

Sarcoptic mange of camel in upper Egypt: Prevalence, risk assessment, and control measures

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ABSTRACT

This study was designed to reveal out the prevalence of Sarcoptic mite infestation and the risk factors associated with occurrence of mange in one-humped camels (*Camelus dromedarius*) at smallholder farms in Upper Egypt, and to develop an applicable therapeutical protocol for the Sarcoptic mange infested camels. A total of 660 one-humped camels were randomly selected from different villages of Assiut, Upper Egypt. The animals were undergone clinical and parasitological examinations. Skin scrapings revealed that *Sarcoptes scabiei* var. *cameli* mite was present in 6.06% (n=40/660) camels of the area. Statistical analysis of some ecological parameters showed that there was significant relationship ($P<0.05$) between mite infestation in camels and season, housing management, and use of acaricides. On the other hand, age and sex did not significantly affect the prevalence of the disease. Topical application of moxidectin at 0.5 mg/kg bwt or subcutaneous administration of doramectin at 200 µg/kg bwt, along with treatment of animal environment was found to be the best protocol for the eradication and prevention of Sarcoptic mange in camel. The findings of this study indicate that *Sarcoptes scabiei* var *cameli* is the preeminent agent of mange infestation in one-humped camel in Upper Egypt. Use of acaricides for the treatment of affected camels, along with spraying the animal environment by insecticides is a effective protocol not only for controlling mange in camels but also for prevention of re-infestation from the animal environment.

Keywords

Butox-50, Camel, Doramectin, Environment, moxidectin, Sarcoptic mange

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INTRODUCTION

The one-humped camel (*Camelus dromedaries*) is a crucial animal that can survive in hot and arid environment. Camels are considered as an elemental part in the sophistication and farming of many Arab countries; the unique physiological system of camel allows them to fill an important position in the desert farming. Camels are good sources of milk, meat, drought power, and serve as means of transportation, and hence, they support the survival of millions of citizens in barren areas of the world (Abdally, 2008; Megersa et al., 2012; Volpato et al., 2015).

The total population of camel in the world is estimated as 14 million, of which, Africa has 78.22%, Asia has 21.71%, and the remaining world has only 0.07% (FAO, 2012). Developing countries have 99.03% of this camel population. In Egypt, there has a stationary upsurge in livestock count, specially cattle (from 3.53 to 5.00 million). However, in recent years, camels have decreased from 141 thousand to 110 thousand. (FAO, 2011). The camel has received very little attention as compared to other species of domesticated animals of Egypt.

Dairy farmers face lots of new challenges nowadays, one of those is to improve health condition of their animals. In dealing with this objective, camel mange is one of the major veterinary problems in most of the developed and under-developed countries. Sarcoptic mange in one humped-camels (*Camelus dromedaries*) caused by *Sarcoptes scabiei* var *cameli* is considered to be

one of the most and economically important zoonotic and epizootic diseases that can be spread among animals via direct physical contact with infested animal and indirectly through fomites (e.g., ropes, blankets and saddlery) especially in tropical and subtropical areas (Singh, 2005; Parsani et al., 2008; Wilson, 2008).

The economic values of mange infested animal emanate from decreased body weight, expense of therapy, deterioration of skin due to perforation of the skin and intense pruritus as skin lesions may cover almost the entire body, and occasional mortalities in untreated and young animals, (Wilson, 2008). In addition, mange mite has enormous zoonotic and public health significance (Singh, 2005; Wilson, 2008). Moreover, mange can harshly decrease the welfare of milking animals as reducing the vitality and increased susceptibility to other diseases as a result of secondary bacterial infection. It can abridge milk production and disserve milking procedure as a result of uneasiness of infested animals (Megersa et al., 2012).

Sarcoptidae family are obligate parasites, tunneling through animal skin. *Sarcoptes scabiei* mite is the causative agent of human scabies as well as itching mange among domestic and wild animals, mainly affecting barely haired areas of body. *Sarcoptes scabiei* var. *cameli* affects camels world-wide (Radostitis et al., 2007; Dinka et al., 2010).

Knowledge of ecological parameters such as bad management, housing and care of the animal including feeding, handling and disposal of manure, general sanitation in the stable, overcrowding, separation between susceptible and infested manged animals, are considered as extrinsic secondary determinant and presumably the master key for governing and eliminating mange infestation in camels (Smith, 2006).

