group discussion, observation, secondary data sources and document analysis. The perceived level of the damage caused by pest rodents was assessed using a four-point scale forwarded by [24] in which no damage for 0% damage, limited damage to up to 25% , for moderate level of damage to between 21-50% and for high level of damage to more than half of items being damaged by rodents. The data were also collected on type of items affected; stage and part in which damage was seem to occur. Furthermore, information on the major controlling methods used and mechanism by which pest rodents cause damage were collected from each respondent.

The collected data were tabulated and organized into tables. Both qualitative and quantitative data were analyzed with appropriate descriptive statistics. All the trapped and observed species were identified to the species level with the help of field guides [3], [4] and comparing the prepared skin voucher with specimens preserved in Zoological Natural History Museum of Addis Ababa University.

3 RESULTS AND DISCUSSIONS

3.1 PEST RODENT SPECIES COMPOSITION AND THEIR RELATIVE ABUNDANCE

A total of 556 individual pest rodents were captured of which 509 individuals were new captures and 47 were recaptures from 986 Sherman live-traps nights and 130 snap traps nights. In different parts of the administrations, 12 species of rodents were recorded as serious pest. From the 12 species of pest rodents recorded eight species namely *Acomys cahirinus*, *Arvicanthis nairobae*, *Arvicanthis somalicus*, *Mastomys erythroleucus*, *Arvicanthis natalensis*, *Mus masculus*, *Rattus rattus*, *Tatera rousta* were trapped and the remaining the four species namely *Heterocephalus glaber*, *Hystrix cristata*, *Tachoryctes splendens* and *Xerus rutilus* were observed in the study grids (*Table 1*).

From the trapped rodents the relative abundance of *A. cahirinus* was 109 (21.41%) and followed by *A. nairobae* 95 (18.66%), *R. Rattus* 80 (15.72%) and *M. natalensis*, 71 (13.95%) and *T. robusta* was the least in abundance (4.91%) (*Table 1*). Thus, *A. cahirinus* was the dominant species of trapped rodents and followed by *A. nairobae* (18.66%) and *R. rattus* (15.72%) and among the live-trapped rodents (*Table 1*).

Out of the four pest rodents (*Heterocephalus glaber, Hystrix cristata, Tachyoryctes splendens* and *Xerus rutilus*) observed by direct or indirect observation in the study grid except *Tachyoryctes splendens* that is only recorded from Halo Busa Peasant Association from one of its village located in high altitude area, relatively the rest were widely distributed. *Xerus rutilus* were attempted to be trapped as they were attracted to the bait that placed in Sherman live-traps. However, Sherman live-traps fail to trap *X. rutilus* due to its larger size when compared with the size of size trap (*Table 1*).

Rattus rattus was the dominant and widely distributed rodent species that trapped from all study grids particularly from human residences whereas *A. somalicus* and *A. nairobae* were most of the time trapped from agricultural field and its surrounding habitats. The *R. rattus* trapped were in three different forms. The two were brown in color distinguished from each other by presence of dusky venter or a creamy-white beneath and the other form is pure black form which it is relatively limited in distribution.

Acomys cahirinus most of the time trapped from field although there is a case in which it was also trapped from human residence during the night trapping sessions. In many occasions two individual rodents of *A. cahirinus* and *A. somalicus* were trapped in a single Sherman live-trap in area where they were highly abundant.

Table 1. Species composition and their relative abundance of pest rodent recorded in the study area (number in the bracket indicates re-captures)

Species	Common name	Abundance	Relative abundance (%)
Acomys cahirinus	Cairo Spiny Mouse	109(9)	21.41
Arvicanthis nairobae	Nairobi Grass Rat	95(7)	18.66
Arvicanthis somalicus	Somali Grass Rat	45(5)	8.84
Mastomys erythroleucus	Multimammate Mouse	55(4)	10.81
Mastomys natalensis	Natal Multimammate Mouse	71(9)	13.95
Mus masculus	House mouse	29(2)	5.70
Rattus rattus	Black rat/Roof rat	80(8)	15.72
Tatera robusta	Fringed tail gerbil	25(3)	4.91
Heterocephalus glaber	Naked (Sand) Mole Rat	*	*
Hystrix cristata	Crested Porcupine	*	*
Tachyoryctes splendens	East African Mole-rat	*	*
Xerus rutilus	Unstrapped Ground Squirrel	*	*
	Total	**509(47)**	**100**

3.2 PEST RODENTS DAMAGE PERCEPTION AND THEIR MANAGEMENT

All respondents replayed as they have pest animals' problem. From these the number one crop pest identified by majority (54%) respondents was rodents and followed by insect 26%, wild animals 16% and birds 4%. Moreover, all respondents that mentioned rodents as their severe pest also mentioned as they least able to control over them.

