

An epidemiological and therapeutic study of *Sarcoptes scabiei* parasite in cows of Anbar province, Iraq

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Article information

Article history:

Received January 24, 2021

Accepted May 04, 2021

Available online November 20, 2021

Keywords:

Abamectin

Nitot plant

Prevalence

Scabies mite

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Abstract

This study was conducted to determine the prevalence of *Sarcoptes scabiei* infection in cows in Anbar province, Iraq. The parasite was diagnosed in the laboratory via examining skin scrapings taken from the suspected cows. The results indicated that the infection rate in cows with *S. scabiei* reached 37.5%, the animals of 3 months - <3 years old have the highest rate of infection. The results of the study showed that head lesions were more present and clearer than others. Furthermore, the highest rate of infection was recorded in the winter season and the lowest in the summer season. It has been proven that the concentration of (5-10) mg/ml of the aquatic extract of *Hammada articulate* had a great effect on the parasite, however, the concentration 10 mg/ml leads to the complete disappearance of all parasites and the cure of the infected cows on the 14th day of treatment, which is equal to the drug Abamectin in its effect on the parasites. The current study concluded that cows in the study areas were infected with scabies mites at a high rate, and this calls for finding safe treatment methods by using medicinal herbs and plants because they contain many active compounds that affect the parasite and lead to its mortality, and they are safe strategic alternatives to harmful chemical drugs. This necessitates the establishment of an integrated control approach through treatment with effective plant extracts and to maintain the cleanliness of the animal environment.

DOI: [10.33899/ijvs.2021.129420.1646](https://doi.org/10.33899/ijvs.2021.129420.1646), ©Authors, 2022, College of Veterinary Medicine, University of Mosul.

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Introduction

Sarcoptes scabiei, or itch mite, is an obligate ectoparasite that infects the skin of a wide range of animals causing mange, it is an important disease that causes heavy economic losses due to its ability to negatively affect livestock production and can increase the mortality rate (1). This disease has a wide global spread, especially in developing countries, *S. scabiei* belongs to class Arthropoda and order Acarina and the family of sarcoptidae (2). It affects many species of wild and domestic animals, including cows, sheep, goats, buffaloes, rabbits, dogs, cats, and they may also infect wild boars, bears, koalas and monkeys (3).

Approximately, more than 100 mammal species belonged to 27 families can be affected, these parasites burrow deep into the skin and form 1 cm long tunnels in

where they feed and multiply, causing an inflammation, severe itching, excoriation, and hair loss, the parasite causes different clinical manifestations including wasting, weight loss, anemia, severe itching, dermatitis, local bleeding, ulcers, hair loss, low production of meat and milk, and might terminated with decimation of animals (4).

Several studies have been conducted to investigate the scabies parasite in many countries around the world. For example, in Ethiopia, an infection rate of 10.9% in examined cows was recorded (5). on the other hand, Haggag *et al.* (6) indicated a 48% infection rate among ows in Behera province, Egypt. As for Iraq, a study conducted in Duhok province, north Iraq, which recorded a rate of 57.7% (7). As well, Mustafa (8) mentioned an infection rate of 13.8% in Sulaymaniyah province, while Shahatha (9) found the incidence rate of 34.6% in Anbar province.

Many medicinal plants and herbs have been used in the treatment of diseases, including parasitic diseases because they contain many effective compounds including alkaloids, fuocumarins, glycosides, resins, tannins, volatile oils, saponins, and others, the Nitol or *Hammada articulate* plant belongs to the Chenopodiaceae family, which is characterized as a small shrub, about 40-95 cm high, with deep roots and a strong dry base, prefers gravel and fossilized soil as well as clay soil, and blooms from early July to mid-October, it is characterized by containing many compounds effective including alkaloids, fuocumarins, glycosides, flavones, tannins, volatile oils, and saponins, it is used for the treatment of skin diseases, including scabies in animals, as well as for treating skin eczema in humans (10).

