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Parasitology

Acaricidal Effects of Selamectin and *Ficus sycomorus* extracts on *Sarcoptes scabiei* Mites Infection in Rabbit

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ABSTRACT

This study aimed to evaluation of the *in vitro* and *in vivo* acaricidal activity of the *Ficus sycomorus* (*F. sycomorus*) against fur mites in rabbits. Methanol 70% was used to extract *F. sycomorus* extracts from either the leaf or stem bark. The *in vitro* acaricidal activity of *F. sycomorus* extracts was tested using 2 ml of each *F. sycomorus* extract at 0.125, 0.25, 0.5, and 1 mg/ml concentrations in each experimental Petri dish containing ten *Sarcoptesscabiei (S. scabiei)* mites/dish. Negative control mites were given distilled water, whereas positive control mites were given selamectin. The stereomicroscopic examination was then performed 30 minutes after incubation and was repeated hourly until 7 hours after incubation. The mortality rate, median lethal time (LT_{50}), and lethal concentration (LC_{50} and LC_{99}) were calculated. Also, for *in vivo* acaricidal activity of the same extracts were done using fifty intact New Zealand white male rabbits allocated to five experimental groups (n = 10). The first experimental group kept without infection as the negative control

group. Whereas, the rabbits in other groups were inoculated with 50*S. scabiei* mites previously isolated on the skin of the tip of the left ear auricle. After the infection confirmation, the second group was treated topically with distilled water and kept as the positive control group. Also, the third group was treated with selamectin at a dose rate of 12 mg/kg BW on days 0, and 14th during treatment and served as a drug-treated group. While the fourth and the fifth groups were subjected to 9 drops (0.6 ml) of 100 mg/ml daily of either *F. sycomorus* leaf or stem bark extracts topically on the fur mite lesions every other day up to day 21. The results of the study revealed a promising *in vitro*acaricidal activity of *F. sycomorus* leaf and bark extracts on *S. scabiei* mites and this effect was time and dose-dependent. LC_{50} and LC_{99} of *S. scabiei* at 4 hours after *F. sycomorus* leaf extract treatment were 0.149 and 1.373 g/ml, while for the bark extract were 0.124 and 1.074. This effect was confirmed in the *in vivo* trials as either leaf or stem bark extracts of *F. sycomorus* showed an effective acaricidal activity against *S. scabiei* mites.

Keywords: Acaricidal effects, *Ficus sycomorus*, Rabbits, *Sarcoptesscabiei* and Selamectin.

INTRODUCTION

Sarcoptes scabiei (*S. scabiei*) (Acari: Sarcoptidae) is a common ectoparasite caused by *S. scabiei* mites. This mite burrows in skin tissues to form tunnels, causing scabies in humans and mange in animals. The disease affects a wide range of mammals, including wild and domesticated canines and felines, wild pigs, ruminants, wombats, koalas, great apes, lab animals, and rabbits (Pence and Ueckermann 2002; Suckow et al., 2002). *Sarcoptes* belong to the scab mite family and contain only one species, *S. scabiei*. This species' identification is dependent on the host species, for example, *S. scabiei var. hominius* in humans and *S. scabiei var. cuniculi* in rabbits. *S. scabiei* mites have a two-month life cycle on the host skin (Suckow et al. 2002). Mites feed on lymph and skin-sloughed epithelial cells (Hofing and Kraus 1994). Rabbit mange has widespread because wild animals, particularly dogs, can transmit the disease to other dogs and rabbits (Arlian et al. 1984). *S. scabiei* infection in rabbits causes body weight loss, decreased productivity, and poor wool fiber quality (Harrenstien et al., 1995). In addition, affected rabbits may develop dermatitis, pyoderma, eczema, and urticarial affections (Khan et al., 2012).

Permethrin and ivermectin among other acaricides were used to control *S. scabiei* infections in animals (Goldust et al. 2012, 2013; Shang et al. 2013). Many restrictions may affect the treatment strategy for *S. scabiei* infection, such as drug resistance caused by the repeated use of the same drug with the same mode of action on the same infected animals (Khan et al., 2012).Drug resistances may arise if these chemical acaricides weren't used properly. Many reports indicated that drug-resistant mites may arise from acaricide treatment failure (Currie et al. 2004; Mounsey et al. 2008; Khan et al., 2012). Moreover, the chemical acaricides may cause toxicity, and environmental impurity as most of them are considered environmental pollutants (Halley et al. 1993; O'Brien 1999). Therefore, there is an urgent need to develop alternative strategies for the treatment of *S. scabiei* infections. Botanical acaricides are much promising alternatives to treat *S. scabiei* infection in rabbits as these compounds have several advantages over the chemical ones. These acaricides decompose quickly in nature, do not develop drug resistance, and

are safe for humans and animals (Mulla and Su 1999; Samish and Rehacek 1999; Panella et al. 2005). Many botanical acaricides are promising compounds for mite control. Tea tree oil (Melaleuca alternifolia) has been shown to have excellent acaricidal properties, killing 80 percent of exposed *Sarcoptes* mites in 1 hour in vitro (Walton et al. 2004). E. adenophorum also demonstrated effective acaricidal activity against *S. scabiei* and *P. cuniculi* (Nong et al. 2012).