The majority (76.7%) of respondents believed that the frequency of rodent damage occurrence was 'regular' and 'frequent' whereas a few respondents (3.3%) were either unable to determine the rate of occurrence or consider it as it occur rarely. The rest respondents stated as the rates of occurrence of rodents' damage is 'occasional'. Most respondents claim the seasonal based regular out break of rodents' damage on their household products based on the availability of food in the house or field.

Respondents reported the damage caused by rodents to both standing crops and stored grains. Cereal crops particularly sorghums and maize, which dominantly cultivated, was most susceptible at the seedling, vegetative, matured and storage stage of its development. More than half of the cereal crops were damaged at its storage stages although it also occurs at its matured, seedling and vegetative stage. Particularly the squirrels cause a great damage by eating the seed before and after its germination stage with 1-2 leaves. The damage occurred at this stage forces farmers to replant the field with other seed.

Fruits and cash crops were also affected at their different stage of growth. The major damage on fruits like that of cereals occurrence at their matured stage was stated by 8.7% of respondents. Few of the respondents stated as rodents cause damage on vegetative stage of growth of the plant. Cash crops like chat affected by mole rat whereas groundnut by squirrels

at all of their stages of developments in the field particularly at its seedling stage and after seeding formation and when it is matured before harvest.

In the same way, the occurrences of rodents' damage on vegetables in their vegetative and seedling stage were reported. Like that of cereals, fruits and cash crops the damage occurred on vegetables at matured stage were reported by few respondents. Unlike that of cereals, the damage on vegetables was not perceived as significant at its seedling and storage stages of developments.

As shown in *Table 2* the majority 70 (46.7%) of respondents estimated the moderate loss on cereal crops up to 50% of their product and followed by loss of less than quarter of their product. In addition, 16% of respondents blame rodents for the loss of more than half and by emphasizing on the incidence of a total loss on their agricultural and household products.

Relatively low rates of damage on fruits, legumes and vegetables were recorded although its estimation of the loss was not as such low. Respondents that had pest rodents infestation on these agricultural crops reported as they face a moderate loss (*Table 2*). In Ija Anani and Biyo Awale Peasant Associations, the loss on groundnut by the squirrel was believed to be tremendous. Even some discouraged and stopped cultivation of the groundnut and sorghum crops in fear of the loss by these pest animals.

Table 2. Respondent estimation on the level of loss caused by pest rodents

Crops	Estimated level of damage					
	Low (<25%)		Moderate (25% - 50%)		High (>50%)	
	Frequency	%	Frequency	%	Frequency	%
Cereal	56	37.3	70	46.7	24	16.0
Fruits	4	2.7	7	4.7	-	-
Legumes	5	3.3	15	10	1	0.7
Vegetables	8	5.3	8	5.3	1	0.7
Others	36	24	75	50	39	26

Porcupines were ranked as leading pest rodent for sweet potatoes although other agricultural crops were too affected by them. Respondents reasoned out that in areas that have porcupine infestation the cultivation of potatoes and sweet potatoes was not carried for fright of their damage.

The least mentioned pest rodent group but not least in their level of damage was mole rat. The damage by mole rat was more pronounced on fruits and vegetables (potatoes and sweet potatoes) as they are fossorial and eat their root and become difficult to control. They destroy sweet potato and other root and tuber crops by collecting and storing it in their burrow. Even large plantations planted for shedding and other purposes were also damaged through feeding its root and making the plant dye and dry.

In addition to the loss on agricultural crop products, household materials and equipments, livestock's (goat), poultry and children were also affected. Half of respondents estimated the losses to be from moderate. These results revealed that communal rodents particularly Brown Rat (*Ratttus rattus*) have been observed as causing great loss on poultry by eating egg and chickens. They also eat the hooves and horns of goat and cattle causing difficult to move and to be infected by microorganisms. In the same way *Xerus rutilus* were also notified as it predate chickens by entering into human residence. In general, the local communities blame all rodents including *H. glaber*, *T. splendens* and *H. cristata* as they damage all things available in their home.

3.3 PEST RODENTS MECHANISM OF DAMAGE AND CONTROL

The present result revealed that rodents were the most noxious pests causing substantial damage to agricultural crops, livestock, poultry, household items and human health through different mechanisms like feeding, discomforting, contaminating and mechanical and disease transmission (*Table 3*).