From the studies conducted to treat scabies, a study done by Aboelhadid *et al.* (11) appear the, *in vitro* and *in vivo* effect of *Citrus limon* essential oil against sarcoptic mange in rabbits. On the other hand, Li *et al.* (12) also studied the effect of lemongrass oil on *S. scabiei* parasites.

Scabies disease causes great economic losses and leads to a decrease in animal production and the death of large numbers of animals, it affects various types of animals in most countries of the world, including Iraq, so this study was conducted to determine the extent of the prevalence of scabies mites in cows in Anbar province and to find a safe and effective treatment for this disease using medicinal plants and herbs, the aqueous extract of the Nitol plant was used because it contains many effective compounds, which are considered a good strategic alternative to chemical drugs that harm human health, animals, and the environment.

This study provides a basis for exploring the therapeutic potential of these medicinal plants against parasitic diseases. However, extensive studies are needed to determine the effectiveness of the active compounds of other plants, which may lead to a significant addition of value in the pharmaceutical industry, and to provide a cost-effective method of treatment with minimal side effects.

Materials and methods

Animals and study area

A total of 416 suspected cows were examined from both sexes and at different ages ranged from 3 months to 15 years, animals are located in different areas in Anbar province including Sufism, Al-Jazeera, Saqlawiyah, Habbaniyah, Fallujah, and Hit.

The skin scrapings were examined in the laboratory to diagnose and watch the *S. scabiei* parasites. The study also included the effect of different concentrations of the aquatic extract of *Hammada articulate*, also known locally as a Nitol plant, and its comparison with the drug Abamectin on the parasites.

Collection and examination of samples

Skin scrapings were taken from different groups of cows present in livestock fields in Anbar province for one year, an average of thirty percent of cows per farm and 15 percent of every village visited were included in this study. After selecting the animals, each cow was attached and hair was trimmed from the lesion margins with scissors then the area was cleaned with a 10% KOH solution (13). The lesions were scraped from the ends using a sterile scalpel until blood bled from the site and samples were collected monthly (about 40 samples) and placed in glass bottles and brought to the Parasitology Laboratory for examination according to the method used by Cloes (14), by adding 10 ml of 10% KOH solution and placed in a water bath of 80°C for 20 minutes to remove the tissue and fiber. Then the cooled samples were placed in the centrifuge at a speed of 1500 cycles/min for 5 minutes, a drop of the precipitate was examined microscopically at 40x, 100x for final diagnosis of the causative parasite.

Infection level estimation

The level of infection for each infected animal was estimated by counting the number of scabies mites in all its stages in 10 light fields under the magnification force of 40 X, and then dividing the resulting number on the number 10, and the standard is the number of mite / light field (15).

Preparation of the aquatic extract of the Nitol plant

The Nitol plant (Figure 1) was collected from the 70th kilometer west of Rutba, for the purpose of preparing the aqueous extract of the plant which was diagnosed in Herbarium - University of Anbar. The plants were cleaned and dried in an incubator set at 30-35°C. The plant was extracted according to Kanojiya *et al.* method (16) by crushing 40 grams of the plant with 160 ml of distilled water in a ratio of 4:1 using a blender. The mixture was placed inside a snow bath to ensure that the active compounds were not harmed by the high temperature. The substance was then mixed for 60 minutes using an electric magnetic motor (stirrer) and left the mixture for 24 hours at 4°C for the purpose of soaking.

After that, the mixture was nominated using filtration papers to dispose of plant fiber parts, then the plant extract was dried using a lyophilizer. The powder was stored after the drying process in glass bottles at -10°C until use. The standard concentration of the extract was prepared by taking 2 grams of raw extract and 20 ml of distilled water. Based on the standard concentration (100 mg/ml), and then the required concentrations 5, 7.5, 10 mg /ml were prepared.