The actually applicable tools for eradication mange infestation comprise of administration of advanced acaricides formulation. These can be administrated with the profit gained from descriptive epidemiological investigation. Breeders and veterinarians execute therapeutics against mange ordinarily just after appearance of clinical manifestation. remarkably efficient treatment as those administrated during the "cryptic phase" utilizing acaricides (largely doramectin), are a useful approach for eliminating mange infestation due to they wipe out the source of infestation at the next season (Bisdorff and Wall, 2008). Despite its importance, inadequate clinical investigation on sporadic cases of infested camel with mange

as well as their associated factors of sarcoptic mange infestation and its prevalence are still unknown in many areas of Upper Egypt. Moreover, there is no available data regarding the prevalence of this disease in Upper Egypt. Therefore, the present study was designed to study the prevalence and risk factors associated with spread of mange among one humped-camels in Upper Egypt, as well as some clinical therapeutic protocols on camel mange and its environment were assessed.

MATERIALS AND METHODS

Animals and data collection: The present research work was carried out at different villages (n=6) located in Assiut Governorate, Egypt where the camels were managed and housed traditionally, during the period from July 2013 to August 2014. A total of 660 one humped-camels of different ages (between 9 month to 15 year) were randomly selected. The particulars of the animals such as age, sex were registered. The data regarding management, soundness, mixed breeding as well as regular or irregular administration acaricides were collected. All the camels were examined clinically. The camels were fed (feed mixture + Berseem (*Trifolium alexandrinum*) with hay at 2 kg/day plus rice straw *ad libitum*. Water was also offered to the camels *ad libitum*.

Clinical examination: The animals were clinically investigated on the first day of visit. Camels infested with skin lesions were investigated for body score condition as well as desire to feed.

Parasitological examination: The suspected camels were selected for parasitological investigation after clinical examination. Profound skin scrapings from the edges of the clinical lesions were collected in labeled Petri dishes. The edges of which were smeared with vaseline so as to prevent the mites from escaping. The dishes containing scrapings were warmed to a temperature just sufficient to be tolerated on the back of the hand (about 38°C), and were examined under a stereoscopic microscope for the presence of different stages of mites. The scrapings which were found negative for mites were transferred to test tubes containing 10 mL of 10% KOH and heated for 5 min in a beaker containing water; later, the tubes were centrifuged for 3 min at 2,000 rpm, and the supernatant fluid was discarded. About 5 mL of water was added to the sediment, and the tubes were again centrifuged. The supernatant fluid was again discarded and a drop of sediment was investigated under stereoscopic

microscope for the detection of different stages of mites (Tikram and Ruprah, 1986).

Therapeutic trial of infested animals: Fourty camels infested with Sarcoptic mites were allotted randomly into 4 equal groups. The first group received 0.5 mg/kg bwt moxidectin pour on (Cydectin pour on, Japan). The second was administrated with two doses of doramectin (Dectomax, Pfizer, Egypt) 10 days apart at 200 µg/kg bwt through subcutaneous (S/C) route. The 3rd group was administrated with a single dose of moxidectin as pour on at 0.5 mg/kg bwt in addition with Deltamethrin (Butox-50, Intervet) to surrounding animal environment such as bedding materials, wall, fomites etc. twice at 10 days interval. The 4th group received doramectin (Dectomax, Pfizer, Egypt), S/C, and after 10 days, the animals received another dose of the same drug at 200 µg/kg, S/C, plus this regime Deltamethrin (Butox-50, Intervet) was applied to animal housing in every 10 days till the end of the experiment (70 days). The infested camels were medicated, and the effectiveness of each treatment protocol was assessed after clinical examination and parasitological detection of mites on the 1st day of treatment and on 7, 14, 21, 28, 56 and 70 days post-treatment.

Statistical analysis: Analysis of variance of results on the impact of animal age, season and different sex, related communities, housing management and acaricides was calculated utilizing General Linear Models Procedure of SAS software version 9 (SAS, 2009). Moreover, Statistical association between prevalence of *S. scabiei* infestation in one-humped camel and potential risk was computed using

univariate analysis using chi-square (χ^2 -test). Significant association of variables with at $P < 0.05$ (two-sided) was superintend to the multivariate logistic regression model.

RESULTS AND DISCUSSION

Skin condition of camels is considered as a mirror of the health status. Infested camel with Sarcoptic mange was an universal obstacle in the late of 19th century. Sarcoptic mange infestation in camels is often regarded as the 2nd most important disease of dromedary camels, after trypanosomosis (Mochabo et al., 2005; Palanivelrajan et al., 2015). It is a highly contagious chronic debilitating condition with high degree of morbidity. Infested camels may stop grazing, and milk production is decreased.

