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Epidemiology and control of mange in sheep and goat in Menofia Governorate

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ABSTRACT

The present study aimed to investigate the epidemiology of mange disease in Menofia Governorate and to identify the efficacy of different acaricides to control mange mites infesting sheep and goat in the governorate. For this purpose, a total number of 1500 sheep and 750 goats were examined during the different months and seasons of the year by visual inspection of animals' body. The examined animals were also parasitologically and microscopically examined. All parasitological positive samples were subjected to different treatment protocols with acaricides. The results revealed that prevalence of mange in sheep was 24.5% and 23.33% in goat and the highest prevalence of mange in sheep and goat was in summer season, (36.57%) in sheep and (32%) in goat, while the lowest prevalence was in winter, (14%) in sheep and (14.8%) in goat. Moreover, the highest prevalence of mange was observed in Shebein El-Kom , (6.73% , 5.73%), in sheep and goat, respectively, while the lowest prevalence was noticed in El-Bagour (4% , 3.73%), in sheep and goat, respectively. On the other hand, the results revealed that the efficacy of deltamethrin was 63.55%, the diazinon efficacy was 81.2%, the ivermectin efficacy was 81.95%, On the other hand, the treatment protocol of infested animals with deltamethrin + ivermectin proved an efficacy of 87.63% and the efficacy of the treatment protocol with diazinon + ivermectin was 94.7%. .

1. INTRODUCTION

Sheep and goat are highly patronized in most regions across the world, and so a big market exists for their meat (Ameha, 2006). Sheep play an important role in the food production systems as a source of animal protein including meat and milk, and constitute an important source for hides and skin which are considered the backbone of economy for some countries (Gebely, 2012; Hagos *et al.*, 2018).

Mange mites are a potential threat causing serious economic problems to sheep and goats production due to skin and wool damage, anemia, poor physical condition, decrease milk and meat, decrease in growth rates and general weakness that makes the affected animals more susceptible to other diseases (Ameen et al., 2012; Al-Ezzy et al., 2015). Mange disease need a good control intervention in most countries (Sertse and Wossene, 2007; Iqbal *et al*., 2015).

Two types of *Sarcoptes* mites, *Sarcoptes scabiei var caprae* and *Sarcoptes scabiei var ovis* were the most type of mites infesting goats and sheep (Rehbein, et al., 2005) and (Christensen, 2005). The most important mite species of sheep are that causes psoroptic mange and *Sarcoptes scabiei var ovis* that causes sarcoptic mange (Tolossa, 2014) and is referred to as a highly contagious skin disease (Radostitis et al., 2007).

The epidemiology of mange is still not well understood and seems to differ between animal species and areas of the world (Alasaad et al., 2011; Mazyad *et al.*, 2001) examined 939 sheep for mange infestations in four environmentally different localities in North Sinai, Egypt and found that the prevalence of mange of the examined sheep was (20.98%), where (4.05%) were infested with Sarcoptes scabiei mites and (16.93%).with Psoroptes ovis. The prevalence of mange in sheep was (10.9%) during the summer, while it was (9.3%) in goats in winter (El-Said *et al.*,2013). Moreover, Seid *et al.* (2016) found that the prevalence of mange in goats was 7.5 % and 1.2 % in sheep. The types of mites identified in goats were *Sarcoptes caprae* (6.9 %) and *Psoroptes ovis (*0.9 %), while in sheep the isolated mite was Sarcoptes ovis (0.3 %).

There are a wide range of acaricides available at market for control of mange mites in livestock. Permethrin is a synthetic pyrethroidal acaricide that is well tolerated, has low toxicity, rapid metabolism but more expensive than other agents (Strong and Johnstone, 2007).

Ivermectin appeared to be well known acaricide for treatment of mange in most animals (Crump and Omura 2011). Intensive use of it, can lead to development of resistance, so that ivermectin need a synergistic product for rapid treatment of infested animals. Permethrin 5% is a common anti-mange agents that can be used as a synergistic acaricide (Currie *et al.*, 2004). Ivermectin plus permethrin application can be used for treatment of mange. Ivermectin was highly effective against sarcoptic and psoroptic mites within 14 to 28 days in infested animals (Hamel *et al*., 2015). Treatment of affected animals with ivermectin plus permethrin was highly effective and more powerful acaricides resulting in rapid improvement, faster effect (Sobhy *et al.*, 2018).