Ficus sycomorus (*F. sycomorus)*is one of the important Egyptian plants containing numerous bioactive alkaloids, tannins, flavonoids, and phenolic compounds (Sandabe et al., 2006; Zaku et al., 2009; Al-Matani et al., 2015; Dawod et al., 2021). These bioactive compounds are found in fruits, leaves, and bark. This fact encourages many researchers to investigate these valuable chemicals in this plant species (Sandabe et al., 2006; Hassan et al., 2007; Konai et al., 2017; El-Beltagi et al., 2018). *F. sycomorus* fruits are commonly used to treat jaundice, fungal infections, and dysentery (Hassan et al., 2007). In humans, it is also used to treat cough, liver disease, stomach disorders, diarrhea, skin infection, epilepsy, tuberculosis, lactation disorders, helminthiasis, infertility, and sterility (Sandabe et al., 2006). Furthermore, stem bark milky latex is used topically to treat common fungal infection (Al-Matani et al., 2015), ulcers, burns, inflammation, warts, wound infection prevention, and wound healing (El-Sayyad et al., 2015). *F. sycomorus* plant extracts have a strong antifungal effect against camel dermatophytes (Zakaria et al., 2018). This antiparasitic property may be useful in the treatment of *S. scabiei* infection in rabbits. The current study aimed to investigate the potential in vivo acaricidal effect of *F. sycomorus* leaf or bark methanolic extracts against *S. scabiei* mites. Therefore, the in vivo acaricidal activity of such compounds on experimentally infected rabbits with *S. scabiei* mites was evaluated.

MATERIAL AND METHOD

Ethical approval:

The Institutional Animal Care and Use Committee (IACUC), Faculty of Veterinary Medicine, University of Sadat City, Egypt, oversaw all experimental procedures for this study (Ethical approval number: VUSC-017-1-19).

Collection of mites:

S. Scabiei mites (*Cheyletiellaparasitivorax*) were collected in July 2021 from naturally infected rabbits at commercial rabbit farms in Sadat City, Menoufia Province, Egypt. According to (Walton and Currie, 2007), live adult mites were collected from rabbits with no history of acaricide use. Scabs were isolated from the infected rabbits' ears and transported to the laboratory within 30 minutes. *S. Scabiei* mites were incubated at 35 ^{o}C for 30 minutes before being morphologically identified under a light microscope (Arlian, 1989).

Plant material and extraction:

F. sycomorus leaf and bark samples were collected from Quesna, Menoufia Province, Egypt in June 2021. The plant samples were air dried and then grounded to obtain their powders. Then the powdered samples were subjected to methanol extraction to obtain methanolic extract (Dawod et al., 2021). Finally, either leaf or bark extracts of *F. sycomorus* were diluted with distilled water to obtain 0.125, 0.25, 0.5, and 1 g/ml concentrations.

In vitroacaricidal properties of F. sycomorus leaf and bark extracts:

The *in vitro*acaricidal activity of either leaf or bark extracts of *F. sycomorus* was done according to (Fichi et al., 2007 a, b and Du et al., 2008). Briefly, ten experimental groups were prepared, as one group for each concentration. In each experimental group ten *S. Scabiei* mites were situated in each of several Petri dishes (10 cm in diameter and 2

cm deep) along with filter paper chips. Then 2 ml from each *F. sycomorus* extract concentration was added to experimental Petri dishes. In the negative control group, the mites were treated with distilled water with glycerin, while the positive control group, the mites were treated with selamectin (Revaluation, Zoets, USA). The treatment groups were incubated at 25ºC with 75% relative humidity and then subjected to stereomicroscopic examination beginning from 30 minutes post incubation and repeated hourly till 7 hours post incubation. Dead mites were identified as a lack of response to the needle stimulation (Macchioni et al., 2004). Then the mortality percentage, median lethal time (LT_{50}), and lethal concentration (LC_{50} and LC_{99}) were estimated according to (Govindarajan 2010).

