

Morphological and Developmental Studies for the Predatory Mite *Phytoseiulus persimilis* Athias-Henriot (Acarina: Phytoseiidae)

NAWAL AHMED HESSEIN¹

ABSTRACT

The development of the predatory mite *Phytoseiulus persimilis* Athias-Henriot was studied in the laboratory at $25^{\circ} \pm 2^{\circ}\text{C}$ and 45–65% RH. The incubation period averaged 1.9 days. The larval stage or the deutonymphal stage averaged one day, while that of the protonymphal stage was 1.1 days. The total developmental period averaged 5.0 days. Mating took place shortly after maturation of the deutonymphs. The preoviposition period averaged 36 hours. The sex ratio was 2.8 females for each male. The eggs of the spider mite *Tetranychus hydrangeae* Pritchard and Baker was the main food used by the predatory mite to complete its development. The immature stages are newly described, while both the adult female and the adult male were redescribed.

INTRODUCTION

The predatory mite *Phytoseiulus persimilis* Athias-Henriot is of great importance in controlling several species of phytophagous mites. Many reports had proved that it is one of the most efficient predators in the family Phytoseiidae. Bravenboer and Dosse (2) reported its effectiveness in controlling the carmine mite *Tetranychus cinnabarinus* (Boisduval) on peach as well as *Tetranychus urticae* Koch. on cucumber grown in greenhouses in Netherlands. Oatman *et al.* (10) had obtained a successful control of the two spotted spider mite *T. urticae* Koch. in strawberry fields in southern California with this species. While in Lebanon Dosse (6) found that this predator is also important in controlling the carmine mite on vegetables.

In Libya it has been found in large numbers between populations of *Tetranychus hydrangeae* Pritchard and Baker on the leaves of the blue dawn flower *Ipomoea leari* Paxt. in spring (personal observation). Also Damiano (4) has reported it on vegetable crops and ornamental violets. This report discusses the morphology and the developmental stages of this predatory mite under laboratory conditions. These informations are required before starting any study on the dynamics of its predation as well as its possible role in the control of both the carmine mite and the two spotted spider mite.

¹Assistant Professor, Entomology Section, Department of Plant Production, Faculty of Agriculture, University of Tripoli, Tripoli, Libyan Arab Republic.

MATERIALS AND METHODS

The blue dawn flower plants were the source of supply for the plant feeding mite. The technique described by McMurtry and Scriven (9) was followed in this study. Detached leaves of the blue dawn flower plants were placed upside-down on pieces of wet cotton in petri-dishes. Two adult females of the predatory mite were placed on each leaf. The eggs of the plant feeding mite *T. hydrangeae* which are the main food for the predatory mite were supplied by continuous addition of adult females of the phytophagous mite on the used leaves. Citrus pollen grains were used as a supplementary food beside the spider mite eggs. The leaves were changed whenever they became in unsatisfactory condition. Studies were conducted in an adjusted incubator at $25^{\circ} \pm 2^{\circ}\text{C}$ and 45–65% RH.

RESULTS AND DISCUSSION

The adult female (Fig. 1) like all other stages is oval in shape and red in color, but comparatively large in size and measures 0.363 mm long and 0.284 mm wide on the average. The dorsal shield is heavily sclerotized, with apparent reticulation in case of the old females. The arrangement of the setae agrees with the description reported by