Chemical detection of active compounds in plant (17)

Detection of glycosides

1 g of a dry plant extract was mixed with 10 ml distilled water, added a few drops of Fehlink reagent, the appearance of red indicates the presence of Glycosides.



Figure 1: The Nitol plant *Hammada articulate*.

Detection of fuocumarins

Two equal amounts of a plant extract were mixed with 1% potassium hydroxide; the appearance of greenish-yellow indicates the presence of Fuocumarins.

Detection of flavonoids

A 10 ml solution of 50% ethanol was added to 10 ml of 50% potassium hydroxide and mixed in an equal amount, the presence of a yellow color indicated the existence of Flavonoids.

Detection of terpenes

A mixture of the following chemical materials was prepared: One gram of plant extract was dissolved in 2 ml of chloroform, followed by a drop of anhydrous acetic acid and a drop of concentrated sulfuric acid, the presence of brown sediment indicated the existence of Terpenes.

Detection of alkaloids

10 grams of plant extract was boiled with 50 ml of distilled water containing 4% hydrochloric acid (HCL). The solution was cooled and filtered. Following this, 0.5 ml of leachate was tested in a watch glass with 0.5 ml of Meyer reagent, the appearance of white deposits indicates the presence of Alkaloids.

Detection of tannins

A few drops of lead acetate solution 1% were added to 5 ml of the plant extract; the appearance of white gelatin deposits indicates the presence of tannins.

Detection of phenols

1 ml of dry plant extract was added to 1 ml of a 1% ferric chloride solution, the appearance of green or blue color indicating the presence of phenols.

Detection of the saponins

3 ml of mercuric chloride solution 1% was added to 5 ml of the plant extract, the appearance of the white deposit indicated the presence of saponins.

Detection of volatile oils

A few drops of plant extract were added to the filter paper to reduce saturation and exposure to ultraviolet radiation, the

appearance of a grayish color indicates the presence of volatile oils.

Treatment experiment

The experiment was carried out on a herd of cows infected with the mange in Saqlawiya district of Fallujah, which is 50 heads. The herd was divided into 5 groups, Group 1 was considered a control group, and group 2 was treated with Abamectin drug (GENESIS™) with a dose of 0.2 mg/kg of body weight (the recommended dose) by SC for one-time injection. Moreover, group 3 was treated with a concentration of 5 mg/ml of the aquatic extract of the Nitol plant by subcutaneous injection. Group 4 was treated with 7.5 mg/ml of the aquatic extract of the Nitol plant. The group 5 was treated with 10 mg/ml of the aquatic extract of the Nitol plant. A clinical examination was performed and an estimate of the level of infection for all animals was performed by collecting the levels of infection of the group animals and dividing them by the number of group infected animals on days 0, 7, 14, and 21 after treatment with aquatic extract of the plant and the drug used.

Statistical analysis

The data collected on disease prevalence were analyzed statistically using different statistical techniques by Statically Analysis Software (SAS) application (proc) for Windows version 10 (18). The prevalence of mange was assessed using descriptive statistics. Chi-square was applied to confirm disease spread based on sex, seasons, and age; the results were compared using least significant difference (LSD), data on the presence of lesions were collected to estimate the percentage of their appearance on different body parts. For the therapeutic study, results and data generated from the trial were expressed as mean \pm standard error for continuing variants, using the one-way analysis of variance (ANOVA) table, at a probability level $P < 0.05$.

Results

This study is the first of its kind in a country where the Nitol plant is used to treat *S. scabiei* parasites. The results revealed a 37.5% infection rate of the *S. scabiei* parasite in Anbar province. The *S. scabiei* was characterized by its small size and flat spherical shape from both the ventral and dorsal sides. The legs were short and not prominent in both sexes. Females had three sensory spines in the front of the midline and six in the back, while in males the sensory spines are hairy (Figure 2). It was noted that the infection rate between males and females is close (Table 1). As for the relationship of infection with animal age, the highest infection rate was 56.1% in cows at ages 3 months- <3 years old and the lowest was 19.3% at ages 9-<12 years, with significant differences (Table 2).