The severity of mange infestation often influences the number of treatments required to eliminate infestation and the overall success of acaricide treatment. Hence, when

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designing treatment protocols, it is important to treat all in-contact animals, including domestic animals, and ensure humans follow sound biosecurity protocols to avoid becoming a source of parasitic infestation (Madeleine *et al*., 2019).

The present study aimed to investigate the epidemiology of mange disease in Menofia Governorate and to identify the efficacy of different acaricides to control mange mites infesting sheep and goat in the governorate.

2. MATERIAL AND METHODS

2.1.1. Animals and study area

A total number of 1500 sheep and 750 goats of different ages and both sexes were randomly selected from five villages located in Menofia Governorate, Egypt, viz; Shebin El-kom, Tala, Menouf, Ashmoon and El Bagour Centers, during the period from December 2017 to November 2018. The recorded data including management, climate,and regular or irregular administration of acaricides. A total number of 375 samples from sheep and 165 samples from goat were collected from Shebin Elkom, 350 sheep samples and 170 goat samples were collected from Tala, 240 sheep samples and 115 goat samples were collected from Menouf, 285 sheep samples and 150 goat samples were collected from Ashmoon and 250 sheep samples and 150 goat samples were collected from El-Bagoor during the different seasons of the year.

2.1.2. Clinical examination (Nimmervoll *et al.,* 2013)

Clinical inspection of each animal was performed visually and by multiple fleece partings, followed by physical examination of skin, inspection, and palpation of the skin across all parts of the animal body for the presence of gross lesions that may indicate the clinical form of mites' infestation.

2.1.3. Acaricides used

2.1.3.1. Diazinon 15% manufactured by ADWIA Co. S.A.E. 10th of Ramadan City Egypt.

2.1.3.2. Deltamethrin (Butox-50, manufactured by Intervet, Egypt.

2.1.3.3. Ivermectin 2% (Diver 2) (a broad-spectrum anti-parasite medication). manufactured by VetLarge Co. I. P.I. 6th of October City, Egypt.

2.2- Laboratory parasitological examination

2.2.1. Sample collection (Desie *et al.,* 2010)

Skin scrapings from the edges of the clinical lesions were collected in labeled Petri dishes. The edges of which were smeared with vaseline to prevent the mites from escaping. Collected samples were examined by microscope and further identification of species was conducted in the parasitology laboratory according to the methods for the identification described by (Alterio *et al.,* 2004).

2.2.2. Laboratory technique for detection of mites

The technique was carried out after Kotb and Abdel-Rady, (2015)**.** The Petri dishes containing skin scrapings were warmed to a tempreature (about 38 °C) and were examined under a steroscopic microscope for the presence of different stages of mites . The scrapings which were found negative for mites were transfererred to test tubes containing 10 ml of 10% KOH and heated for 5 minutes in water bath or in a beaker containing water. The tubes were centrifugated for 3 minutes at 2000 rpm and the supernatant fluid was discarded. About 5 ml of water was added to the sediment, and the tubes were again centrifugated. The supernatant fluid was again discarded and a drop of the sediment was investigated under the microscope for the detection of different stages of mites.

2.3. Grouping of animals for treatment protocols

The treatment protocols will briefly explained as the following: All infested sheep (101) and goats (43) with prevalence of 6.73 %, 5.73% at Shebin Elkom were treated using deltamethrine as spray (2 ml/liter) for two times, 14 days intervals. The infested sheep (90) and goats(43) with prevalence of 6%, 5.73% at Tala, were treated using diazinon as spray (2 ml/liter) for two times, 14 days intervals. The infested sheep (48) and goats (31) with prevalence of 3.2%, 4.13% at Menouf, were treated using two subcutaneous injection with Ivermectin (200 µg/kg), 14 days intervals. The infested sheep (70) and goats (30) with prevalence of 4.67%, 4% at Ashmoon, were treated using deltamethrin as spray (2 ml/liter) then ivermectin subcutaneous injection (200 µg/kg) at the same time, 14 days intervals. The infested sheep (60) and goats (28) with prevalence of 4%, 3.73% at Elbagoor, were treated using diazinon as spray (2 ml/liter) then ivermectin subcutaneous injection (200 µg/kg), 14 days intervals.

