Rabbit management and occurrences of mange mite infestations in rabbit farms in Morogoro Municipality, Tanzania

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SUMMARY

A cross-sectional study was conducted in Morogoro Municipality between September and December 2015 to explore the rabbit farming and assess the common health problems with a focus on epidemiology of mange infestation. A total of 18 rabbit farms with 622 animals from 9 wards were investigated. A questionnaire was administered to the rabbit farmers to gather information on rabbit management and the associated challenges. All rabbits found in the farms were examined for mange lesions and skin scrapping was collected and analysed for mange mites in the laboratory using standard procedures. It was found that Morogoro Municipality had 18 rabbit farms with average of 34.6±23.1 rabbits per farm. Farmers reported to keep rabbits as sources of meat and income. Most of rabbits (83.1%) were raised in cages and were fed on green herbes, grasses and concentrates. Constraints to rabbit production were availability of good feeds, predators, lack of extension services and diseases particularly diarrhoea, infertility and skin conditions. Mange mite infestation was reported by 33.3% of respondents and poor hygiene, not resting of rabbit house and keeping of rabbits on the floor were significant ($P < 0.05$) factors for mange infestation. Prevalence of mange infestation was 23.2% and 33% in rabbits and farms respectively. All the mange mites observed were identified as *Sarcoptes scabiei cuniculi*. The observed clinical lesions were predictors of mange mite infestations (p=0.0000072283). Rabbit production in Morogoro is at infancy stage and is constrained with many drawbacks. Mange mites are prevalent in rabbit farms in Morogoro Municipality and therefore proper animal husbandry practices and application of acaricides are recommended.

Key words: Mange mites, rabbit management, diseases, prevalence

INTRODUCTION

The 2012 Population and Housing Census showed that the human population of Tanzania increased by 30% from 34.4 million in 2002 to 44.9 million 2012 with an average growth rate of 3% per annum (URTNC, 2012). The population increase in Tanzania particularly in urban areas demands increased supply of animal protein of which the current output of livestock has not been able to provide. In Tanzania, conventional livestock keeping is common and by the end of 2015/2016 Tanzania's conventional animal population was 25.8 million cattle, 17.1 million goats, 9.2 million sheep, 2.67 million pigs, 42 million village chicken and 34.5 million commercial chicken (URT, 2016). The average annual growth rate of conventional livestock sector is 2.4% which is lower than the rate of human population growth (3.0%) (URT, 2016). Cattle produce most of the red meat consumed in Tanzania contributing 53% of total meat production (Tanzania National Livestock Policy, 2006). Nevertheless, the current per capita consumption of meat in Tanzania is 15 kg per year, which is very low, compared to FAO recommendation of 50 kg (FAO, 2011). This implies that the current conventional livestock population has not met the demand for meat supply in the population. This deficit can be covered

through including non conventional livestock production as a formal sector in Tanzania. It has been shown in a wide context that non-conventional livestock species could provide enough meat, if not more than what is needed (NRC, 1991).

Non conventional livestock including rabbits may play a greater role in poverty alleviation and substantially contribute to food security in developing countries if the sector is recognized and promoted (Komwihangilo *et al.*, 2016). The current National Livestock Policy of Tanzania (URT, 2006), recognizes the potentials of non conventional meat sources and advocates the need for inventorization, characterization and evaluation of these sources for increased livestock productivity and improved livelihood of the people. The key constraints to the development of a viable rabbit industry in Africa range from institutional and policy limitations to environmental conditions (Tanzania National Livestock Policy, 2006). Institutional limitations include lack of appropriate policy framework for small stock development that supports backyard and smallholder rabbit production systems (Lebas *et al.*, 1997). For example, lack of improved extension services and supply of inputs necessary for rabbit keeping are among the constraints (Oseni *et al.*, 2014; Tanzania National Livestock Policy, 2006). Environmental constraints include adaptation to heat stress and/or slow growth rate as a result of a multitude of factors like sub-optimal management, inadequate nutrition and inappropriate housing design which also limit the rabbit industry (Cheeke, 1986; Lebas *et al.*, 1997; Lukefahr, 1998). Other limitations to rabbit production include the absence of a tradition of eating rabbit meat in Tanzania and rabbit diseases like coccidiosis, pasteurellosis, pneumonia, enteritis, salmonellosis and colibacillosis (Semunguruka, 1978; Tanzania National Livestock Policy, 2006). In addition, ectoparasites, especially mites, are the most frequent cause of the dermatologic problems in rabbits (White *et al.*, 2002). Mange is a highly contagious skin disease, characterized by crusty, pruritic dermatitis and hair loss and caused by a variety of parasitic mites burrowing in or living on the skin (Pence and Ueckermann, 2002).