In the present study, Sarcoptic mange infestation caused by *Sarcoptes scabiei* var *cameli* was identified from one humped-camels in Upper Egypt from Assiut Governorate as 6.06% (n=40/660) (Table 1 and Figure 1). The results were more or less coincided with Abdel Rahman et al. (2001), Osama and Idris (2001), Mohammed et al. (2007), Megersa et al. (2012), Awol et al. (2013), Ashraf et al. (2014), and Palanivelrajan et al. (2015).

Keeping camel under human observation and adequate management such as adequate nutrition, treatment of internal and external parasites and monitoring of physiological status and health are very crucial and important for camel well-being (Ashraf et al., 2014; Maha Momenah, 2014). Concerning to housing

Table 1. Parasitological examination of skin scraping samples.

Animals number	Positive cases	Negative cases	% of <i>Sarcoptes scabiei</i> var <i>cameli</i> mange infestation
660	40	620	6.06

Table 2. Effect of ecological systems on prevalence of mange in camels.

Ecological parameters	Isolated mite <i>Sarcoptes scabiei</i> var <i>cameli</i>	Overall %
Housing Management	Muddy land	27 ^a
	Dry land	13 ^b
Related communities	Separate rearing	13 ^a
	Mixed rearing	27 ^b
Acaricides use	Regular use	1 ^a
	Irregular use	15 ^b
	Not use	24 ^b
Season	Summer	5 ^a
	Autumn	7 ^a
	Spring	7 ^a
	Winter	21 ^b

Variables with different superscript letters in the same column are significantly different at $P < 0.05$.

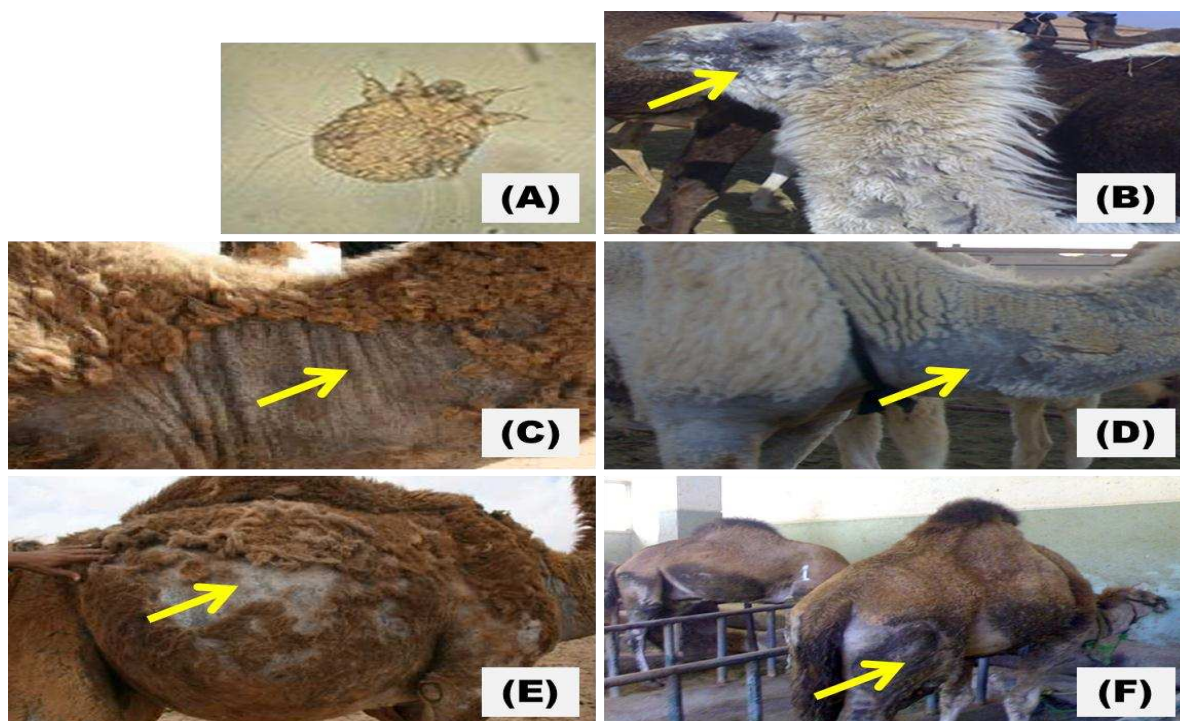


Figure 1: Sarcoptic mite and clinical signs caused by them in camel. (A) Skin scraping showing *Sarcoptes scabiei* mites, (B) camel is showing hairless area in the head and neck due to Sarcoptic mange, (C) camel is showing hairless area in the neck due to Sarcoptic mange, (D) camel is showing hairless area in the hind and fore limbs due to Sarcoptic mange, (E) camel is showing hairless area in the body due to Sarcoptic mange, (F) camel reared with buffaloes showing hairless area in the hind and fore limbs due to Sarcoptic mange.

