

Morphometry of adults and larval stages of *Cicadatra persica* (Cicadidae: Hemiptera) distributed in Erneh, Syria

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Abstract

This study was conducted in order to describe and measure the morphological characters of adults and larval stages of the cicada *Cicadatra persica* distributed in Erneh, Syria. Eggs, newly hatched nymphs, fully developed nymphs, exuviae and adults were described and measured. The mean lengths of eggs (1.9 ± 0.1 mm) were the same as newly hatched nymphs (1.8 ± 0.174 mm), whereas the mean length of the fully developed nymphs (3.1 ± 0.185 cm) was longer than the adults. Several parts of adults' body (males and females) were measured. The results show that the mean of females bodies (2.60 ± 0.118 cm) were larger than males ones (2.45 ± 0.192 cm), nevertheless, there were no significant differences between them.

Introduction

Little is known about the species *Cicadatra persica* Kirkaldy 1909, which is distributed in Middle East countries and surrounding areas. *C. persica* was reported for the first time in Macedonia and its song was recorded and analyzed (Gogala & Trilar, 1998, 2003). Kartal & Zeybekoğlu (1996) described the internal and external structure of the reproductive system of its adults.

Researches on *C. persica* distribution in Syria are limited. The only researches conducted on this species were by Dardar *et al.* (2012, 2013a, 2013b), Dardar and Belal (2013) emphasizing the morphological differences among egg nests and adult individuals of *C. persica*. In this study, pictures are given for adults, larval stages and eggs of *C. persica* and some morphological characters are measured.

Materials and methods

Collecting individuals

Adults and larval stages of *C. persica* were collected from apple fruit orchards in the village Erneh that is located in Al-Sheikh Mountain in the south west of Syria.

The eggs were collected by cutting the twigs that hold egg nests from apple fruit orchards.

The newly hatched nymphs were collected by using the traps described by Dardar *et al.* (2012) and fixed in an ethanol and glycerin solution to maintain body soft to aid the study with a stereomicroscope.

The fully developed nymphs were collected by digging in the soil during adults' emergence period. Adults were collected by hand and with emergence traps described by Dardar *et al.* (2012) from the orchards at sunset and sunrise times, when the insects are collected in larger numbers.

Morphometric study

Morphological characters of adults and larval stages identified by Moulds (2005) were studied by using a stereomicroscope (Olympus SZ61, optical lens: 10X, body lens: 2X).

The length of body of adults (n=11 males, n=11 females) and fully development nymphs (n=8) was measured in cm by a ruler; 34 and 30 morphological characters of males (n=11) and females (n=11) of *C. persica* were measured.

The length of different parts of body of adults was measured with the stereomicroscope with a magnification of 0.67. The length of the body and different parts of the body of the newly hatched nymphs (n=6) was also measured with a magnification of 4.5.

The real length of different part of the body was measured in mm.

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Statistical analysis

Means and standard deviations were calculated for the length of different parts of adults' body and larval stages using SPSS software (IBM Corp., Armonk, NY, USA).

Two independent samples t-test were carried out for the length of some morphological characters in order to compare males and females of *C. persica*.

Results and discussion

Morphometric study

The eggs

The color of the newly laid eggs is white (Figure 1) when newly laid and then it changes gradually into black light yellow (Figure 2), dark yellow, light rosy, and completely rosy (Figure 3) before hatching.

The mean length of the egg of *C. persica* was 0.1 ± 1.9 mm (n=6).

The newly hatched nymph

The body of the nymph is rosy. The head is conical and ends with a long rostrum. Ocelli are absent; there are two pairs of eyes and antennae on the both lateral sides of the head (Figure 4). It has sucking mouthparts. The pronotum is well developed and longer than mesonotum and metanotum in order to support the fore legs to dig in the soil. The wing pads are absent.

The sixth pairs of legs are transparent. The fore femur is large and has a vertical spine on the lateral side of the leg. In this age, we cannot distinguish between the genital organs of males and females. Each antenna consists of 7 transparent segments (Figure 5).

The lengths of 24 morphological characters for newly hatched nymphs (n=6) of *C. persica* were measured (Table 1).

The fully development nymph

The color of the body is brown (Figure 6). The head is triangular and held two pairs of eyes and antennae. Each antenna consists of 7 segments. The ocelli are absent. It has sucking mouthparts. Mesonotum is larger than pronotum and hold fore wing pads. The metanotum is small and hold the hind wing pads (Figure 7). There are six pairs of legs, and the fore legs hold 3 spines that are different in size on the lateral side of the leg (Figure 8). The abdomen consists of 8 segments end with the genital organ.

The mean length of the body's nymph was 3.1 ± 0.185 cm (n=8).



Figure 1. White eggs.



Figure 2. Yellowish eggs.



Figure 3. Rosy eggs.



Figure 4. The newly hatched nymph.



Figure 5. Antenna of the newly hatched nymph.



Figure 7. Full development nymph (ventral view).



Figure 6. The full development nymph.



Figure 8. Fore legs of the full development nymph.

Table 1. The measurements (in mm) of the morphological characters for newly hatched nymphs of *Cicadatra persica* (n=6).