2.4. Evaluation of acaricide efficacy

The efficacy of acaricide was estimated according to this equation:

$$\frac{\text{Number of recovered animals (become free from infestation)}}{\text{Number of infested animals before treatment}} \times 100$$

3. RESULTS

3.1. Epidemiology of mange infestation in sheep and goat

3.1.1. Prevalence of mange infestation of sheep and goat during different months of the year

The results tabulated in table (1) showed that the highest prevalence of mange in sheep (45.7%) was noticed during August and the highest prevalence in goat (38%) was observed during April. On the other hand, the lowest prevalence of mange in sheep (13%) was noticed during February and the lowest prevalence in goat (12.8%) was observed during December.

Table 1 Monthly Prevalence of mange infesting sheep and goat

Month	Examined sheep	Infested Sheep		Examined Goat	Infested goat	
		No.	%		No.	%
December	150	20	13.3%	125	16	12.8%
January	200	30	15%	75	11	14.67%
February	100	13	13%	50	10	20%
March	120	40	33.3%	75	20	26.67%
April	155	43	27.7%	50	19	38%
May	100	27	27%	75	17	22.67%
June	180	54	30%	75	22	29.3%
July	100	42	42%	50	18	36%
August	70	32	45.7%	50	16	32%
September	100	23	23%	50	14	28%
October	150	28	18.66%	50	7	14%
November	75	17	22.7%	25	5	20%
Total	1500	369	24.6%	750	175	23.33%

3.1.2. Prevalence of mange infestation of sheep and goat in different seasons

The results in table (2) revealed that during the winter season, 63 out of 450 (14%) sheep and 37 out of 250 (14.8%) goat were found infested with mites. During the spring season, 110 out of 375 (29.3%) sheep and 56 out of 200 (28%) goat were found infested with mites. During the summer season, 128 out of 350 (36.57%) sheep and 56 out of 175 (32%)goat were found infested with mites. During the autumn season, 68 out of 325 (20.92%) sheep and 26 out of 125 (20.8%) goat were found infested with mites.

Table 2 Prevalence of mange in sheep and goat during different seasons of the year

Animal	Sheep			Goat		
	Examined	Infested		Examined	Infested	
Season		No.	%		No.	%
Winter	450	63	14%	250	37	14.8%
Spring	375	110	29.3%	200	56	28%
Summer	350	128	36.57%	175	56	32%
Autumn	325	68	20.92%	125	26	20.8%
Total	1500	369	24. 6%	750	175	23.33%

3.1.3. Prevalence of mange in sheep and goat in different localities of Menufia governorate

The results in table (3) revealed that in Shebein El-kom,101 out of 375(6.73%) in sheep and 43 out of 165 (5.73%) in goats were infested with mange , respectively. In Tala, 90 out of 350(6%) in sheep and 43 out of 170(5.73%) in goats were infested with mange, respectively. In Menouf, 48 out of 240 (3.2%) in sheep and 31 out of 115 (4.13%) in goats were infested with mange the prevalence of mange , respectively. In Ashmoon, 70 out of 285 (4.67%) in sheep and 30 out of 150 (4%) in goats were infested with mange the prevalence of mange, respectively. In El-Bagoor, 60 out of 250 (4%) in sheep and 28 out of 150 (3.73%) in goats were infested with mange, respectively.

Table 3 Prevalence of mange infesting sheep and goat in different localities in Menoufia Governorate

Locality	Infested sheep		Infested goat	
	No.	%	No.	%
Shebien El-Kom	101	6.73%	43	5.73%
Tala	90	6.00%	43	5.73%
Menouf	48	3.2%	31	4.13%
Ashmoon	70	4.67%	30	4.00%
Elbagoor	60	4.00%	28	3.73%
Total	369	24.6%	175	23.33%

3.2. Control of mange infestation in sheep and goat

3.2.1. Efficacy of acaricides against mange infesting sheep and goat

The efficacy of deltamethrin in sheep and goat as revealed in table (4), 71.3% and 55.8%, respectively, The efficacy of diazinon in sheep and goat was 81.1% and 81.4%, respectively, while the efficacy of ivermectin in sheep and goat was 83.3% and 80.6%, respectively. As well, the efficacy of deltamethrin plus ivermectin in sheep and goat was 88.6% ,and 86.66% respectively. Meanwhile, the efficacy of diazinon plus ivermectin in sheep and goat was 96.66% and 92.8%, respectively..