Table 3. Effect of animal age and sex on prevalence of mange in camels.

Isolated mite <i>Sarcoptes scabiei</i> var <i>cameli</i>			Overall Percentage
Sex	Male	23 ^a	57.5%
	Female	17 ^a	42.5%
Age	Less than 2 year	15 ^a	37.5%
	2 to 7 year	13 ^a	32.5%
	7-15 year	12 ^a	30%

Variables with different superscript letters in the same column are significantly different at $P < 0.05$.

Table 4. Showed effect of Sarcoptic mange on Appetite and Score of body condition of camels.

Isolated mite <i>Sarcoptes scabiei</i> var <i>cameli</i>			Overall Percentage
Appetite	Normal appetite	10 ^a	25.0 %
	Inappetence	30 ^b	75.0 %
Score of body condition	0 score (poor)	29 ^a	72.5 %
	1 score (good)	11 ^b	27.5 %

Variables with different superscript letters in the same column are significantly different at $P < 0.05$.

management and mite infestation, we found that there is a positive significant correlation ($P < 0.05$) between prevalence of mange infestation and housing management (Table 2). The prevalence of sarcoptic mange in camels reared on muddy soil (67.5%) was higher than those reared on dry soil (32.5%). This result may be attributed to the fact that the optimum condition for mites survival in the environment are relatively high moisture with relatively low temperature as well as mites can not resist dry environment (Angarano and Parish, 1994).

As well as significant association ($P < 0.05$) between mite infestation and related communities was observed (Table 2). Mixed rearing (*i.e.*, camel with buffaloes, sheep and dogs) was positive statistical significance with the prevalence of mange infestation ($P < 0.05$). Twenty seven camels (67.5%) infested with sarcoptic mange were mixed reared with other animal species, whilst only 13 (32.5%) cases were reared alone (Table 2). Lack of strict species specificity may lead to transmission the infection from other animal species to camels as a result of close contact of camels with such animals (Qadoos et al., 1995; El-Khodery et al., 2009).

Table 5. Efficacy of therapeutic treatment on *Sarcoptes scabiei* var *cameli* of camels.

Group	Treatment protocols	No.	Examination	Day of examination						
				0	7	14	28	42	56	70
I	moxidectin	10	Positive clinical lesion	10 (100%)	7 (70%)	1 (10%)	3 (30%)	3 (30%)	6 (60%)	8 (80%)
			Positive skin scraping	10 (100%)	6 (60%)	1 (10%)	4 (40%)	5 (50%)	7 (70%)	9 (90%)
II	Doramectin	10	Positive clinical lesion	10 (100%)	5 (50%)	1 (10%)	0 (0%)	1 (10%)	3 (30%)	4 (40%)
			Positive skin scraping	10 (100%)	6 (60%)	0 (0%)	0 (0%)	1 (10%)	4 (40%)	5 (50%)
III	moxidectin + Butox-50	10	Positive clinical lesion	10 (100%)	6 (60%)	1 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
			Positive skin scraping	10 (100%)	6 (60%)	1 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
IV	Doramectin + Butox-50	10	Positive clinical lesion	10 (100%)	2 (20%)	1 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
			Positive skin scraping	10 (100%)	2 (20%)	1 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

The moxidectin was used at 0.5 mg/kg bwt, pour on; Doramectin was used at 200 µg/kg bwt subcutaneously.

From the results shown in **Table 2**, it is clear that untreated or irregularly treated camels were influenced significantly ($P<0.05$) on the prevalence of Sarcoptic scabiei infestation in one humped-camels. Thus, 60% and 37.5% of infested camels that were not previously treated or irregularly treated with acaricides, respectively. On the other hand, the lowest prevalence was recorded in animals that were regularly treated with acaricides (2.5%). Despite the fact of the efficiency of different ameliorative drugs against mange infestation of animals, the renewal of mange infestation of treated animals might be the main obstacle to prevention and control the disease as result of neglected environmental treatment as bedding and fomites. Moreover, resistance to drug as result of irregular treatment or misusing of drug has been reported *in vitro* and *in vivo* (Currie et al., 2004). Antiparasitic resistance is fundamentally disclosed during field practice, following treatment fiasco. It should be implicit that in mange mite infestation, appropriate therapeutic as well as combating measures can be carried out in association with scientific diagnosis. (Bates, 2000b).