Figure 2: *Sarcoptes scabiei* parasite in the examined skin scrapings, 40X.

Table 1: Percentage of infection with *S. scabiei* according to sex

sex	n examined	n infected	%
Males	202	74	36.6
Females	214	82	38.8
Total	416	156	37.5

Table 2: Percentage of infection with *S. scabiei* according to age

Age (year)	n examined	n infected	%
<3	89	50	56.1
3-<6	80	35	43.7
6-<9	81	32	39.5
9-<12	88	17	19.3
12-<15	78	22	28.2
Total	416	156	37.5

The disease was clinically characterized by thickening and waviness of the skin, hair loss and severe itching in most cows. Scabies lesions were most commonly observed on the head, followed by the back and neck respectively of the affected cows (Figure 3).

The head lesions were more present and more pronounced than others, where the highest was recorded. The percentage was 33.3%, followed by the back lesions 31.4%, while the back legs lesions recorded the lowest rate of 1.2% with significant differences (Table 3).

The seasonal results showed that the highest prevalence of scabies mites was observed during the winter season, followed by autumn and then spring, while the lowest prevalence of the parasites was observed in the summer, with incidence rates reaching 59.6, 40, 33.6, and 16 %, respectively with statistically significant differences (Table 4).

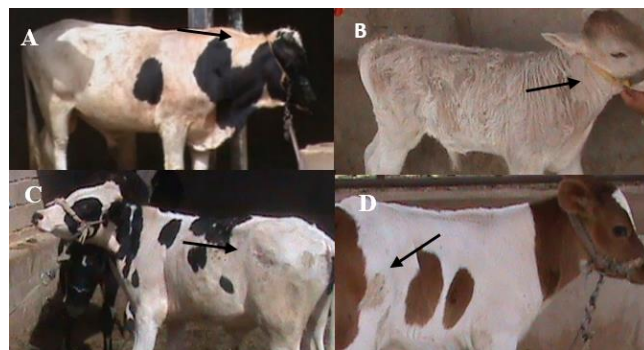


Figure 3: Mange at different regions of the body (A) at head, (B) at neck, (C) at back, (D) at back leg.

Table 3: Percentage of infection with lesions *S. scabiei* according to location on the body

location of lesions	n infections	%
Head	52	33.3
Neck	33	21.1
Back	49	31.4
Abdomen	10	6.4
Front legs	10	6.4
Back legs	2	1.2
Total	156	100

Table 4: Percentage of infection with *S. scabiei* according to Seasons of the year

Seasons	n examined	n infected	%
Winter	119	71	59.6
Spring	104	35	33.6
Summer	106	17	16.0
Autumn	90	36	40.0
Total	416	156	37.5

The results of this study revealed the efficacy of the aqueous extract of *H. articulate* plant in killing *S. scabiei* parasites. Concentrations 5, 7.5, 10 mg/ml of the aqueous extract were used and compared with the Abamectin drug. In control group 1, the infection continued until the end of the experiment, where the average infection level was 3.27, 3.42, 3.56, 3.86 mites/light field for days 0, 7, 14, and 21 respectively. Group 2 was treated with 0.2 mg/kg of body weight of Abamectin drug the average infection level was 3.86 mite/light field before treatment and decreased to 1.25 mite/light field on day 7 of treatment and on day 14 the mite parasites completely disappeared. For group 3, which was treated with 5 mg/ml of aquatic extract from the *H. articulate* plant, the average level of infection before treatment was 3.55 mite/ light field and decreased to 1.51 and 0.44 mite/ light field on days 7 and 14, respectively, by the 21st day after treatment, the parasites had completely disappeared,

with an average infection level of 0 mite/ light field. Whereas group 4 was treated with a concentration of 7.5 mg/mL of aquatic extract, the average infection level decreased from 3.77 mites/ light field to 1.66 and 0.26 mite/light field on day 7, 14 respectively of treatment, on day 21, the scabies mites disappeared completely. Moreover, group 5 was treated with

a concentration of 10 mg/ml of aquatic extract, which significantly affected the mite parasites and led to a decrease in average infection level from 3.84 mites/light field to 1.12 mites/light field on day 7 of treatment, and on day 14 all parasites were eliminated (Table 5).

