A study on ingested blood amount and body fluids balance of the fowl tick, *Argas* (*Persicargas*) *persicus* (Acari: Argasidae)

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ABSTRACT

Mean *Argas* (*Persicargas*) *persicus* (Oken 1818) (Acari: Argasidae) unfed and fed females weighted 3.34 and 11.50 mg, respectively. It was more than for males (2.6 and 8.27 mg), respectively. The amount of ingested blood by females (9.31mg.) was larger than males (5.65 mg.). The excreted coxal fluid was also larger in fed females (1.15 ± 0.5) than fed males (0.13 ± 0.01). Gut fluid (G) contained the least of body water. It increased after feeding in females and males (1.110 and 1.008 mg), respectively. Haemolymph fluid (H) increased in females than males after feeding.

Key words: Ticks, blood meal, water balance, *Argas persicus*.

INTRODUCTION

Ticks are economically important ectoparasites found in all parts of the world.They are transmititing a greater variety of pathogens than any other blood-feeding arthropods (Hoogstraal 1985; Estrada-Peña and de la Fuente 2014) . Soft ticks received little attention from researchers despite their impact on the poultry industries. In Egypt, *Argas persicus* (Oken 1818) (Acari: Argasidae) is considered as the major argasids that attack many bird species with economic importance (Hoogstraal 1985; Estrada-Peña et al. 2003). Previous biological studies of *A. persicus* have clearly addressed the developmental durations of this tick species (El-Kammah and Abdel-Wahab 1980; Zahid et al. 2021); unfortunately with no interest in the impact of feeding on either the tick body contents or the amounts of blood intake out from the host's body.

This work was conducted to determin the average ingested blood weights by the poultry ticks, *A. persicus* and to determine the percentages of water contents in gut content, haemolymph, and coxal fluid of the starved and engorged ticks.

MATERIALS AND METHODS

The study specimens of the adult fowl ticks, *A. persicus* were obtained from the laboratory colonies at the faculty of Agriculture, Cairo University. Pigeons were used to rear the study colonies. Newly emerged adults were individually weighed before and after feeding. Coxal fluid was collected and weighed after feeding.

The ingested blood by males and females was determined by weighting the ticks before and after feedings excluding the weight of the excreted coxal fluids.

H_2O% in fluid contents of haemolymph (H.), coxal Fluid (C) and gut fluids (G) of starved and engorged females and males ticks were determined. Small dishes made of inch square pieces of aluminium foil were prepared for collecting fluids on them. Fluids were collected from starved and after feeding specimens by micro capillary tubes (Oleaga et al. 2021).

Gut fluids were collected from dissected out guts, centrifuged (4000 rpm) for 5 mins to obtain cell free gut fluids. Haemolymph was collected in micro capillary tubes through an incision made on the dorsal integument; Coxal fluids were collected from fed adult specimens only.

RESULTS

Females (unfed and fed) weighed more than males (3.34, 11.50, 2.6, 8.27 mg) respectively (Table l). It was also found that the amount of ingested blood by females (9.31mg.) was larger than males (5.65 mg.). The amount of blood that females absorbed leads to laying large amount of eggs. Unfed females could not lay eggs. Mated fed females need amount of blood meal. Males ingested 1⁄2 the amount of blood ingested by females. The excreted coxal fluid was also larger in fed females (1.15±0.50) than fed males (0.13± 0.01).

To assess the moisture requirements necessary for survival, water balance characteristics were determined for each developmental stage, form egg to adult.

The amount of water in the gut, haemolymph and coxal fluid of *A. persicus* are listed in Table (2).

Gut fluid (G) contained the least of body water. It increased after feeding in females and males (1.110-1.008), respectively. Haemolymph fluid (H) increased in females than males after feeding. Coxal fluid was secreted only after feeding. It contained higher water than in the gut and close to that of the haemolymph fluids in females. It increased significantly ($P>0.05$) than gut fluids while no significance ($P<0.05$) than haemolymph fluids.

DISCUSSION

In the present study, measurements of the blood meals ingested by *A. persicus* adults were in relation with the body weights (Table 1). Blood meals uptaken from the hosts are apparently need time before initiating the digestion (Sonenshine 1991), and this may explain the considerable differences of weights pre- and post-engorgement in both tick sexes. Obviously, female ticks either of hard or soft ticks are gaining outstanding blood meals compared to males (Table 1). In consideration to the blood as a rich source of major nutrients that helps ticks to live, it also plays a vital role in spermatogenesis in males and oogenesis in females (Sonenshine and Stewart 2021). Females need to ingest extremely higher amounts of blood to translate the blood protein in formation of their high numbers of oviposited eggs (Dantas-Torres 2010).

Certainly, ticks excrete excess fluids of the uptaken blood meals through the coxal organs in order to regulate ion balances and save the haemolymph volume (Boné 1943; Lees 1946; Kaufman et al. 1981), and in argasids, coxal fluids should in parallel increase as much as higher amounts of blood been sucking to help in these regulations (Kaufman et al. 1981). This might explain the increase of the coxal fluids during the feeding process.

As the body wall of the soft ticks is interestingly expandable to occupy the large amounts of blood taken out from the host, their midgut also in considerably expandable to assimilate these large amounts of blood (Sonenshine and Roe 2013). The data obtained in this study confirms the increasing contents of blood post-engorgement. On the other hand, volumes of haemolymph are interestingly increasing not only in argasids, but in ixodids as well to play the immune functions against either the toxic materials of the heme or the pathogenic cocktail that might be exist in the blood meal through cellular immunity (Mans 2014). Other possible explanation of the increasing volumes of the tick haemolymph is the crucial cycles involved in the tick metabolism (Mans 2014).

The findings of this study provide numerical data, approving the scientific facts that are previously noted in one of economically important soft ticks in Egypt, *A. persicus* that threatening the poultry sector of the country. Further studies should be performed to correlate the findings addressed in here with the possible pathogen loads associated with this tick species.

Table 1. Mean (±SD) blood weight (mg) ingested by *Argas persicus* adults fed on pigeons

Stage	Unfed	Fed	Coxal fluid	Net ingested blood
Female	3.34 ± 0.22	11.50 ± 1.40	1.15 ± 0.5	9.31 ± 0.2
Male	2.6 ± 0.26	8.27 ± 2.25	0.13 ± 0.01	5.56 ± 1.25

Table 2. Mean (±SD) water (mg) in fluid contents of gut (G), haemolym, (H.) and coxal fluid (c) of staved and engorged adult *A. Persicus* using 50 indiveduals per test

Case	Male			Female		
	G	H	C	G	H	C
Starved	1.045 ± 0.01	1.150 ± 0.21	–	1.021 ± 0.31	1.15 ± 0.04	–
Engorged	1.008 ± 0.02	1.009 ± 0.12	0.13 ± 0.01	1.110 ± 0.02	1.14 ± 0.31	1.15 ± 0.50

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