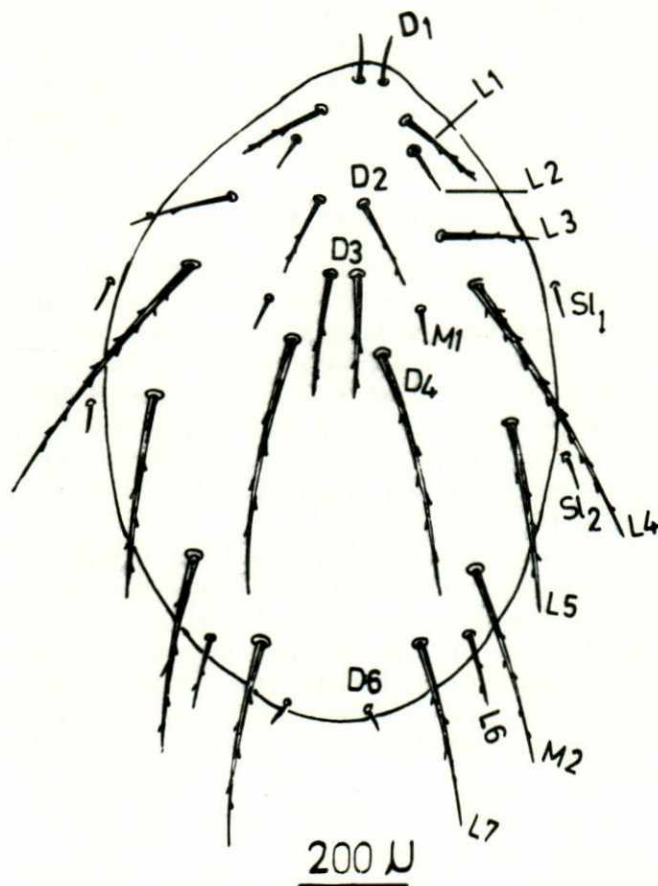


Fig. 1. Adult female dorsal shield: D_1 – D_4 and D_6 , dorsal setae; M_1 and M_2 , median setae; L_1 – L_7 , lateral setae; SL_1 and SL_2 , sub-lateral setae.

Chant (3). There are the following setae on each side as shown in Fig. 1: five dorsal setae (D_1 – D_4 and D_6), two median setae (M_1 and M_2), seven lateral setae (L_1 – L_7), and two sub-lateral setae (Sl_1 and Sl_2). Setae D_5 are absent. Like all the stages of that species slight serration of the dorsal setae occurs, however, the fourth lateral setae (L_4) are comparatively more serrated.

On the ventral side (Fig. 2A), like other phytoseiids and as described by Schuster and Pritchard (11), there are on each side: three sternal setae (S), one metasternal seta (Ms), one genital seta (G), four preanal setae (Pr), one para-anal seta (Par), one ventro-