Table 5: The effect of the aquatic extract of the Nitol plant compared with the drug abamectin on the average infection level of *S. scabiei* parasites

Group	Average infection level (mite / light field) \pm standard error			
	0 day	7 day	14 day	21 day
Control (G1)	3.27 \pm 0.44 a	3.42 \pm 0.34 a	3.56 \pm 0.66 a	3.86 \pm 0.38 a
Abamectin 0.2 mg/kg	3.86 \pm 0.52 a	1.25 \pm 0.22 b	0 d	0 d
Abamectin 5 mg/kg	3.55 \pm 0.48 a	1.51 \pm 0.24 b	0.44 \pm 0.32 c	0 d
Abamectin 7.5 mg/kg	3.77 \pm 0.25 a	1.66 \pm 0.20 c	0.26 \pm 0.08 c	0 d
Abamectin 10 mg/kg	3.84 \pm 0.77 a	1.12 \pm 0.06 c	0 d	0 d

Different characters within the column indicate significant differences between the coefficients within the level of significance $P < 0.05$ according to the test LSD.

Discussion

The results showed a high infection of scabies mite in cows in Anbar province, and these results are higher than what was recorded by Mustafa (8) in Sulaymaniyah province, where he recorded an infection rate of 13.8%. and the results of Shahatha (19) which recorded a rate of 34.6% in Anbar province. But it is less than what the researcher Zangana *et al.* (7) found, which amounted to 57.5% in Duhok province, these differences may be attributed to variations in the environment, climate, access to veterinary services, and other breeding practices such as concern for hygiene conditions in the fields of livestock breeding by livestock keepers.

The reason for the prevalence of scabies disease in Anbar province is due to the mismanagement of the herd by livestock keepers, failure to adhere to hygiene conditions in barns and animal husbandry fields, and direct contact with sources of infection such as dogs and cats plays a major role in the spread of infection, In addition, the spread of insects, especially mosquitoes and flies, has a major role in the spread of disease, as insects are among the mechanical factors that transmit infection between animals, also the failure to continue treatment by livestock keepers (20).

Shahatha (21) stated that poor animal health and body condition, malnutrition, harsh climatic conditions, and animal infestation with parasitic or other infectious diseases are predisposing factors for scabies. The difference may also be due to different diagnostic methods and Hamoo *et al.* (22) stated that precise diagnostic methods should be used to distinguish between types of parasites that cause diseases in humans and animals, including ectoparasites.

The results indicated a higher incidence of *S. scabiei* parasites in young cows compared to older ages, this is consistent with what Ahmed *et al.* (23), the reason for the

higher prevalence of scabies in young animals compared to it for older animals is attributed to keeping young and adult animals together and thus infection through direct contact with each other with biting. In addition, farmers in most villages in Anbar province are not well-versed in wealth management practices modern animal. On the other hand, Head lesions were more present and more pronounced than other lesions on other parts of the body, and this corresponds to the study of Shahatha (9), the reason for this is that the parasite easily attaches to areas of low hair like the head and back.

The results confirmed that the seasons of the year had a significant effect on the rate of scabies mite infestation, as the highest infestation rate was recorded in the winter season and the lowest in the summer, this corresponds to results Abo-Elhassan (24).

The reason for the higher infection rates in the winter season compared to the summer season is the speed of transmission of the scabies parasite through direct contact and contact between animals in cold weather, in addition, ectoparasite activity increases with low temperature and high humidity, and overcrowding during the winter months are conducive to the rapid spread of mites' life cycle (9).