The common mites affecting rabbits include ear mites (otoacariasis or ear canker), fur mites (cheyletiellosis) and burrowing mites (mange) (Lebas *et al.*, 1997). Ear mite infestation caused by *Sarcoptes scabiei cuniculi* is very common in rabbits and has been encountered all over the world, though at variable frequencies (Radi, 2004; Mitra *et al.*, 2014). The other mites that affect rabbit include *Cheyletiella parasitivorax* (Lebas *et al.*, 1997; Radi, 2004). *Cheyletiella parasitovorax* and *Listrophorus gibbus* are very common fur mites encountered around the world and affect mainly rabbits. *Trombicula autumnalis* and *Dermanyssus gallinae* are fur mites that are less common in rabbits because they specifically infest other species but can be hosted by rabbits (Lebas *et al.*, 1997; Radi, 2004). Mites can be easily prevented by avoiding intermingling between affected and unaffected rabbits (Ayodhya, 2013; Mitra *et al.*, 2014). Maintaining a better animal husbandry and hygiene in the farm may help to overcome problems of skin conditions including the mites infestation (Lebas *et al.*, 1997; Aiello and Moses, 2010).

Rabbit production is a growing industry and provides food and income at low investment costs in different countries worldwide, it is probably not given much attention in Tanzania. Concomitantly, mange mites infestations has been

observed to be a common problem in rabbits production in Morogoro Municipality (Unpublished SUA Animal Hospital data, 2015), there has been no study which established the magnitude of the problem and the possible factors for infestations. The current study aimed to explore the rabbit farming and assess the common health problems with a focus on epidemiology of mange infestation in Morogoro Municipality, Tanzania.

MATERIALS AND METHODS

Study areas and sources of sample

A cross-sectional study was conducted in Morogoro Municipality and involved nine wards out of 29 wards which form the Morogoro Municipality. The study wards involved were Magadu, Tungi, Kingolwira, Kichangani, Bigwa, Mlimani, Kilakala, Mazimbu and Mzinga. The criteria used to obtain the wards were presence of rabbit keepers in the wards. Because of the scarcity of households that kept rabbits, all the wards that had farms of rabbits were involved in the study. A total of 18 small scale rabbit farms whose owners willingly accepted to participate in the study were involved. To get the households that keep rabbits, the livestock extension officers in the specific wards were involved. Other farmers were traced through the SUA Animal Hospital records.

Questionnaire survey and sampling of rabbits

On arrival at the farm, structured questionnaires were administered to the rabbit farmers in order to gather information on rabbit general management systems and reasons for keeping rabbits, common health problems of rabbit; and knowledge of farmers on skin diseases. Factors that may lead to mange infestations were also explored. Basic information of the farms were also collected like number of the rabbits in the flock, age and sex distribution, duration of keeping rabbits, ownership of rabbit farms, keeping of other animals and many other information. Based on size, rabbit farms were classified for convenience as small flock if the farm had rabbits from 1 to 40 and as large flocks when rabbits were above 40. In terms of age, young rabbits were those with two months or below and adult when had above two months of age.