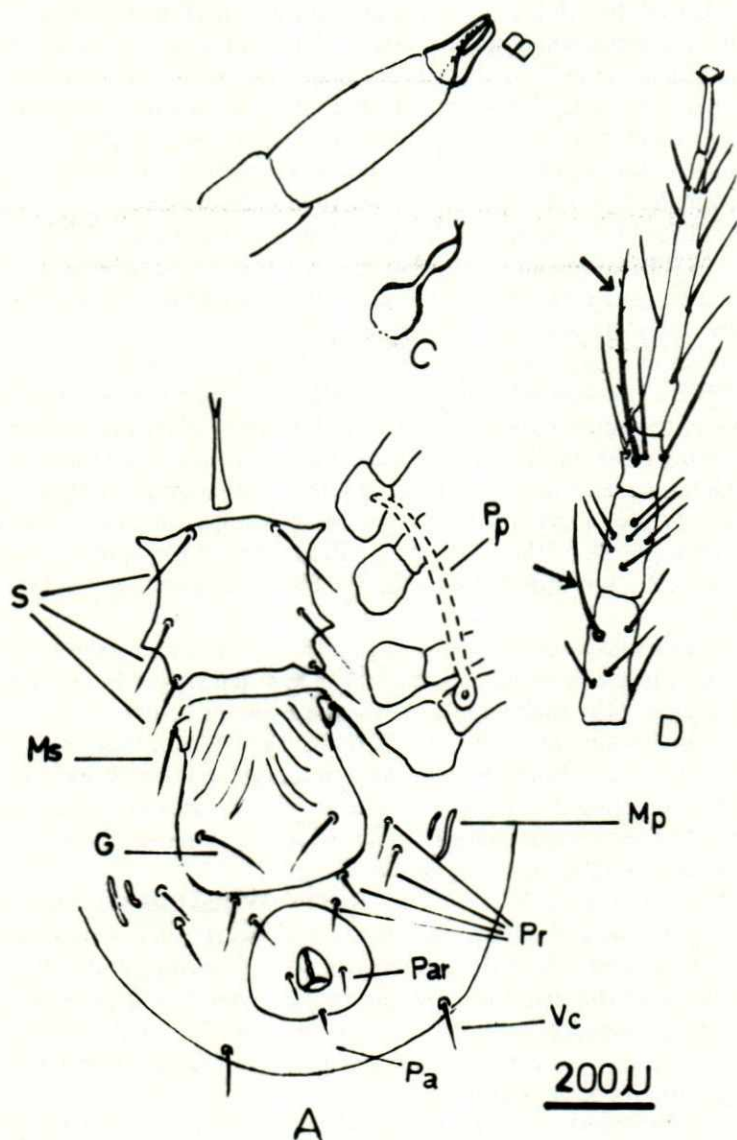


Fig. 2. Adult female. A, ventral surface: S, sternal setae; Ms, metasternal setae; G, genital seta; Pr, preanal setae; Par, para-anal seta; Vc, ventrocaudal setae; Mp, metapodal plates; Pa, postanal seta; Pp, peritremal plate. B, Chelicera. C, Spermatheca. D, Arrows indicate macrosetae on fourth leg.

caudal seta (Vc), and two metapodal plates (Mp). There is also one postanal seta (Pa). The peritremal plate (Pp) is complete and measures 0.174 mm long on the average. The tip of the chelicera (Fig. 2B) differs in shape and structure from that one of the adult male. It has the fixed digit obviously toothed. The cervix and the atrium of the spermatheca (Fig. 2C) are gradually swollen towards the tip. Leg four (Fig. 2D), like all the other four-legged stages has two macrosetae, a comparatively long one on the basitarsus and one on the genu.

The adult male is smaller and more active than the adult female. It measures 0.300 mm long and 0.237 mm wide on the average. The chaetotaxy of the dorsal shield (Fig. 3) is similar to that of the adult female. On the ventral side (Fig. 4A) the sternal and the genital plates are combined into one plate (SGp), carrying five setae on each side. The ventri-anal plate (Vap) has three pairs of preanal setae. The number and arrangement of the para-anal setae, the postanal seta, and the ventrocaudal setae are similar to that of the adult female. The peritremal plate is also complete, and measures 0.158 mm long on the average. The tip of the chelicera (Fig. 4B) differs from that one of the adult female. It has also the fixed digit obviously toothed.

The distribution of the setae on the dorsal shield and the analplates for both the adult female and the adult male, as well as the structure of the spermathecae in case of the adult female agree with what had been reported by Dosse (5) for the description of *Phytoseiulus riegei* Dosse (= *P. persimilis*).

The deutonymph measures 0.300–0.348 mm long and 0.237–0.269 mm wide. The dorsal shield (Fig. 5) is less sclerotized, but with the same number and arrangement of setae like that of the adult female. On the ventral side, none of the plates are present. The distribution of the setae on the venter are two kinds. In case of the male deutonymphs which are smaller in size, the setae are of the same number and arrangement like that of the adult male. While in case of the female deutonymphs which have larger size, the number and arrangement of the setae are similar to that of the adult female. The peritremal plate is similar but shorter than that of the adult and measures 0.095 mm long on the average.

The protonymph measures 0.269 mm long and 0.221 mm wide on the average. Its dorsal shield (Fig. 6) is less sclerotized than that of the deutonymph, and with a similar chaetotaxy like that of the adult female. All the plates on the venter are absent. The setae on the ventral side is similar to that of the adult stage except that only three pairs of sternal setae are present. Like the deutonymph there are either three pairs of preanal setae in the case of male protonymphs, or four pairs of preanal setae for the female protonymphs. The peritremal plate is much shorter compared to that of the deutonymph and measures 0.032 mm long on the average.