More than 93% of respondents reported that rodents affect them by discomforting and contaminating (*Table 3*). These pest rodents cause discomforts during their feeding, gnawing and sound production. They produce noisy sound in the walls, attics and ceiling during their scampering, running, scratching, gnawing, grooming, playing and fighting that result in discomfort and sleepless particularly during the night time. Furthermore, they were bite and make wound on the palm and fingers of foot of children and adults. These make them to be ferrous and to feel discomfort with them. In addition to direct

consumption, they were also upshot high damage indirectly by contaminating stored crops by their droppings, urine, hairs, oily skin gland secretions and microorganisms. Most respondents perceived as pest rodents fall into drinking water and also ate and spoil the prepared human food. They contaminate the food more than what they eat by making it to be disgust and forcing them to disposed it as waste.

About 81% of respondents face the rodents' problem related to mechanical damage (*Table 3*). They reported as pest rodents cause mechanical damage almost on all household materials and structures.

Local communities were initiated for pest rodent management after noticing the damaged crops in the fields and after noticing rodent movement rather than considering it as part their routine farming practice. They use different controlling methods or mechanisms like using cat and dog, hunting, trapping and scaring, rodenticides and field sanitation. However, their pest rodent management actions were in ad-hoc, one-off uncoordinated and reactive. The majority of them were only initiated for rodent management after noticing damaged.

Table 3. Respondent estimation on the level of loss caused by pest rodents

Damage/Control	Alternative Mechanism	Frequency (n=150)	Percentage (%)
Damage	Feeding	145	96.7
	Discomforting	140	93.3
	Contaminating	140	93.3
	Mechanical damage	122	81.3
	Disease causing and transmission	3	2.0
Controlling	Using cat	122	81.3
	Hunting and trapping	114	76
	Rodenticide	59	39.3
	Field sanitation	22	14.7

The most widely used method to control rodents damage was the use of cat although it only used to control pest rodents in house or human residence. In addition to cat dog was also used to scare porcupine and squirrels although not much effective. The secondly widely used methods or techniques were hunting, trapping and scaring. They use different equipments like spear, stick, pebble of stone and locally prepared traps or purchased snap traps. Some uses a bucket filled with water to kill rodents. Even they use any materials that were strong and used to beat and kill rodents. For instance more than 10 killed individual pest rodents were over one night was observed in Kelicha Peasant Association form one household by using stick. The third widely used controlling method was the use of rodenticides. However, the types of rodenticides they use were insecticides of grain weevil which seems to be inappropriate. The forth method is habitat manipulation. It is used as a management strategy for the control of pest rodent by clearing bushy and scarab habitats that can be used as pest rodents hiding and reproduction site. The habitat manipulation is used to make habitat uneasily accessible for rodents' food and shelter. One of the very important techniques observed is the technique used to avoid the accessibility of food or materials to rodents by hanging on the roof. They were also uses techniques like diverting floods and smoking into the burrows of mole rat to kill them and to make their burrow unfit for their survival.

4 DISCUSSIONS

The present results of pest rodent species composition is slightly higher than the previous studies conducted by [8] that indicated as 11 species were serious pest in the central parts of Ethiopia. According to [25] reported as the damage caused by rodents depends on their population and species. Thus the high stock of pest rodents' species in the administration can be used as an indication for high potential of pest damage.

The pest rodent species recorded in the present study range from small sized house mouse (*Mus masculus*) to large sized African Crested Porcupine (*Hystrix cristata*). Some pest species are found specifically in certain geographical and environmental conditions, while others are widely distributed. Their occurrence in different abundance and distribution make them to cause a wide range of damage and losses on cereals, legumes, vegetables and root crops. For instance the house mouse (*Mus musculus*) is found mostly in urban areas and in some village dwellings [26]. However, the roof rat (*Rattus rattus*) and the multimammate rat (*Mastomys natalensis*) and the Grass rat (*Arvicathis species*) are widely distributed over East Africa [7], thus occupy diversity of habitats including cultivated fields. The most common rodents in sub-Saharan Africa belong to the genus *Mastomys*. They occur all over the continent in natural grasslands, thicket, cultivated areas and human habitations [12].