Before the rabbit samples were collected; all the animals in the farm were examined for lesions that suggest skin condition with more emphasis on mange infestation. Primary clinical lesions of mites infestation that were being observed include crust in the ear canal for ear mites; dandruff and seborrhea on the dorsum and neck, and lesions resulting from burrowing mites namely alopecia, self-mutilation wounds due to severe pruritus on the lips, nose, head, neck and around the genitals. Presence of any of these clinical signs was used as an indication for mange infestation. Presence of a single rabbit with clinical signs that suggest mange, was enough to classify the farm as mange positive. In the infested farms, rabbits with apparent clinical signs of mange were selected for sampling while in farms that were free from mites infestation, rabbits for sampling were randomly selected. In households with small rabbit flocks, all adult animals were sampled and only representative samples were taken from large farms.

Sample collection and laboratory identification of mange mites

Fur mite samples were collected from both health and affected animals by brushing the skin and hairs. Skin scrapings for burrowing mites were collected from

animals with clinical manifestations using knife blade and scooping spoon. Collected samples were preserved in the glass tubes and subsequently sent to the laboratory for analysis.

In the laboratory, the samples were transferred from the tubes into glass petri dish, crashed and added with potassium hydroxide (KOH) 10 % solution and left to stay for 24 hours so as to allow digestion of crusts. The plastic pipette was used to mix a sample solution and two to three drops of the mixed sample was put on a glass slide and examined under a light microscope at ×10 and ×40 objectives. Identification of mange mites of rabbit was done according to the standard identification key described by Sousby (1982). Presence of at least one mite or a larva on microscopic slide was regarded as positive case.

Data analysis

The collected data was entered in Microsoft Excel spread-sheet and were analysed using Epi Info™ Version 7 (Centre for Disease Control, Atlanta, USA). Using Statcalc, proportions of categorical variables were computed and further compared using the chi-square test at a critical probability of $P < 0.05$. The strength of associations between dependent and independent variables were determined using 2 x 2 contingency tables.

RESULTS

Demographic characteristics of the respondents and keeping of rabbits

A total of 18 rabbit farmers were interviewed from nine wards in Morogoro Municipality. The demographic characteristics of the respondents are shown in Table 1. It was realized that Morogoro Municipality had 18 rabbit keepers and most of the rabbit farmers were in Magadu and Tungi wards. Most of the rabbit farms (55.6%) were either owned by government or religious institutions. The average number of rabbits kept per farm was 34.6±23.1 (range 5 and 70 rabbits) while the average duration of farmers that have been keeping rabbits was 7.4±5.6 (range 3 and 28 years). Up to 16 (88.9%) of the farmers reported to keep animals other than rabbits which included goats, cattle and chicken. Several reasons for keeping rabbits were mentioned by the respondents including rabbits as source of food and income. Rabbits kept by the government institutions were also used for teaching and experiments. Rabbit farming was not the sole sources of income to all the respondents but they reported to do other agricultural activities, some were employed and others doing business.

Table 1. Demographic information of the respondents

Respondent's parameter	Category	Number of respondents (%)
Age (years)	25 - 40	8 (44.5)
	41 - 50	5 (27.8)
	Above 50	5 (27.8)
Sex	Male	13 (72.2)
	Female	5 (27.8)
Education level	Primary school	6 (33.3)
	Secondary school	8 (44.4)
	College	4 (22.2)
Duration of keeping rabbits (years)	3 - 5	7 (38.9)
	6 - 8	7 (38.9)
	Above 8	4 (27.7)
Ownership of rabbit farms	Institutions	10 (55.6)
	Individual farmers	8 (44.4)
Distribution of rabbit farms per wards	Magadu	4 (27.7)
	Tungi	3 (16.7)
	Kingolwira	3 (16.7)
	Kichangani	2 (11.1)
	Bigwa	2 (11.1)
	Mlimani	1 (5.6)
	Kilakala	1 (5.6)
	Mazimbu	1 (5.6)
	Mzinga	1 (5.6)
Do you keep other animals apart from rabbits	Yes	16 (88.9)
Is rabbit keeping the sole sources of your income?	No	18 (100.0)
Reasons for keeping rabbits	Kept as source of meat	12 (66.7)
	Source income	8 (44.4)
	Teaching and experiments	3 (16.7)
	Copied from friends	2 (11.1)
	Decorative animals	2 (11.1)
	Kept as hobby	2 (11.1)
Sources of income of respondents	Agriculture	11 (61.1)
	Salaried employment	7 (38.9)
	Business	5 (27.8)