***In vivo*acaricidal properties of *F. sycomorus* leaf and bark extracts:**

For evaluation of the *in vivo*acaricidal properties of *F. sycomorus* extracts, fifty intact New Zealand White male Rabbits of one month old were randomly assigned into five experimental groups (n = 10). Rabbits are individually housed indoors in galvanized pens with slotted floors and a self-serve water spout. Animals were fed once a day with a commercial diet of 18% crude protein. An adjustment period of 3 weeks allowed rabbits to be dewormed and accommodated to pen living, routine feeding, and diet change before study initiation. During the adjustment, period animals were dewormed with Ivermectin (1 ml/50 kg BW). By the end of the adjustment period, ear skin samples were taken and examined under a light microscope to confirm the clear status of the ear skin.Then the first experimental group was not inoculated with any infected mites and was kept in a separate room as a negative control group (control –ve). Whereas, the rabbits in other groups were inoculated with 50 *S. Scabiei* mites previously isolated on the skin of the tip of the left ear auricle. The animals were examined daily till *S. Scabiei* mite lesions appeared clearly on the ear skin. A microscopic examination was done to confirm the mite infection via the presence of live *S. Scabiei* mites in scabs of the ear lesion. After the infection confirmation, the second group was treated topically with distilled water and kept as the positive control group (control +ve). Also, the third group was treated with selamectin (Revaluation, Zoets, USA) at a dose rate of 12 mg/kg BW (McTier et al., 2003) on days 0, and 14th during treatment and served as a drug-treated group. While the fourth and the fifth groups were subjected to 9 drops (0.6 ml) of 100 mg/ml daily of either *F. sycomorus* leaf or stem bark extracts topically on the fur mite lesions every other day up to day 21. The efficacy of the treatment compounds was established in the reduction of the sarcoptic mange lesions with no viable mites on microscopic inspection.

Clinical examination and scoring of skin lesions:

The rabbits were inspected for the presence of the clinical signs or pathological lesions for mite infection before and after inoculation of the mite infection. The appearance of mite lesion over the left ear skin including erythema, crusts, ear scabs, dandruff, exudation, and alopecia indicates the infection. Moreover, the presence of live mites during stereomicroscopic examination for the ear skin scabs confirmed the infection. During the experimentation periodical, the microscopic examination policy was followed once every 3 days intervals until day 21 post-treatment. The last microscopic examinations were done on the 7th day post the previous treatment (day 28 after the treatment conduction). The scoring of the skin lesion was done according to table 1.

Table (1): Different scores of *S. scabiei*mites on rabbit fur:

Score	0	1	2	3	4
Fur mite score discerption	No lesion	Minimal level lesion over ear auricle skin	Moderate level lesion over ear auricle skin	Severe lesion over ear auricle and mild lesion leg skin	Severe lesion over ear auricle, claw, and nasal skin
Image					

Figure (1): Symptoms of severe *S. scabiei*infection over rabbit fur.

Parasitological Examination:

Before the starting of the*S. Scabiei* infection in the study deep and superficial skin scraps were examined from each rabbit to confirm the clear status. Thereafter, initiation of the infection and confirming the ear skin lesions samples were withdrawn to confirm infection. Then samples were taken on the 1st, 7th, 14th, 21st, and 28th days throughout the treatment period to estimate the response to the different treatments. The skin samples were soaked with normal saline then the debris was removed before microscopic examination. The identification of the dead mites was done according to (Macchioni et al. 2004).

Measurements and sampling:

Body weight and gain were estimated just before and after and Blood samples were taken from the marginal ear vein 21 days after the initiation of treatments. Each sample was divided into two portion the first

was centrifuged at 3000 rpm to take the serum while the second portion was treated with EDTA to estimate WBCs, lymphocytes, RBCs, and hemoglobin using automated hematology analyzers. Serum samples were stored at – 20° C till the further investigation was done.

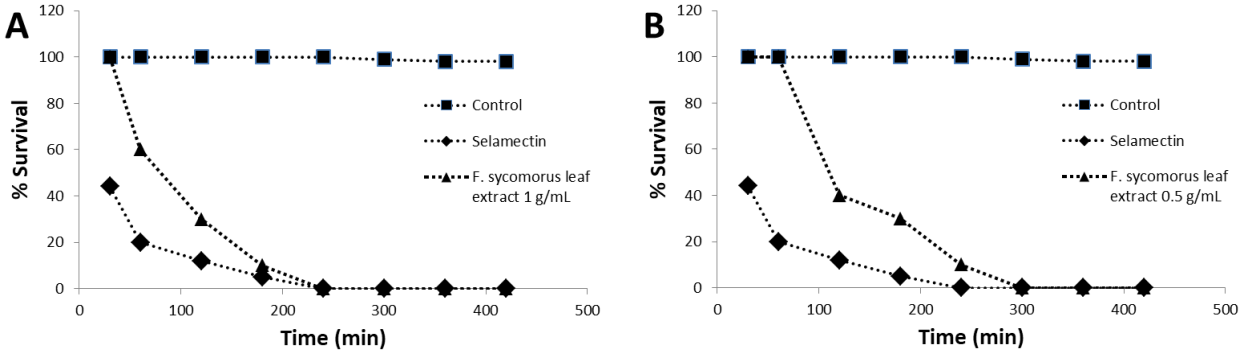
Statistical analysis:

After the conduction of the trials, the data were collected and enrolled into a statistical analysis using SPSS software version 23. Data of haemogram and percentage were logarithmically and arcsine transformed to obtain normally distributed data. One-way ANOVA with Duncan mean separation test was used to analyze mite survivability percentage, rabbit body weight, haemogram, and serum proteins. Moreover, periodical fur mite lesion scores were analyzed using Kruskal–Wallis one-way analysis of variance with Dunn–Bonferroni test for pairwise comparisons as post hoc to detect the significant differences across different treatments. Furthermore, probit regression analyses were conducted to evaluate the median lethal time (LT_{50}) and lethal concentration (LC_{50} and LC_{99}) of either leaf or stem bark extract of *F. sycomorus* on*S. scabiei*mites according to Finney (1971) and Govindarajan (2010). The level of significance was kept at ($P<0.05$).

RESULT

Effects of selamectin, Ficus sycomorus stem, and bark extracts on in vitro Sarcoptes scabiei mite survivability:

The current work evident the *in vitro*acaricidal effects of either *F. sycomorus* leaf or bark methanolic extract against *S. scabiei*. These effects mainly depend on the concentration of such extracts compared with positive and negative control groups (Figs. 3, and 4). The positive control groups (selamectin treated) showed an efficient acaricidal effect against *S. scabiei* compared with the positive control group ($P<0.01$). The *in vitro* highest toxic acaricidal activity of *F. sycomorus* leaf and bark extracts against *S. scabiei*was reported at a concentration of 1 g/ml. Moreover, the lowest survivability percentages of *S. scabiei* mites were recorded at the dose of 1, 0.5, 0.25, and 0.125 g/ml *F. sycomorus* leaf extract at 4, 5, 7, and 7 hours after treatment initiation, respectively. While the lowest survivability percent was obtained at the concentration of 1, 0.5, 0.25, and 0.125 g/ml *F. sycomorus* stem bark extract at 4, 5, 6, and 7 hours post-treatment. Also, the results showed the death of all *S. scabiei*tested mites during the first 5 hours post-treatment of either leaf or bark extract at the dose of 1 and 0.5 g/ml.



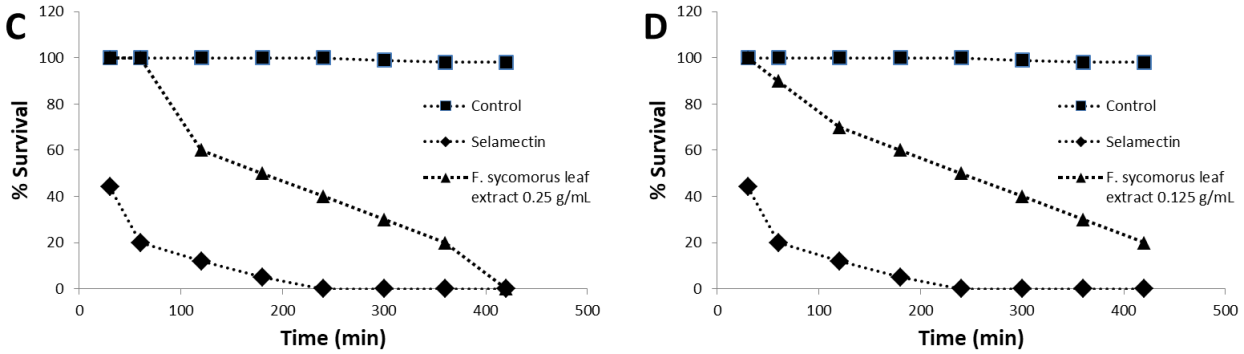


Figure (3): Survival curves of *S. scabiei*after *in vitro* exposure to *F. sycomorus* leaf extract:A) *F. sycomorus* leaf extract with a dose of 1 g/ml B) *F. sycomorus* leaf extract with a dose of 0.5 g/ml, C) *F. sycomorus* leaf extract with a dose of 0.25 g/ml, D) *F. sycomorus* leaf extract with a dose of 0.125 g/ml. Curves compared the acaricide effect of *F. sycomorus* leaf extract with the positive control (selamectin) and an unchallenged and untreated negative control (distilled water + glycerin).