Moreover, we found that there is a positive significant correlation ($P<0.05$) between prevalence of sarcoptic mange infestation and season (**Table 2**). The severity of infestation was observed during winter season (25.5%), while the lowest infestation was recorded in summer season (12.5%) followed by autumn and spring season (17.5 and 17.5%, respectively). This result was agreed with Tikram and Ruprah (1986) who found that sarcoptic mites survive better at 20-27°C than at 31-39°C. However, our results was not supported by

Ashraf et al. (2014) who found that the disease mostly prevalent in hot humid rainy season.

The effect of sex of camel (**Table 3**), we found that the prevalence rate of Sarcoptic mange was 57.5% in male and 42.5% in female (**Table 3**). Statistical analysis of data showed that there was no significant correlation between Sarcoptic mange infestation and gender. Our result was coincided with Megersa et al. (2012) who reported that the recorded data of mange infestation of male and female camels was not significantly difference. On the other hand, this result is not coincided with Awol et al. (2014) who found that the statistical analysis of variable between prevalence of male and female infested camel with mange was significantly difference ($P<0.05$). The same data was detected in statistical analysis of animal age data *i.e.*, there is no any significant correlation between Sarcoptic mange and camel age (**Table 3**). Our data was agreed with Megersa et al. (2012) and Awol et al. (2014), while Ashraf et al. (2014) stated that age of camels might be important factors in mange infestation, in which both very young and very old camels are particularly susceptible.

According to the severity and appetite of animals infested with mange (**Table 4**) showed that 30 (75%) of infested cases had lack of appetite while only 10 (25%) of infested camels with Sarcoptic mange had normal appetite. Moreover, poor body condition was recorded in 29 (72.5%) camels infested with mange mite. This result may be attributed to sever allergy and itching due to outcome of histamine liberated from damaged body cells which are compelling allergens (Fowler, 2010).

It is widely acknowledged that mange mite in animal is a major constraint in farming, leading to low productivity and economic losses. As a disease is the ultimate consequence of animal environment maladaptation, it also forms a crude indicator of animal welfare (Radostitis et al., 2007). Some populous regions in the tropics have additional problems with environments that are receptive for parasitic infections. The environment includes location, climate and husbandry. Precise awareness has been driven to environmental determinants in livestock enterprises (Novak et al., 2005; Megersa et al., 2012). Additionally, shortage of consciousness regarding application of advanced ameliorative drug for curing mange infestation, insufficient of economic knowledge of the pastoral inhabitants associated with arduous approachability of some veterinary clinics, have most probably participated in elevation of ignorance of animal breeder toward advanced veterinary medical technology. In this concern, it is decisive to neatly behold the veterinary troubles and thereafter layout a convenient planning policy that establish a suitable program for combating prevalence of mange among animals (Ashraf et al., 2014).

On clinical level with regarding to camel infested with Sarcoptic mange mites (Table 5), amelioration was detected swiftly in group received moxidectin pour on as well as that animal group administrated by Doramectin S/C adjunct with treatment of animal environment (group III & IV) as compared with only moxidectin pour on and doramectin without treatment of animal environment (group I & II). 100% of the Sarcoptic infested camels received either moxidectin pour on or doramectin adjunct with treatment of environment has become clinically and parasitological cure at 28 day post-administration without reinfestation versus in-cure was observed in group I & II. This result was coincided with Şuteu and Cozma (2004), Bala and Rath (2006) and Abdally (2010) who found that Doramectin was reported to serve a highly efficient effect against mange infestation in contrast of Amitraz (Formamidine compound).

Moreover, our results provide the proposal of decontamination of animal environment utilizing acaricides supplemented with animal treatment may preclude mange re-infestation from animal environment (Cadiergues et al., 2004). It is substantial note, nonetheless,, that a considerable majority of farmer population are deliberated to be conscious of the benefit of applying advanced veterinary services in handling infected livestock, although they are conceived of in most time be squeamish against

veterinarian instructions to complete therapeutic course till complete animal recovery from infectious diseases and sanitary condition of animal surrounding, due to the too high costs involved. This may presuppose the submission of adequate veterinary services to upgrade soundness knowledge of the farmer population. Furthermore, it is also probable that cured animal may be acquired recurrent infection by Sarcoptic mite as a result of contact with infested animal and contaminated environment. This exertion the significant importance of unveiling a mass of therapeutically campaign to diminish the trouble to the minimum attainable grade (Blood et al., 1990).

CONCLUSION

The results of this study point out that *Sarcoptes scabiei var cameli* is the main causal agent of mange of camels in Upper Egypt. For the treatment of mange affected camels, use of acaricides along with spraying of animal environment (bedding, buildings and fomites) by insecticides is an effective protocol not only for controlling mange but also for the prevention of reinfestation from the animal environment.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

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