Farming system and general rabbit husbandry

All smallholder rabbit keepers visited in the study area kept their animals in shelters with varying types of the rabbit housing (Table 2). Most of the rabbits (83.1%) were being raised in cages provided with bedding materials. All farmers practiced stall feeding (intensive system) and green herbes, grasses and concentrates were the common feed. The rabbit keepers listed several constraints they face including availability of good feeds, predators, lack of extension services and diseases.

Table 2. Rabbit management system and problems faced by farmers

Variable/Parameter	Category	Number of respondents (%)
Management system	Cage system	15 (83.1)
	Floor type (concrete/earthen)	7 (38.9)
Uses of bedding materials in rabbit house	Yes	11 (61.1)
Routine of cleaning of rabbit houses	Everyday	13 (72.2)
	Once per week	1 (5.6)
	Twice per Month	2 (11.1)
	No specific regime	2 (11.1)
Feed type	Green herbage and grasses	18 (100.0)
	Cassava roots and potatoes	8 (44.4)
	Concentrates (maize bran & compounded chicken feeds)	12 (66.7)
Feeding schedule	Twice a day	16 (89)
	Once per day	2 (11)
Problems faced by rabbit keepers	Poor availability of good feeds	13 (72.2)
	Predators (rats, cats, insects)	12 (66.7)
	Lack of extension services	8 (44.5)
	Diseases	6 (33.3)
	Markets of rabbit meat	4 (22.2)
	Poor availability of drugs	4 (22.2)
	Overcrowding of rabbits in houses	2 (11.1)
	Inbreeding	1 (5.6)
	Mortalities of young rabbits	1 (5.6)
	Low knowledge on rabbit management	1 (5.6)

Health problems of rabbits and respondents knowledge on mites

The respondents reported that rabbits get different disease conditions that include diarrhea, infertility, alopecia) and wounds. All the respondents were aware about skin diseases in rabbits but only few were knowledgeable that mites were among the causes of skin diseases (Table 3). Up to 33.3% of the respondents said that mites' infestation was more common during the dry season. Respondents were able to identify the common locations of clinical lesions of mites on the animal's body. Only 11% of the rabbit keepers were knowledgeable on the mode of mites transmission as they said that direct contact of animals was common means of mites spread from one animal to the other. Almost 39% of the respondents knew how to control mange in rabbits as they were treating them by using ivermectin at every three months.

Risk factors for mange infestation in rabbits

The magnitudes of mange infestation in rabbits in relation to the possible risk factors are presented in Table 4. Several factors were considered during the survey but only poor hygiene in rabbit houses, not resting of rabbit houses between batches and keeping of rabbits on the floor were statistically significant ($P < 0.05$) factors that were associated with mange infestation. It was also observed that adult rabbits were being mixed with young ones, a practice that may serve as means of mange mite transmission through contact. Nevertheless, adult rabbits were more infested (33.6%) than the young rabbits (32.1) but the difference was not statistically significant ($p>0.05$).