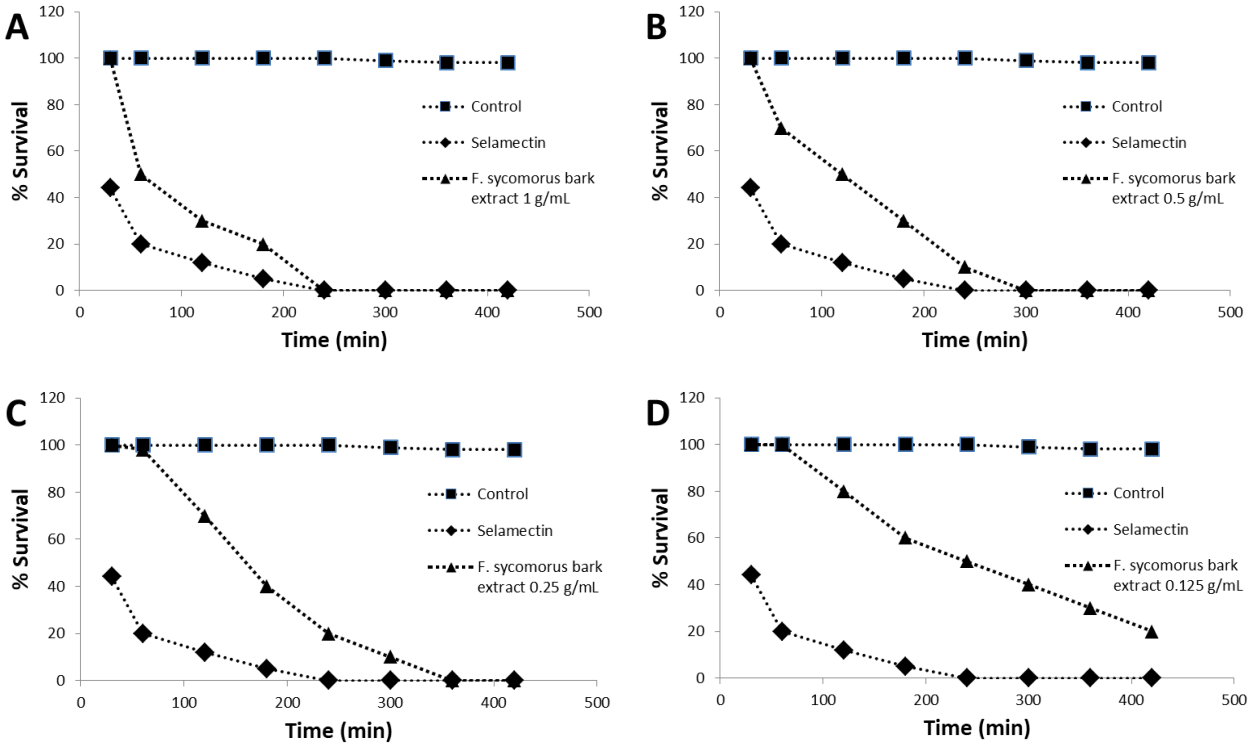


Figure (4): Survival curves of *S. scabiei*after*in vitro* exposure to *F. sycomorus* bark extract:A*) F. sycomorus* bark extract with a dose of 1 g/ml, B) *F. sycomorus* bark extract with a dose of 0.5 g/ml, C) *F. sycomorus* bark extract with a dose of 0.25 g/ml, D) *F. sycomorus* bark extract with a dose of 0.125 g/ml. Curves compared the acaricide effect of *F. sycomorus* bark extract with the positive control (selamectin) and an unchallenged and untreated negative control (distilled water + glycerin).

In vitro toxicity of Ficus sycomorus stem and bark extracts on Sarcoptes scabiei mite:

Concerning the *in vitro* toxicity of the *F. sycomorus* leaf and bark extracts on *S. scabiei* mites (Tables 2 and 3), it was clear that the values of LC50 and LC99 of *S. scabiei* at 4 hours after *F. sycomorus* leaf extract treatment were 0.149 and 1.373 g/ml, while there were 0.124 and 1.074 for the bark extract. Moreover, the LT50 values for doses of 1, 0.5, 0.25, and 0.125 g/ml of *F. sycomorus* leaf extract were 1.348, 2.129, 3.045, and 3.658 hours, whereas these values were 1.318, 1.899, 1.869, and 3.957 for the *F. sycomorus* stem bark extract, respectively. The results suggested a significant decrease in the survivability of *S. scabiei* mites with the increase in dose and time of treatments by either *F. sycomorus* leaf or bark extract. Equally, these results ensure the acaricidal activity of such extracts is time and dose-dependent.

Table (2): *In vitro* toxicity of *F. sycomorus* leaf and bark extracts on *S. scabiei*mites at 4 h post-treatment (LC_{50} and LC_{99}, with 95 % fiducial limits in parentheses):

F. sycomorus extract	Regression line	LC_{50} (g/ml)	LC_{99} (g/ml)	Pearson Chi-square	P-value
Leaf extract	y = 1.994 + 2.411x	0.149 (0.49-0.235)	1.373 (0.616-108.323)	0.997	0.704
Bark extract	y = 2.250 + 2.482x	0.124 (0.015–0.200)	1.074 (0.502-185.129)	0.341	0.843

LC_{50}: lethal concentration 50; LC_{99}: lethal concentration 99; g/ml: gram per milliliter. (probit regression analysis).

