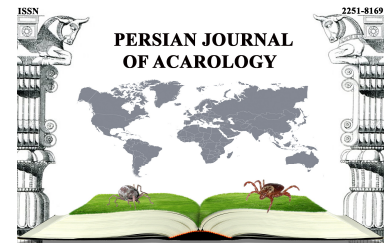




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## Article

# Pesticide effects of *Consolida orientalis* extract on larval stage of *Argas persicus* (Acari: Argasidae)

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### ABSTRACT

The extract of some plants has acaricidal properties that can be used for controlling arthropods. This study reports the effects of *Consolida orientalis* (Ranunculaceae) extract on the larval stage of *Argas persicus* (Acari: Argasidae). In order to determine the efficacy of the extract on the larval stages and mortality of ticks, the dipping method was used. To determine the lethal concentration, three suspensions 1%, 10% and 100% from this extract and distilled water as a control group were used. This extract showed pesticide effects in comparison with the control group on the larval stage of tick ( $p < 0.05\%$ ). It showed 100% mortality with minimum concentration for larvae. According to the results and the abundance of this plant, it is suggested that more work must be done on the effect of the *C. orientalis* extract on the different life stages of hard and soft ticks.

**KEY WORDS:** Acaricide; Ixodida; oriental knight's-spur; Ranunculaceae; soft ticks.

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## INTRODUCTION

Arthropods are important because of their roles as vectors of bacteria, viruses and other pathogenic germs (Hendrix 1998). *Argas persicus* (Oken) has a worldwide distribution especially in warm climates (Leeflang and Ilemobade 1977; Yu *et al.* 2015). Apart from causing anemia, anorexia, weight loss, and depressed egg output, *Argas persicus* is the vector of fowl pathogens (Qamar *et al.* 2009). The larval stage of *A. persicus* can cause chicken paralysis (Wall and Shearer 1997). It is thought that chemical control by acaricides is the best control method, but the appearance of pesticide resistant (Shyma *et al.* 2015), environmental damage and toxicity of chemical residues to humans are drawbacks to this strategy (Graf *et al.* 2004). Therefore, better substitutes for existing chemical pesticides seem necessary. The active compounds of plants with pesticide properties are a promising way to control ticks and other arthropods. The main benefits of plant pesticides are being non-threatening to human health, low toxicity to animals, rapid decomposition in the environment and slow resistance against them in the ticks (Abdus Zahir *et al.* 2009). Extracts and essential oils have shown significant acaricidal activity against various stages of tick species (Ravindran *et al.* 2012; Ghosh *et al.* 2013; Singh *et al.* 2014; 2015; Godara *et al.* 2014). *Consolida* is a genus of about 40 species of annual flowering plants in the family Ranunculaceae, native to Western Europe,

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the Mediterranean and Asia. Toxic substances of oriental knight's-spur, *C. orientalis* (J. Gay) are diterpenoid alkaloids. In 1960, great progression was made in determining the structure of diterpenoid alkaloids, which are 11 alkaloids derived from the plant *Consolida*. These alkaloids can affect the neuromuscular junction (Olsen and Manners 1989).

The aim of this study was to evaluate the effect of different concentrations of *Consolida orientalis* extract on the larval stage of *Argas persicus*. In order to obtain the nymph stage, experimental contamination should be performed. This step was not performed in the present study.

## MATERIALS AND METHODS

*Consolida orientalis* extract was prepared by Barij Essence® Inc. (Kashan, Iran). The *A. persicus* ticks are active during the night. They spend the daytime hidden in cracks and crevices of the walls of chicken houses or wooden materials such as windows or doors of poultry-roosting areas. Therefore, these places were examined for the presence of ticks in some villages of Kermanshah and Salmas counties of Iran and after collecting, ticks were transferred into the parasitology laboratory, Faculty of Veterinary Medicine, Urmia University, where their species and sex were determined using morphological characteristics (Hosseini-Chegeni and Tavakoli 2013). After identifying the genus and species of ticks, they were kept at room temperature and 80% relative humidity inside the desiccator for a month. During this time, female ticks laid eggs and eggs were kept in another Petri dish inside the desiccator at room temperature and 80% relative humidity to hatch eggs. *Consolida* extract concentrations of 1%, 10% and 100% were diluted with distilled water. Five ml of each dilution was poured into Petri dishes and 15 larval stages of ticks were immersed in each dilution for 5 seconds. This operation was repeated three times for each dilution of extracts. Five ticks with distilled water were used as control samples. Ticks collected from different concentrations of extracts were transferred into separate Petri dishes containing a filter paper and they were incubated in a desiccator. To evaluate the pesticide effect of the extracts on the larval stage of ticks, samples were reviewed daily for five days, and the number of dead ticks was recorded. The immobility of ticks was considered tick death (Tavassoli *et al.* 2009). Then, the results were analyzed using SPSS version 17 and the general linear model test and to evaluate LC50 of *Consolida*, SPSS software and Probit analysis was used.

## RESULTS

The results indicated that extracts of the plant had an effect on the larval stage of *A. persicus*. Based on statistical analysis, there is a significant difference between the mortality caused by the *C. orientalis* extract on different days and at different concentrations compared with the control group of tick larvae ( $p < 0.05$ ). The results show there is a significant difference between the mortality rate caused by the extract on day 1 in comparison with other days and day 2 in comparison with other days ( $p < 0.05$ , Table 1). The result of evaluation LC50 of *C. orientalis* is shown in Table 2.