The dorsal shield of the larva (Fig. 7) is less sclerotized than the protonymph. The arrangement of the setae is similar to the other stages except that some setae are absent such as L_5 , L_6 , M_2 and both Sl_1 and Sl_2 . It measures 0.221 mm long and 0.205 mm wide on the average. None of the plates are present on the venter and its chaetotaxy is similar to that of the protonymph. Larvae that have three pairs of preanal setae are considered as male larvae, while those with four pairs of preanal setae are considered as female larvae. The peritremal plate is absent.

The egg is oval in shape, translucent, red in color and measures 0.202 mm long and 0.177 mm wide on the average. Its incubation period is 1–3 days with an average of 1.9 days. This period is comparatively longer than that mentioned by Dosse (5). He found that this period was 1.3 days at 25°C. However, Laing (7) stated that the egg stage averaged 3.1 days at a range of temperature from 58.5°F to 80.0°F. The low relative

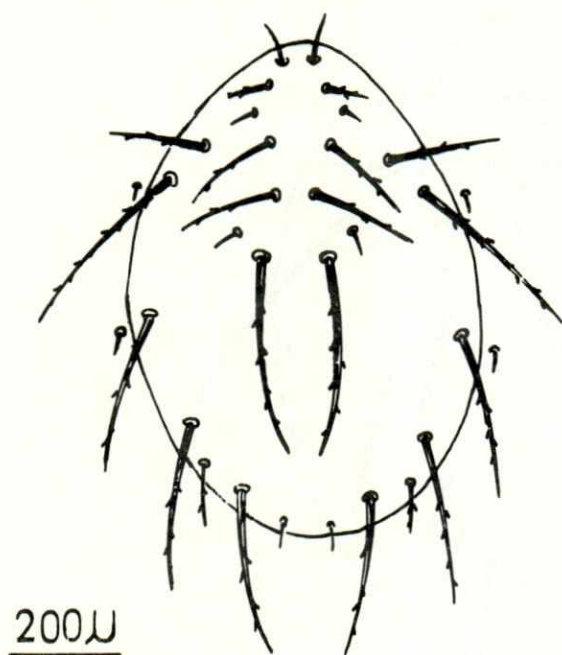


Fig. 3. Adult male dorsal shield.

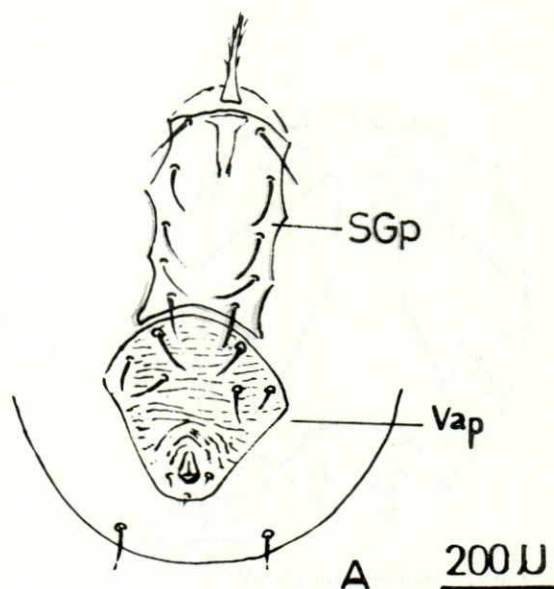
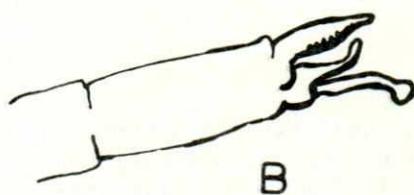


Fig. 4. Adult male. A, Ventral surface: sternal and genital plate (SGp), ventrianal plate (Vap). B, Chelicera.