Table (3): *In vitro* toxicity of *F. sycomorus* leaf and bark extracts on *S. scabiei*mites (LT_{50}, with 95 % fiducial limits in parentheses):

F. sycomorus extract	Concentration (g/ml)	Regression line	LT_{50} (h)	Pearson Chi-square	P-value
Leaf extract	1	y = -0.565+ 4.356x	1.348 (0.972-1.729)	1.747	0.941
	0.5	y = -1.836 +5.595x	2.129 (1.721-2.719)	2.490	0.870
	0.25	y = -1.744 + 3.605x	3.045 (2.290-3.797)	3.450	0.751
	0.125	y = -1.411+ 2.505x	3.658 (2.672–5.126)	0.523	0.998

Bark extract	1	y = -0.452+3.771x	1.318 (0.920–1.714)	4.252	0.643
	0.5	y = -0.931 +3.794x	1.899 (1.276–2.239)	3.136	0.792
	0.25	y = -2.356 + 5.534x	1.869 (1.323–2.409)	0.917	0.989
	0.125	y = -1.971+ 3.299x	3.957 (3.049–5.144)	0.565	0.997

LT_{50}: lethal time 50; h: hour.(probit regression analysis).

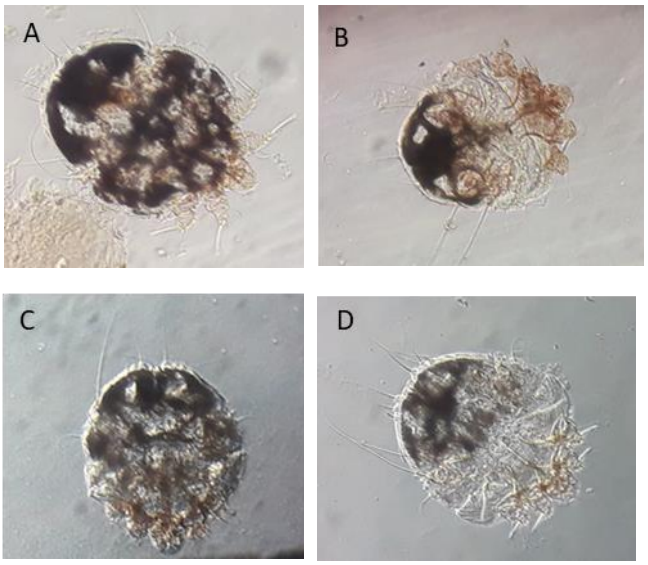


Figure (5): *S. scabiei* mite after*in vitro* exposure to selamectin or *F. sycomorus* extracts: **A)** an unchallenged and untreated negative control (distilled water + glycerin), **B)** positive control (selamectin), **C)** *F. sycomorus* leaf extract with a dose of 1 g/ml, **D)** *F. sycomorus* bark extract with a dose of 1 g/ml.

Effect of selamectin, Ficus sycomorus leaf, and bark extracts on infection lesion score of in vivoSarcoptesscabieiinfected Rabbits:

During the first day after treatment, all challenged groups had higher lesion score values compared with the negative control group (chi-square x^2 = 13.30, P<0.01). The same trend appeared during the 7th and 14th days after treatments. In contrast, during the 21 days post-treatment, the positive control group sustain the highest lesion score (3.80±0.20) than selamectin (0.86±0.40), and unchallenged negative control groups (0.00±0.00). Moreover, the *F. sycomorus* leaf (2.56±0.34), and bark (3.25±0.25) treated groups were not significantly differed from the selamectin and positive control group (chi-square x^2 = 22.45, P<0.01). During the 28th day post-treatment, the lesion score values were decreased in the negative control (0.00±0.00), selamectin (0.86±0.40), and *F. sycomorus* leaf extract groups (2.11±0.42) compared with the

positive control group (3.80±0.20) (chi-square $x^2 = 19.99$, P<0.01).

Table (4): Effect of selamectin, *F. sycomorus* leaf, and bark extracts on lesion scores of *S. scabiei*infected Rabbits:

Group	Lesion score				
	Day 1	Day 7	Day 14	Day 21	Day 28
Control –ve	0.00±0.00 b	0.00±0.00 b	0.00±0.00 b	0.00±0.00 b	0.00±0.00 b
Control +ve	3.20±0.20 a	3.40±0.25 a	3.80±0.20 a	3.80±0.20 a	3.80±0.20 a
Selamectin, 6 mg/kg	3.14±0.34 a	2.86±0.51 a	2.29±0.47 ab	1.14±0.34 b	0.86±0.40 b
Leaf extract, 100mg/ml	3.00±0.33 a	2.78±0.40 a	2.56±0.34 ab	2.56±0.34 ab	2.11±0.42 b
Bark extract, 100mg/ml	3.25±0.48 a	3.00±0.41 ab	3.75±0.25 a	3.25±0.25 ab	3.00±0.41 a
Chi-square	13.30	13.53	19.87	22.45	19.99
P-value	0.01	0.01	0.01	0.01	0.01

0, 1, 2, 3, and 4 scores denoted absence, minimal, mild, moderate, and severe lesions, respectively. Values are presented as mean ± SE. [a-d] Means within the same column with different superscripts are statistically different at $P < 0.05$ (Kruskal–Wallis one-way analysis of variance with Dunn–Bonferroni post- hoc test).