The results displayed in table (4) showed that the efficacy of deltamethrin 63.55%, followed by diazinon 81.2%, and ivermectin 81.95%, while deltamethrin plus ivermectin 87.63% and finally the efficacy of diazinon plus ivermectin 94.7%. From these results, it was concluded that the best acaricide used to control mange of small ruminants was the application of diazinon as spray with ivermectin injection at the same time.

4. DISUCSSION

The results revealed that the prevalence of mange in the examined sheep was 24.60% and 23.33% in the examined goats during different seasons in five localities of menoufia governorate . The results agreed with those mentioned by Mazyad *et al.* (2001), who found that the prevalence of mange in sheep examined in four environmentally different localities in North Sinai, Egypt was 20.98%. Our findings were in agreement with Al-Zubaidei (2003) who recorded that the prevalence of mange mites was 22.96% with *Sarcoptes* and *Psoroptes* mites in sheep in Baghdad province, Iraq.

Our findings were in agreement with Ameen *et al.* (2012) in Nigeria who found that the infestation rate of mange in sheep was 23.68%, while it was 29.63% in goat. The results were agreed with Qudoos *et al*. (1997) in Ethiopia ,who reported that the infestation rate of mange in sheep was 21%. Also, the results were partially agreed with Mitra *et al.* (1993) in Ethiopia, who revealed that Sarcoptes scabiei mites were isolated from 15.9 % and 19 % of the examined sheep and goat, respectively.

Our results were slightly lower than that reported by Al-badrani (1998), who found that the prevalence of mange was 28.1% in Sheep in Al-Mosul province, Iraq. Moreover, our results were in agreement with Sertse and Wossene (2007) in Amhara Regional State (Ethiopia) who recorded that the prevalence of mange was 22.9% in sheep, respectively.

Table 4 Efficacy of acaricides used against mange in sheep and goat:

Acaricides	Species	No. of infested animals before treatment	2 weeks after 1st treatment		2 weeks after 2nd treatment		Overall Efficacy (%)
			No. Cured	% Efficacy	No. Cured	% Efficacy	
Deltamethrin	Sheep	101	37	36.6%	72	71.3%	63.5%
	Goat	43	12	27.9%	24	55.8%	
Diazinon	Sheep	90	50	55.6%	73	81.1%	81.2%
	Goat	43	22	51.2%	35	81.4%	
Ivermectin	Sheep	48	29	60.4%	40	83.3%	81.9%
	Goat	31	17	54.8%	25	80.6%	
Deltamethrin + Ivermectin	Sheep	70	50	71.4%	62	88.6%	87.6%
	Goat	30	21	70%	26	86.66%	
Diazinon + Ivermectin	Sheep	60	43	71.6 %	58	96.6 %	94.7%
	Goat	28	20	71.4%	26	92.8%	

On the contrary, the results of some researchers were not partially or completely in accordance with our findings. Shiferaw *et al.* (2010) found that the prevalence was 5.85% and 8.11% in goat and sheep, respectivelly in Wolita Sodo zone, Ethiopia. The finding of the current study was higher than the prevalence reported by Molu (2002) in the Southern range land of Oromia (Ethiopia), who mentioned that prevalence of mange was 14.64% in sheep and 16.45% in goats. Our results revealed that prevalence of mange during winter season in sheep and goat was 14% ,14.8% while during spring season, it was 29.3%,28% while during summer season 36.57%, 32% and during autmn season 20.92%, 20.8% in sheep and goat .These results also disagree with those of El-Said *et al*. (2013) who reported that the high prevalence of mange in sheep was (10.9%) during the summer season, while it was (9.3%) in goats during the winter and spring season. Also, our results disagreed with Al-Ezzy *et al*. (2015), who found that infestation rate of mange in sheep was 7.942%, and the prevalence was highest in winter, especially February that reached (7.46%) and was lowest in December (2.71%). Yasine *et al*. (2015) recorded that the prevalence of mange was 7.6 % and 13.8 % in sheep and goats, respectively, as detected in Oromia Zone of Amhara region, North Eastern Ethiopia. Moreover, Seid *et al.* (2016) found that the prevalence of mange was 7.5 % in goats and 1.2 % in sheep. In the present study, the prevalence (24.60%) of mange in sheep was higher than that detected by Dansure and Belay (2018) (10.46%) in Jigjiga area, and Dessie *et al*., (2010) (1.99%) in selected sites of Wolaita zone (Ethiopia), but lower than the prevalence (67.65%) detected by Shenkutie (1987) in Robie areas Ethiopia. Our results were also higher than that detected in both sheep and goat by Shibeshi *et al.* (2013), (15.87%) in Guto-Gidda Distric, East Wollega, Western Ethiopia. These differences might be related to variations in agro-climate, season of study and management system.