Table 3. Respondents' knowledge on mites and location of lesions on rabbits

Variable/Parameter	Category	Number of respondents (%)
Do the rabbit get diseases?	Yes	18 (100.0)
List the common diseases of rabbits	Diarrhoea	11 (61.1)
	Infertility	5 (27.8)
	Losses of hair and skin wounds	4 (22.2)
	Abscess	2 (11.1)
	Coccidiosis	2 (11.1)
	Paralysis	1 (5.6)
Do you know skin diseases of rabbits?	Yes	18 (100.0)
Awareness on mange disease	Knowledgeable	5 (27.8)
	Unaware	13 (72.2)
Farmers experience mange mites in their rabbits	Encountered cases	8 (44.4)
	Never experienced	10 (55.6)
In which season of the year do mange cases normally occur in rabbits farms	Dry season	6 (33.3)
	Rainy season	4 (22.2)
	I don't know	8 (44.4)
Common location of clinical lesions of mites on rabbits	Whole head	2 (11.1)
	Legs	2 (11.1)
	Ears	4 (22.2)
	Dorsum	4 (22.2)
	Belly	2 (11.1)
	Unaware	4 (22.2)
Do you control mange	Yes	7 (38.9)
How do you control mange	By ivermectin injection	7 (38.9)
	Keeping rabbits in cages	3 (16.7)
At what interval do your rabbits injected with ivermectin?	Three months	5 (27.8)
	When are show signs of skin diseases	2 (11.1)

Prevalence of mange in rabbits and farms

During the survey, 205 rabbits were clinically examined for mange lesions and subsequently skin scrapings were collected for laboratory investigations. The number of farms which had clinical mange was 14 (88.9%). Clinically, 64 (31.2%) rabbits had signs suggestive of mange infestations as detailed in Table 5. Laboratory results revealed that 27 (23.2%) rabbits were confirmed to have mange mites which were identified as *Sarcoptes scabiei cuniculi*. Of the mange positive samples, 15 (7.3%) were from male rabbits and 12 (5.8%) samples from female rabbits although statistically, the difference was not significant ($p>0.05$). Mites infestation cases were detected in 6 (33%) of the rabbit farms. It was observed that the six infested rabbit farms were from five wards namely Kilakala, Magadu, Bigwa, Kichangani and Mazimbu. In all the farms in which the mites were detected, rabbits had apparent clinical features of mite infestations. The clinical lesions for mange observed during this study were predictors of mange mite infestations since were found to be associated with presence of mange mites in the sample after laboratory analysis ($p=0.0000072283$).

Table 4. Risk factors for mange infestation in rabbits

Risk factor	Category	Number (%) infested	RR	95% CI	P value
Sex	Female (n=115)	43 (37.4)	0.867	0.716 - 1.049	0.193133
	Male (n=90)	25 (27.8)			
Age	Adult (n=149)	50 (33.6)	0.979	0.791 - 1.212	0.979918
	Young (n=56)	18 (32.1)			
Bedding materials	Used (n=107)	41 (38.3)	1.2	0.969 - 1.425	0.137011
	Not used (n=98)	27 (27.6)			
Rabbit house hygiene	Good (n=184)	50 (27.2)	5.1	1.782 - 14.59	0.000001*
	Poor (n=21)	18 (85.7)			
Rest pen between batches of rabbits	Rest (n=90)	18 (20.0)	0.707	0.584 - 0.855	0.000691*
	Do not rest (n=115)	50 (43.5)			
Housing system	Cage type (n=180)	49 (27.2)	3.03	1.501 - 6.127	0.000005*
	Floor type (n=25)	19 (76.0)			
Farm size	Large (n=91)	24 (26.4)	1.199	0.991 - 1.451	0.065441
	Small (n=44)	44 (38.6)			
Keeping of other animals	Keep (n=190)	65 (34.2)	1.216	0.926 - 1.598	0.400599
	Not keep (n=15)	3 (20.0)			
Routine mange control	No (n=132)	46 (34.8)	0.933	0.767 - 1.134	0.595297
	Yes (n=73)	22 (30.1)			

RR - risk ratio; CI - confidence interval, * - statistically significant

DISCUSSION

The purpose of the current study was to explore the rabbit farming and assess the common health problems of rabbit with a focus on epidemiology of mange infestation in Morogoro Municipality, Tanzania. It was generally established that rabbit farming is still in an infancy stage as the whole municipality had only 18 farms with a total of 622 rabbits. Although farmers tried to follow a better rabbit husbandry, still they were being faced with many problems that included poor availability of inputs, lack of extension services and diseases in particular diarrhea and skin conditions.