Effect of* selamectin, *Ficussycomorus leaf, and bark extracts on body weight and hemogram of in vivo Sarcoptesscabieiinfected Rabbits:

The positive control group sustained the lowest live body weight (1344.00±50.85 gm) compared with the unchallenged negative control group (1717.60±97.76 gm), while the selamectin group recorded the highest body weight gain (1772.29±53.21 gm) and was not significantly differed from the negative control group. Furthermore, both leaf and bark extract groups were not significantly differed from the positive control group (P<0.00). Linearly, either bark extract and the control negative group sustained higher RBCs (6.33±0.01; 6.33±0.01 $x10^6$/ml) compared with the positive control (5.44±0.01 $x10^6$/ml), selamectin (5.74±0.02 $x10^6$/ml) and *F. sycomorus* leaf extract groups (5.52±0.00 $x10^6$/ml), as the later groups were not significantly differed from each other. The same trend appeared in the hemoglobin and PCV% results.

The challenged groups recorded high WBCs, lymphocytes, monocytes, and granulocytes values compared with the unchallenged negative control group (P<0.01). in contrast, the thrombocytes

decreased significantly in the positive control group (78.67±5.07 $x10^3$/ml) compared with the negative control (116.00±8.50 $x10^3$/ml) and *F. sycomorus* bark extract groups (116.67±7.36 $x10^3$/ml) (P<0.01).

Table (5): Effect of selamectin, *F. sycomorus* leaf, and bark extracts on body weight and hemogram of *S. scabiei*infected Rabbit:

Group	**Control –ve**	**Control +ve**	**Selamectin** 6 **mg/kg**	**Leaf extract 100 mg/ml**	**Bark extract 100 mg/ml**	**P-value**
Body weight (gm)	1717.60±97.76^a	1344.00±50.85^b	1772.29±53.21^a	1476.40±110.68^b	1402.50±53.39^b	0.00
RBCs ($x10^6$/ml)	6.33±0.01 ^{a}	5.44±0.01^b	5.74±0.02^b	5.52±0.00^b	6.33±0.01 ^{a}	0.00
WBCs ($x10^3$/ml)	4.50±0.16^b	11.33±0.05^a	13.48±0.03^a	11.00±0.00^a	13.52±0.02^a	0.00
Lymphocytes ($x10^3$/ml)	2.74±0.14^b	5.59±0.02^a	6.65±0.01^a	4.25±0.07^{ab}	6.37±0.02^a	0.00
Monocytes ($x10^3$/ml)	0.38±0.15^b	1.25±0.08 ^{a}	1.11±0.04 ^{a}	0.72±0.03 ^{a}	1.28±0.03 ^{a}	0.00
Granulocytes ($x10^3$/ml)	1.09±0.26^b	4.24±0.08 ^{a}	5.42±0.07 ^{a}	3.26±0.07 ^{a}	5.73±0.04 ^{a}	0.00
Total protein (g/dl)	7.00±0.67	7.16±0.01	6.85±0.07	6.80±0.20	6.72±0.11	0.87
Albumin (g/dl)	3.48±0.17^a	3.30±0.03^{ab}	3.44±0.09^a	3.16±0.02^{ab}	3.06±0.16^b	0.05
Globulin (g/dl)	3.52±0.57	3.86±0.02	3.40±0.07	3.64±0.22	3.66±0.14	0.83
Hemoglobin (g/dl)	12.43±0.17^a	11.03±0.24^b	11.37±0.51^b	11.57±0.13^b	11.70±0.15^a	0.01
PCV (%)	34.20±0.45^a	29.57±0.61^b	31.23±1.40^b	31.43±0.34^b	31.63±0.66^b	0.01
MCV (fl)	55.15±0.71^b	54.23±0.29^b	54.07±0.97^b	56.93±0.36^a	49.87±0.29^c	0.00
MCH(pg)	19.60±0.33^b	20.27±0.06^b	19.70±0.40^b	20.97±0.15^a	18.50±0.06^c	0.00
MCHC (%)	36.27±0.12^b	37.33±0.12^a	36.40±0.10^b	36.83±0.09^{ab}	37.03±0.32^a	0.00
Thrombocytes ($x10^3$/ml)	116.00±8.50^a	78.67±5.07^b	97.33±10.08^{ab}	95.67±5.13^{ab}	116.67±7.36^a	0.01

Values are presented as mean ± SE. $^{a-d}$ Means within the same raw with different superscripts are statistically different at P < 0.05 (one-way ANOVA, Duncan's post- hoc test).