The therapeutic trial demonstrated the effective effect of the concentrations of the aqueous extract of the Nitol plant on the scabies parasites, this agrees with a Shahatha (9) and Aboelhadid *et al.* (11).

The effectiveness of the aquatic extract of *H. articulate* plant and its significant effect on *S. scabiei* parasite is due to its content of effective compounds, such as alkaloids, fuocumarins, glycosides flavones, tannins, saponins, and volatile oils which affect the production of enzymes and other vital components in the parasite, thus causing cell destruction and parasite death. Also, it prevents the passage of ions through the cell membrane and affects the biological

activities of the parasite by disrupting the acetylcholine which controls all physiological functions of the parasite leading to parasite death (17). Shahatha (25) indicated that saponins have inhibitory efficacy through its effect on enzyme activity.

The therapeutic field trial showed a clear clinical improvement in all treated cows. The study also revealed that the therapeutic efficacy of the highest concentration of aqueous extract of *H. articulate* plant is equal to the effectiveness of the drug, as measured by analyzes of skin abrasion, body condition, and clinical outcome changes.

Conclusion

This study concluded that the cows of Anbar province were infected with scabies mites by a large percentage, this necessitates the establishment of an integrated control approach through treatment with effective plant extracts and to maintain the cleanliness of the animal environment. so, it is necessary to find safe treatment methods for this disease using medicinal herbs and plants because they contain many effective compounds that lead to the death of parasites. where the significant effect of the aqueous extract of the Nitol plant was observed on the scabies mites, and this is considered one of the good strategic alternatives for the use of chemical drugs that harm human health, animals, and the environment.

Acknowledgments

The author would like to thank the College of Science, University of Anbar, for providing facilities.

Conflict of interest

The authors declare that no conflict of interest exists.

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يبلغ عمرها ٣ أشهر - أقل من ٣ سنوات. وأظهرت نتائج الدراسة أن آفات الرأس كانت أكثر تواجداً وأكثر وضوحاً من غيرها. علاوة على ذلك، تم تسجيل أعلى معدل إصابة في موسم الشتاء وأدناها في موسم الصيف. ثبت أن تركيز ١٠-٥ ملغم/مل من المستخلص المائي لنبات النيتول كان له تأثير كبير على الطفيلي، إلا أن تركيز ١٠ ملغم/مل يؤدي إلى الاختفاء التام لجميع الطفيليات وشفاء الأبقار المصابة في اليوم الرابع عشر من العلاج، وهو ما يعادل عقار أمباكتين في تأثيره على الطفيليات. تستنتج الدراسة الحالية إصابة أبقار منطقة الدراسة بحلم الجرب بمعدل مرتفع، وهذا يستدعي إيجاد طرق علاج آمنة باستخدام الأعشاب والنباتات الطبية لاحتوائها على العديد من المركبات الفعالة التي تؤثر على الطفيل وتؤدي إلى هلاكه، وهي بدائل استراتيجية آمنة عن العقاقير الكيميائية الضارة، الأمر الذي يستلزم إنشاء نهج تحكم متكامل من خلال المعالجة بالمستخلصات النباتية الفعالة والمحافظة على نظافة بيئة الحيوانات.

دراسة وبائية وعلاجية لطفيلي *Sarcoptes scabiei* في أبقار محافظة الأنبار، العراق

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الخلاصة

أجريت هذه الدراسة لمعرفة مدى انتشار الإصابة بطفيلي الجرب الساركوبتي في أبقار محافظة الأنبار، العراق. تم تشخيص الطفيل في المختبر من خلال فحص القشطات الجلدية المأخوذ من الأبقار المشتبه بإصابتها. أشارت النتائج إلى أن نسبة الإصابة في الأبقار بطفيلي الجرب الساركوبتي بلغت ٣٧,٥٪، وكانت أعلى نسبة إصابة في الحيوانات التي