Table 5. Clinical results of mites infestation

Common clinical lesion	No. of rabbits	Percent
Alopecia	15	7.3
Crusts in the ear	11	5.4
Wounds on perianal regions	20	9.7
Hyperkeratosis of the skin around the head	15	7.3
Dandruff and seborrhea	3	1.5

The current study established that in Morogoro Municipality the rabbit farms were few which were mostly owned by government or religious institutions. Since rabbits are non conventional livestock it may be the reason that the sector is not given priority. However, there is generally low production and consumption of livestock probably due to socio-cultural norms and lack of knowledge on how to develop and sustain the resource. Other constraints include inadequate research, extension and information dissemination on non conventional meat sources (Lebas *et al.,* 1997; Tanzania National Livestock Policy, 2006). Although, farmers reported to keep rabbits as sources of meat and income, all confessed that rabbit farming was just one of the enterprises but not the sole sources of income since they depended on crop production, conventional livestock keeping, employment and business (Table 1). Small non conventional livestock like rabbits have several comparative advantages over the conventional ones since have genetic adaptation to specific ecological niches, high reproductive performance, they are easy to feed, manage and handle, have efficient utilization of feed resources, limited competition with humans for feedstuffs, low production risk and easy to market or consume at home (Vietmeyer,1984; Pich and Peters, 1985; Lebas *et al.,* 1997). It should be noted that rabbit farming is an important enterprises it may provide livelihood of many rural and urban communities especially in developing countries (Lebas *et al.,* 1997; Tanzania National Livestock Policy, 2006).

Most of the rabbits in the study areas were kept in cages and provided with bedding materials and being fed with green herbage, grasses and some concentrates at regular intervals. This kind of feeding is a strength with the rabbits production since it makes it is easier to afford even by the rural and urban poor though the quality of feed was questionable (Lebas *et al.,* 1997). Generally, the management system observed in most rabbit farms was good since had clean animal houses and the hygiene was good. A number of problems were listed by the farmers and of greatest importance were poor availability of good feeds, pests, lack of extension services, diseases and markets of rabbit meat. These can partly be among the reasons for the poor performance of the rabbit industry in the Morogoro Municipality. It is recommended that the Ministry responsible for livestock development in Tanzania should address the constraints facing rabbit farming and the public should be sensitized

to invest in rabbit and other non conventional livestock production since are the easier sources of proteins and the management costs are not high compared to conventional livestock (Lebas *et al.,* 1997; Tanzania National Livestock Policy, 2006).

A number of health problems were reported by the farmers including diarrhea, infertility, loss of hairs (alopecia), skin wounds, abscess, coccidiosis and paralysis. Most of these diseases are infectious and can easily be prevented if good animal husbandry practices are instituted. For example, the problem of coccidiosis was reported mostly by rabbit farmers who had floor type of housing. The disease transmission may be facilitated by dirty floor which allows build up of the coccidia oocysts and thereafter be transferred to other rabbits (Lebas *et al.,* 1997; Aiello and Moses, 2010). Diarrhea may partly be due to coccidiosis or other infectious pathogens like bacteria and viruses. Infertility in rabbits may be caused by managemental stress, poor feeding or some infectious diseases (Lebas *et al.,* 1997; Aiello and Moses, 2010). Skin diseases were reported by all the farmers interviewed and showed that the problem is serious in rabbit farms. Studies show that skin conditions may be caused by bacteria, skin parasites, fungi and nutritional deficiencies and may be related to poor management system and lack of routine disease control programs (Lebas *et al.,* 1997; Aiello and Moses, 2010; Elshahawy *et al.,* 2016). Wetness to the animal house environment due to water crocks, leaky water bottle, damp litter, over-grooming by another rabbit or the rabbit's own body fluids like urine scalding, fecal staining, hyper-salivation, or tear overflow, bite wounds and infected skin folds all enhances development of skin diseases in rabbits (Lebas *et al.,* 1997; Aiello and Moses, 2010; Elshahawy *et al.,* 2016).