DISCUSSION

Rabbit scabies is a serious health risk that affects rabbit skin. *S. scabiei* mites are the cause of this contagious infestation. These mites can burrow into the skin and create tunnels, causing severe skin exudation while feeding on the skin epithelial tissues (McCarthy et al., 2004). Mange is a parasitic

skin disease that can affect a variety of hosts, including wild animals, domestic animals, and humans (Walton et al., 2004; Xu et al., 2018). Mites of *S. scabiei* are dangerous parasite that affects rabbits. The use of various acaricides may result in the development of acaricide resistance over time. Botanical acaricides are promising plant compounds that could replace chemical drugs in the treatment of such dangerous parasites.

F. sycomorus is one of the important trees, as their plant extracts exhibit antibacterial, antifungal, and antiprotozoal activities. Accordingly, the current study was conducted to examine the acaricidal effect of either stem and leaf extracts of *F. sycomorus* on *S. scabiei* infection in rabbits.The findings suggested an *in vitro* and *in vivo*acaricidal effect of *F. sycomorus* leaf and stem extracts to *S. scabiei*mites and these effects were dose and time-dependent. These outcomes could be due to the rich tannin content of these extracts (Konai et al., 2017).Min and Hart (2003) reported the direct and indirect effects of plant condensed tannins on gastrointestinal nematodes in sheep and goats. Also, the acaricidal nature of the *F. sycomorus* leaf and stem bark extracts could be attributed to the existence of the ficin enzyme in these extracts. Ficin is a proteolytic enzyme extracted from fig tree latex (Haesaerts et al., 2015). This enzyme is a vital proteolytic fraction of Moraceae family latex that had effective anthelmintic activity (de Amorin et al., 1999). Also, ficin could destroy staphylococcal biofilm due to its potential antimicrobial nature (Baidamshina et al., 2016).

The acaricidal effect of the *F. sycomorus* may be enhanced via its antioxidant nature (Foyet et al., 2017). Singh et al. (2011)mang skin infection in animals may disrupt the oxidant/antioxidant balance via the infecting mites and some oxidative constituents which could be generated by the animal bodies. Furthermore, oxidative stress, immune status, and nutrition could be playing significant roles in the pathogenesis of *S. scabiei* infection. Also, the oxidative stress created from the overloaded free radicals inside the animal body could change the cellular functions and induce some skin adverse effects such as edema, erythema, wrinkling, inflammation, and autoimmune reaction (Muthukumaran et al., 2008).

Selamectin is a semisynthetic avermectin synthesized via *Streptomyces avermitilis*. It was successfully used for topical treatment of mite infestation in rabbits (McTieret al., 2003). In rabbits selamectin was rapidly absorbed throughout the skin as well it rapidly eliminated from the body. Linearly, selamectin is used topically to treat flea infestation in rabbits (Carpenter et al., 2012). The current study findings confirm the effective role of selamectin in treating *S. scabiei* mite infections in rabbits. The results match those of (Kurtdede et al., 2007; Mellgren and Bergvall, 2008). Kurtdede et al. (2007) evident that selamectin was effective against P. cuniculi and *S. scabiei* infections in rabbits. Moreover, Six et al. (2000) and reported the efficient and safe effect of selamectin on ear mites infected dogs and cats. Besides it efficiently treats sarcoptic mange of dogs and cats with wide breed and age varieties. The same results were confirmed in dogs (Shanks et al., 2000). Also, Elhawary et al. (2017) reported a significant effect of selamectin in the treatment of rabbit ear mites (*Psoroptescuniculi*).

The increase of the live body weight in the challenged rabbits treated with selamectin than other challenged groups could be due to low inflammatory action and rapid healing of the skin lesion in this group. Also, selamectin has powerful anthelmintic activity against internal helminth parasites in rabbits. Linearly, McTier et al. (2003)

reported no adverse effects of selamectin on treated rabbits.

The low live body weight and thrombocytes in the positive control group could be due to high inflammatory response and depression in the rabbits of this group. Harrenstien et al. (1995) reported a significant body weight loss, depressed performance, and low wool quality in *S. scabiei* infected rabbits.

The finding evidenced a high level of WBCs, lymphocytes, monocytes, and granulocytes in *S. scabiei* challenged groups. This could be due to high inflammatory responses in the challenged rabbits compared with the unchallenged negative control group. In contrast, Allaam et al. (2014) reported a significant decrease in WBCs, lymphocytes, and eosinophil counts in *S. scabiei* severely infested buffalo.

CONCLUSION

The methanolic extracts of either leaf or stem bark of *F. sycomorus* had an efficient acaricidal effect on *S. scabiei* mites in experimentally infected rabbits. Further studies are needed for the identification and concentration of the active principles of the extracts to use in clinical trials.

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