The seasonal based regular and frequent rodent damage occurrence on household items seems to depend on food availability in the house or field. The damage on household items seems to be high during the summer time when there was no food from agricultural field. Thus except for a few species, many rodent species are forced to migrate from field to human residence depending on the place where food is available [16]. In particular the migration pest rodent from the field to human residence in the Administration is seems to be facilitated since the houses of most respondents who engaged in farming activities are located in the middle of the farm or close to bushes or pile of stone fence.

The majority of the villagers in the Administration use stone bunds for fencing and prevention of soil erosion and water loss and to increase crop production. In the same way, as in [16] indicated the importance of stone bunds made for soil and water conservation in crop fields. However stone bounds become a suitable habitat for breeding and hiding places for rodents, from where the rodents come out and feed on crops and damage household products. In the present study places with stone bounds faces serious pest rodent infestation. Increase in rodent population of epidemic proportion northern Ethiopia, after years of stone bund construction in crop fields. Thus, proper plan needs to be done to assess the relation between stone bunds and rodent dynamics and crop damage in the future.

In variable environments, there need to predict outbreaks of agricultural rodent pests. Rodent populations often increase rapidly in response to periods of unusually high rainfall, presumably due to an increase in the quantity of food available to them or its quality, such that relationships between the likelihood of an outbreak and past rainfall form the basis of a forecasting method [27].

The local communities in the Administration face problems related to pest damage on their products whether they participated on crop cultivation or not. Dominantly pest animals like rodents, insects, wild animals and birds were mentioned as they affect their agricultural or household products of which rodents were the dominant and they least able to control over them. The damage by rodent is an important cause of harvest loss throughout the world-wide and forcing farmers often to list them as one of their most significant crop pests [28].

The different types of crops such as cereals, vegetables and fruits cultivated in study areas were damaged by pest rodents at their different stages of their growth and development. Pest rodents are the most serious and important vertebrate pests of various crops, inflicting damage from sowing onwards until harvesting, storage, distribution and actual consumption of the produce [27]. These crops were most susceptible to pest rodents at different stage of their growth or development. The most serious damage would be the loss of seeds from sawed farm field forcing farmers for the next planting [26].

Almost all respondents believed that rodents cause a significant damage or loss in different items due to their feeding habits of varieties of food items and gnawing nature. Rodents eat on grains, cereals, fruits, seeds, nuts, buds, barks, seedlings, leaves, flowers, roots and invertebrates [29]. Most rodents are opportunistic feeders, capable of changing their feeding habit depending on the availability of food from season to season. Thus, these behavioral traits make them to be the most destructive pest animal.

The present results of the study suggest that as there is a significant variation on the level of damage at different stage of growth on cereal crops with highest during its matured and storage stage. Similar to the previous studies conducted in different counties, pest rodents cause damage on cereal crops from sawed seed predation to the slanting cut of the tiller at its base to the feeding of the matured grain before harvest. They were also dragged the matured grains of cereal crops from the farm field to their burrows. In the farm field although damage was more pronounced around surface openings of their burrows, it was spread all over the field. Most of the rodent damages in agricultural fields occur during the sensitive young seedling stage and just before harvest [26]. The studies made by [28] indicated the cumulative damage occurrence during the dry season reach 54% at the primordial stage, 32% at the booting stage and 16% at the ripening stage. However, farming practice, the change in climatic factors and the intrinsic characteristics of the pest species are among the factors that possibly influence the occurrence and severity of rodent attacks on crops [29].

The level of damage on agricultural crops and other materials were roughly ordered as low for estimation of loss less quarter (>25%), moderate for less than half of loss (<50%) and high indicating for loss greater than half (>50%). However, in some cases during the pilot survey of the current study, the respondents were unable to estimate post-harvest damage. As in [30] stated many countries have a poorly documented on exact losses or damages on agricultural crops and household materials and on their prevalence of rodent-borne disease. They estimated losses on stored cereal crops by merging it with other storage materials and household properties. The estimated amount of crops damage by majority of farmers in the house was higher than in the field. The figure might seem to be small but for such subsistence and small-scale farming community such loss in annual production is hard to tolerate [26].

Rodents are known to damage and destroy 30% of the crops in both pre-harvest and post-harvest conditions worthing of $ 30 billion, globally [31]. In East Africa, they cause considerable economic losses to staple crops, particularly tubers and

cereals. For example, in Tanzania, the loss of cereals by rodents reaches approximately 15% [29] and the damage of maize at sowing and seedling stage is around 40–80% [32]. In western Kenya, as in [33] reported a 20%, 34-100% and 34% loss by rodents out break on maize, wheat and barley, respectively. The studies made in the central Ethiopia have been documented to as rodents consume up to 26% of the cereal crops [8], [17].