During the current study, mange mites infestation in rabbits was found to be a common problem in most of the farms although only 27.8% of the respondents reported mange infestations in their farms and some of farmers (33.3%) associated mange infestations with dry season. Almost 39% of the respondents controlled mange in rabbits by treating them with ivermectin at every three months interval and a few reported that raising rabbits in cages could minimize the problem of mange in a farm. Assessment of risk factors for mange infestations in rabbits revealed that poor hygiene in rabbit houses, not resting of rabbit houses between batches and keeping of rabbits on the floor were the factors associated with mange infestation. Dirty environment in the animal house which may be accompanied with wetness enhances survival and multiplication of mange mites and predisposes the rabbits to infestations (Lebas *et al.,* 1997; Aiello and Moses, 2010; Elshahawy *et al.,* 2016). Resting of animal houses between batches is a good strategic control of many diseases including mange infestations (Lebas *et al.,* 1997). During the resting period, the animal houses can be thoroughly cleaned and disinfected, the practices that can completely eliminate the parasites which are in the environment (Aiello and Moses, 2010; Elshahawy *et al.,* 2016).

It was further found that the farms which had clinical mange lesions were 14 (88.9%) and 64 (31.2%) rabbits had signs suggestive of mange infestations. The common lesions that were observed in the rabbits were alopecia, crusts on the ear pinnae and ear canal, wounds on perianal regions, hyperkeratosis of the skin around the head, dandruff and seborrhea. Analysis of samples in the laboratory revealed that the prevalence of mange infestations in rabbits and rabbit farms was 23.2% and 33%, respectively. The current results are

in line with other studies elsewhere which reported the prevalence to range between 20 to 30% (Elshahawy *et al.,* 2016). However, other studies have reported a low prevalence of mange in rabbits than the current study (Soundararajan and Iyue 2005; Eshar, 2010). Variations in mange infestation rates may be due to differences in the rabbit management system, seasonality, sampling techniques and laboratory methodologies employed. The high prevalence of mange in the present study might be due to the poor management of flock, poor hygiene and lack of resting on the rabbit pens between batches as were observed to be factors associated with mange infestation (Abu-Samra *et al.,* 1981; Elshahawy *et al.,* 2016). Mixing of adult rabbits with young ones as it was observed during this study may also serve as means of direct mange transmission within rabbit farms.

It was further observed that all the mange mites encountered were identified as *Sarcoptes scabiei cuniculi* indicating that this species was commonly circulating in rabbits in Morogoro Municipality. It has been established that *Sarcoptes scabiei cuniculi* is the most common mange of rabbits in most areas of Africa where rabbit production is undertaken (Scott *et al.,* 2001; Elshahawy *et al.,* 2016). Other common mites of rabbits namely ear mites and fur mites were not revealed in the current study area.

Ectoparasites, especially mange mites infestation continues to be the most important external parasite of rabbits worldwide that causes detrimental effects through reduced market value of the carcass, increased treatment costs, reduced feed conversion efficiency, decreased litter size, growth rates and much more sufferings which are against the animal welfare (White *et al.,* 2002; Elshahawy *et al.,* 2016). In order to win the battle on mites infestation in rabbits, it is important that farmers observe proper animal husbandry practices and application of both injectable and topical acaricides. This therefore calls for public education as well as development of control strategies that can minimize infestation rates of mites in farm animals.

It is concluded that rabbit production is still at an infancy stage and farmers struggle to keep rabbits as non conventional animals but are faced with many challenges that include poor availability of inputs, lack of extension services and diseases in particular diarrhea and skin conditions. Mange mites are prevalent in rabbit farms in Morogoro Municipality and this calls for concerted efforts so as to manage the disease which seems to be endemic in rabbits.

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