The character	Mean±Std.	The character	Mean±Std.
Body length	1.8±0.174	Tibia 3	0.34±0.014
Width of head capsulate	0.30±0.025	Tarsi 1	0.11±0.00
Pronotum width	0.375±0.0748	Tarsi 2	0.12±0.026
Coxa 1	0.22±0.031	Tarsi 3	0.15±0.018
Coxa 2	0.16±0.035	Claw 1	0.04±0.011
Coxa 3	0.22±0.031	Claw 2	0.05±0.006
Trochanter 1	0.16±0.027	Claw 3	0.05±0.011
Trochanter 2	0.13±0.025	Scape	0.11±0.008
Trochanter 3	0.12±0.030	Pedicel	0.11±0.010
Femur 1	0.25±0.033	1	0.10±0.005
Femur 2	0.21±0.070	2	0.08±0.009
Femur 3	0.27±0.034	3	0.07±0.010
Tibia 1	0.20±0.034	4	0.05±0.005
Tibia 2	0.25±0.021	5	0.05±0.005

Std., standard deviation.

The adult

The adult emerges from the final stage of nymph by molting that takes about 30-40 min. The newly emerged adult is soft and dull. It remains quiet at rest without any movement on her exuvia, and takes her natural color and her wings begin to harden gradually (Figure 9). Then it flies and leaves its exuvia (Figure 10) on the soil surface, trunks, or weeds.

The body of adult is black; the head is triangular and hold two pair of



Figure 9. Molting.



Figure 10. Exuviae of *Cicadatra persica*.



Figure 11. The antenna of *Cicadatra persica*.

compound eyes, 3 ocelli and one pair of antennae. Each antenna consists of 5 segments (Figure 11). It has sucking mouthparts. The wings are membranous with black veins and orange color at the base. The abdomen consists of 8 segments end with the genital organ.

The male

Thirty-four morphological characters for males (n=11) of *C. persica* were measured (Table 2).

The female

Thirty morphological characters for females (n=11) of *C. persica* were measured (Table 3).

Table 2. Measures (in cm) of the morphological characters for males (n=11) of *Cicadatra persica*.

The character	Mean±Std.	The character	Mean±Std.
Body length	2.45±0.192	Coxa 2	3.61±0.305
Width of head capsulate	9.04±1.162	Coxa 3	3.45±0.317
Pronotum width	11.34±1.248	Trochanter 1	3.10±0.349
Wings span	7.02±0.199	Trochanter 2	2.40±0.366
Fore wing	3.20±0.109	Trochanter 3	2.04±0.258
Hind wing	1.809±0.083	Femur 1	4.78±0.606
Post clypeus	4.36±0.445	Femur 2	5.18±0.611
Operculum	6.96±1.000	Femur 3	5.30±0.761
Aedeagus	5.76±0.998	Tibia 1	5.18±0.663
Pygofer	6.454±0.656	Tibia 2	6.68±0.791
Upper lap	0.61±0.255	Tibia 3	7.78±0.885
Basal lap	0.57±0.127	Tarsi 1	2.61±0.353
Dorsal peak of pygofer	1.26±0.262	Tarsi 2	2.61±0.321
Claspers	1.80±0.475	Tarsi 3	2.64±0.443
Uncus	0.46±0.112	Claw 1	1.2±1.924
Sternite VIII	6.91±0.702	Claw 2	0.72±0.075
Coxa 1	5.49±0.737	Claw 3	0.70±0.077

Std., standard deviation.

Table 3. Measures (in cm) of the morphological characters for females (n=11) of *Cicadatra persica*.

The character	Mean±Std.	The character	Mean±Std.
Body length	2.60±0.118	Trochanter 1	2.88±0.252
Width of head capsulate	8.20±0.340	Trochanter 2	2.17±0.210
Pronotum width	10.91±0.712	Trochanter 3	1.82±0.236
Wings span	7.04±0.311	Femur 1	4.34±0.238
Fore wing	3.19±0.158	Femur 2	4.60±0.190
Hind wing	1.84±0.067	Femur 3	4.77±0.253
Post clypeus	3.94±0.298	Tibia 1	4.55±0.225
Ovipositor	9.68±0.531	Tibia 2	5.78±0.646
Abdominal segment	9.30±0.703	Tibia 3	6.97±0.320
Ovipositor sheath	3.84±0.361	Tarsi 1	2.34±0.192
Valvifer 2	4.97±0.450	Tarsi 2	2.34±0.163
Dorsal peak	0.94±0.143	Tarsi 3	2.34±0.197
Coxa 1	4.71±0.359	Claw 1	0.61±0.070
Coxa 2	3.45±0.163	Claw 2	0.64±0.052
Coxa 3	3.33±0.168	Claw 3	0.62±0.075

Std., standard deviation.

Conclusions

There was no significant differences in the body length, wingspan, or pronotum between males and females of *C. cicadatra* ($P=0.279$, $P=0.148$, $P=0.251$). However, the results show that there were significant differences in the width of head's capsulate and length of the third tibia ($P=0.001$, $P=0.001$); the mean width of head's capsulate of the male was bigger than female's one, while the mean length of the third tibia of the male was bigger than female's one.

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