The prevalence of mange infestation in goat (23.33 %) recorded in the current study was higher than that reported by Mana (2018) ,(10%) in Ethiopia, and by Yifat *et al*. (2013) in Wolaita zone (Ethiopia), (3.64%) comparable with (16.45%) detected in goat and reported by Molu (2002) in Ethiopia. In addition, the prevalence of mange was higher than that (6.8%) mentioned by (Zerhun, 1994) in Ethiopia , 5.85% reported by (Dessie *et al.,* 2010) in Ethiopia, and 8.11% illustrated by (Enquebaher and Etsay, 2010) in Ethiopia. But lower than 28% prevalence recorded by Aziz *et al.* (2013) in Dera Ghazi Khan, Punjab, Pakistan. A possible explanation for these differences in the prevalence among different studies could be variations in environmental and host factors, study seasons, owners knowledge of mites and animal husbandry and managements as has been argued by Kumsa *et al.* (2012) in Ethiopia. It also implies that the climatic conditions of the current study areas are more suitable for survival, reproduction and development of various stages of mange mites.

Concerning control of mange in sheep and goat, the results revealed that the effect of diazinon applied as spray was better than the effect of deltamethrin as spray, as the efficacy of diazinon reached 81.2%, while that of deltamethrin was only 63.5%. The effect of Ivermectin injection, is better than the effect of deltamethrin as spray, as the efficacy of Ivermectin reached to 81.9 % while that of deltamethrin reached 63.5% only. The effect of both deltamethrin as spray with Ivermectin injection was better than the effect of Ivermectin injection alone, as the efficacy of both deltamethrine with Ivermectin reached to 87.6% while that of Ivermectin reached 81.9% only. The effect of both diazinon as spray with Ivermectin injection was the best and regarded as the acaricide of choice used to control mange in sheep and goat as the efficacy reached 94.7%. As well, our results were in agreement with Kumilachew *et al*. (2010) in Ethiopia, who recorded that a clear reduction of mange was noticed after dipping of goats in 0.06% of diazinon.

The findings of the current study were in agreement with Singh and Gill (1989) in India, who found that infested sheep treated with Ivermectin was free from infestation 10–15 days post- treatment. Our results were similar to Williams (1992) in Lousina region ,who noticed that sheep treated with Ivermectin was found negative from sarcoptic mites. Our results also were in parallel with Sekar *et al*. (1997) in India, who mentioned that skin healing was observed after 35 days of treatment with Ivermectin.

These results were also in agreement with Currie *et al.* (2004) in Ethiopia, who recorded that ivermectin was effective against mange in sheep and goats specially when used it with synergistic product such as permethrin 5%. Our results also were partially agreed with Hengge *et al*. (2006) and Kumar and Shekhar (2010) in India who reported that using of Ivermectin resulted in complete resolution of mange crusts and scabs

These results displayed in our study were partially agreed with Pourhasan *et al*. (2013) in Ethiopia, who found that the permethrin had the ability to kill mites and its eggs, however, the combination of permethrin with other acaricides was imported to overcome drug resistance development. Our results also were consistent with Rehbein et al. (2013) in Ethiopia, who mentioned that injections of ivermectin were highly effective against mites. Nevertheless, Our findings were in approximated with Desoky (2015) in Egypt, who concluded that ivermectin injection was considered the best method to control scabies in animals. Our results were also partially similar with Astorga *et al*. (2018) in Virginia (USA), who estimated that a common treatment option for mange is the administration of two doses of ivermectin, two weeks apart. Finally, our findings were similar to the finding of Sobhy *et al.* (2018) in Alex. Egypt, who found that treatment with ivermectin plus permethrin was highly effective powerful acaricides resulting in rapidly improvement, faster effect and safe for animal health.

5. CONCULOSIONS

It is important that the risk factors associated with mange infestation should be taken into account in designing prevention and control programs. We advise to design and implement strategic prophylaxis against mange in addition to the therapeutic approach. For eradication of mange, it is difficult, if not impossible, to prevent mange infestation by sanitation alone, it is best prevented by regular application of acaricides

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