**Table 1.** The effect of different concentration of *Consolida orientalis* extract on larval stage of *Argas persicus*.

Extract	Concentration (Mg/MI)	Number of larvae	Percent of dead larvae of <i>A. persicus</i> in different days				
			Day 1	Day 2	Day 3	Day 4	Day 5
<i>Consolida orientalis</i>	1	60	40	65	100	100	100
	10	60	55	100	100	100	100
	100	60	95	100	100	100	100
Control	Distilled water	60	0	0	0	0	0

\* Statistical analysis was performed using SPSS software and a significant difference compared to the control group was considered  $P < 0.05$ .

**Table 2.** LC<sub>50</sub> of *Consolida* extract on larval stage of *Argas persicus* in days of after using this extract.

LC <sub>50</sub> (95% CI*)	Day
<b><i>Consolida orientalis</i> extract</b>	
2.37 (0.6–4.06)	1
0.51 (0.1–006.27)	2
0.18 (0–0.91)	3
0.24 (0–0.90)	4
0.13 (0–0.72)	5

CI: Confidence Interval

## DISCUSSION

There are many studies about tick resistance to synthetic insecticides (Jyoti *et al.* 2014; Tang *et al.* 2014; Ahanger *et al.* 2015). Therefore, appropriate replacements for synthetic insecticides should be considered. In recent years, plant extracts have been used against arthropod pests and insects (Zargari 1992). The results of this study on acaricidal activity and the elimination of ticks is similar to other studies on extracts of *Murraya koenigii* on *Rhipicephalus microplus* (Canestrini) and oil of *Melaleuca alternifolia* (Maiden & Betche) on *Ixodes ricinus* (L.) nymphs (Iori *et al.* 2005; Singh *et al.* 2015). In addition, many studies have been conducted on the effects of medicinal plants on the evolution of ticks. For example, Singh *et al.* (2014) studied the acaricidal activity of *Cymbopogon winterianus*, *Vitex negundo* and *Withania somnifera* against synthetic pyrethroid resistant *Rhipicephalus* species; they found a low percentage of adult mortality in the treated ticks. In another study, the extract of Myrrh from *Commiphora molmol* trees had an effect on the adult tick of *A. persicus*.

Another study that investigated the efficacy of the extract of *Melia azedarach* on the tick *R. microplus* showed that it kills the larval stage and feeding blood females, but it didn't kill the adult females; it also inhibited egg production (Borges *et al.* 2003).

One study performed by Ribeiro *et al.* (2008) showed that the extract of *Calea serrata* was toxic to the eggs of *R. microplus* and to the larvae of both *R. microplus* and *R. sanguineus*. Mehlhorn *et al.* (2005) showed that *Vitex agnus-castus* extract was efficient as a repellent against *I. ricinus* and *R. sanguineus*.

The findings of a study done by Lori *et al.* (2005) indicated that oil of *M. alternifolia* had acaricidal properties and this lethal effect progressed when the dose was increased to 10 ml (> 80%). Another similar study carried out by Godara *et al.* (2014) showed that the *Atropa belladonna* extract had a lethal effect against the larval stage of *R. microplus* in the concentrations of 10% and 20% after 24 hours. In a study by Tavassoli *et al.* (2010), the effect of extract of *Consolida* on the egg and larval stages of *Hyalomma anatolicum* and *Rhipicephalus bursa* was studied. The effects of different concentrations of extracts on the larval stage of mentioned ticks were dose- and time-dependent, which is in agreement with our findings.

According to the results obtained in this study, *Consolida* extract may be used as a strategy for controlling tick resistance to synthetic acaricides. According to the results and the abundance of this plant, it is suggested that more work be done on the effect of the *C. orientalis* extract on the different life stages of hard and soft ticks.

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## بررسی اثر کنه‌کشی عصاره *Consolida orientalis* بر مرحله لاروی (*Argas persicus* (Acari: Argasidae)

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### چکیده

عصاره برخی از گیاهان خاصیت کنه‌کشی دارند که می‌تواند برای مهار بندپایان مورد استفاده قرار گیرد. این مطالعه، تاثیر عصاره *Consolida orientalis* در مرحله لاروی و میزان مرگ و میر کنه *Argas persicus* را گزارش می‌کند. به منظور تعیین اثر عصاره در مرحله لاروی و مرگ و میر کنه‌ها، از روش غوطه‌وری استفاده شد. برای تعیین غلظت کشندگی، سه رقت ۱۰٪، ۱٪، ۰٫۱٪ از این عصاره و آب مقطر به عنوان شاهد استفاده شد. عدم تحرک پس از برگرداندن آنها به سطح پشتی، معیار زنده یا مرده بودن کنه‌ها بود. این عصاره اثر کنه‌کشی را در مقایسه با گروه شاهد نشان داد ( $P < 0/05$ ). کمینه غلظت عصاره مذکور، مرگ و میر ۱۰۰٪ را برای لارو نشان داد. با توجه به نتایج به دست آمده و فراوانی این گیاه پیشنهاد می‌شود تاثیر عصاره *C. orientalis* بر مراحل زندگی کنه‌های سخت و نرم آزمایش شود.

واژگان کلیدی: کنه‌کش؛ Ixodida؛ oriental knight's-spur؛ Ranunculaceae؛ کنه‌های نرم.

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