The pattern and the extent of damage by pest rodents depend upon the species, the intensity of infestation, type and stage of growth of crop and nature of the surrounding habitat. Most of the estimates of damage related to pre-harvest stages of the crop although they cause damage at almost all stages of the crop from sowing to its harvesting. Knowledge of the mechanism, extent of the damage and the situations vulnerable to attack by rodents in different crops and regions is important in planning management strategies [18].

Among the oil seed crops groundnut often suffers severe (up to 85%) loss by rodents. Although other pest rodent specie like *M. musculus*, *A. somalicus*, *M. natalensis* and *T. robusta* were abundant in groundnut fields and major damage caused on it was by *X. rutilus* [18]. Rodents may damage the whole or the branches of the plant during burrowing. They damage and removal of the pods at the maturity and harvesting stages and take them in to their burrows [18].

Porcupines are among the world's largest rodents and have long been recognized as forest pests in many countries of the New and Old Worlds [3]. However, the old world porcupines of the genus *Hystrix* have been little studied because of their shy nature, nocturnal habits and tendency to live in remote and inaccessible places [34]. Crops of economic importance such as maize, groundnut and potatoes and vegetables like pumpkin and onions are severely damaged. Similarly in Pakistan porcupine is identified as the abundant and widely distributed and serious pest of fruits, vegetables, flowering plants and forage grasses that ranged between 5.7 and 30%, with an average of 17.6% [34].

Rodents cause direct damage to various commodities by gnawing, feeding, and indirectly damage by spoilage, contamination, deterioration and enhancing susceptibility to fungal and bacterial infestations during pre- and post-harvest stages [18], [30]. Rodents gnaw and perforate structural materials and dig burrow into banks, sewers and under roads and buildings cause flooding, soil erosion and collapse of human built structures [5].

Although rodents known as carriers of more than 60 life-threatening diseases [30] in the present study no body claimed as they cause and transmit disease. However, the wound they cause on skin during their bite, feeding on the skin and nail of human and animals and wounds by piercing of quill during the defense were the astonishing damage. Sever health problem incidence was recorded from Biyo Awale Peasant Association that occurred due to attach of porcupine by its quill.

Even if the majority of respondents know the use of cat for pest rodent control, some are not much interested to use it. The reasons forwarded were the current change of cat's food preference for foods for human consumption rather than feeding on rat and mice meat. This change in food preference of the cats might be a reason for the less interest in trapping and capturing rats and mice. The second reason is the rise of milk cost and meat that is assumed to be natural supplementary food for cat. Thirdly, some rats are beyond the capacity of the cat and they defend well not to be preyed or captured.

Although rodenticides widely used current use of insecticides for pest rodents' management seem to be inappropriate. The unwise and inappropriate use of rodenticides results in genetic resistance, behavioral avoidance, non-target animal poisoning and environmental pollution [28].

Rodents show preferences for habitats with high amount of vegetation cover [35], which is closely related with predation risk. The selection of thick vegetation is considered to be an anti predatory strategy against both aerial and terrestrial predators. Various means of cover removal have resulted in depletion of rodent populations [36]. The composition and abundance of rodents at given habitat depends on microhabitat features, which provide food and shelter against predators [37]. Thus as reported by [38], the habitat manipulation techniques recorded in this study can be considered as cost-effective and is a viable strategy for the control of rodent damage.

5 CONCLUSION

The present high records of major pest rodent species not only indicate us as the area is highly infested with pest rodent species but also indicated us the existence of a high stock of rodents' species composition. Although rodents were listed as number one pest animal and make them to be least able to control additionally insects, wild animals and birds were also perceived as pest. The regular and frequent occurrences of rodents out break can be used as an indication for the extents of pest rodents' problem that seek urgent application of pest management plan and strategy development. Agricultural crops were most susceptible to pest rodents at different stages of their growth. Mostly cereals were damaged by the pest rodents at their storage and matured stage that can be used as an indication on their time of managing the loss. Rodents cause damage on different items through feeding, causing discomfort and mechanical damage. However, to prevent or minimize of

pest rodents infestations different methods like using cat and dog, hunting, trapping and scaring, rodenticides and field sanitation were mostly used. The current local communities' ad-hoc, one-off, and uncoordinated, actions of rodent management actions needs to be improved and ecological based rodent management strategy need to developed and used through education and extension programs that strongly focus on demonstration and community participation.

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