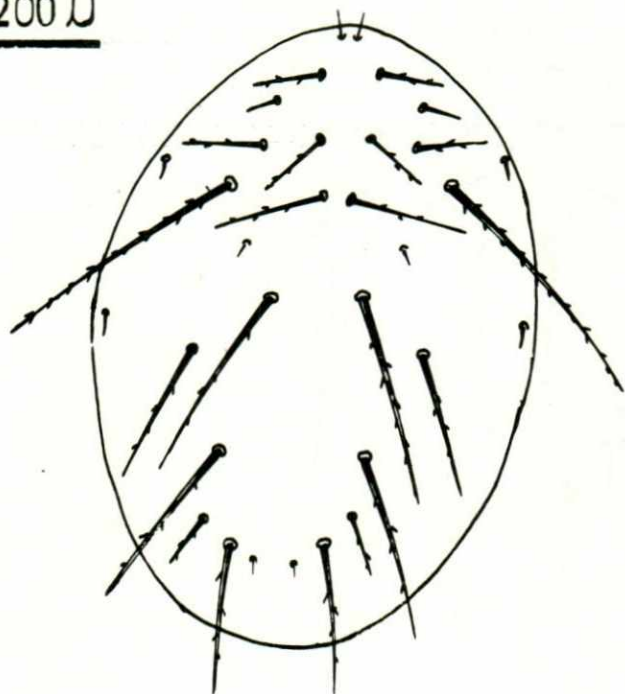
200 μ 

Fig. 5. Deutonymph dorsal shield.

humidity that happened occasionally during the present study might be a reason for the longer time of the egg stage.

Each of the larval stage and the deutonymphal stage had completed its development in one day on the average. Dosse (5) stated also a similar figure for the duration of the

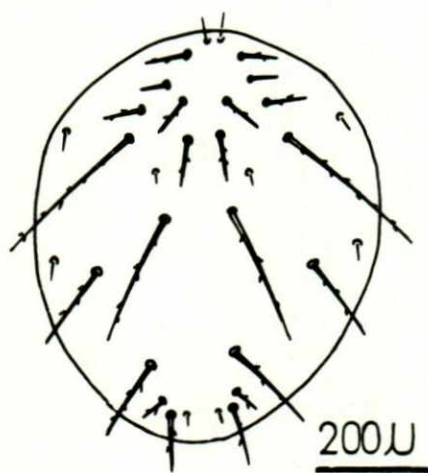


Fig. 6. Protonymph dorsal shield.

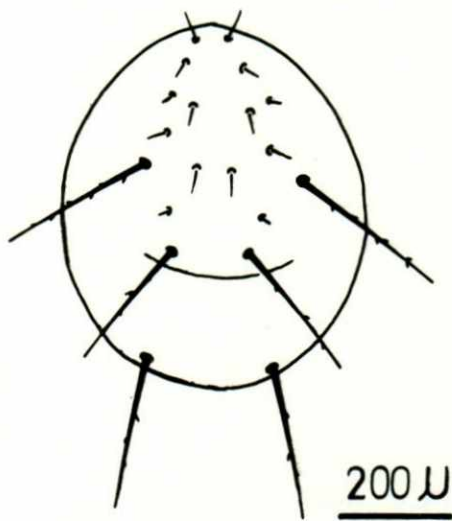


Fig. 7. Larva dorsal shield.

larval stage and 1.1 days for the deutonymphal stage. However, Laing (7) had reported the same duration for the larval stage, but a longer period of 1.7 days for the deutonymphal stage.

The protonymphal stage lasted 1–1.5 days with an average of 1.1 days, which agrees with the findings of Dosse (5) who reported 1.2 days. Laing (7) stated that this stage averaged 1.7 days for the male protonymph and 1.6 days for the female protonymph.

The total developmental period ranged from 4–6.5 days, with an average of 5.0 days, which is slightly longer than the findings of Dosse (5) who stated that at 25°C this period was 4.6 days. However, this period was longer in case of the studies of Laing (7) because it lasted 7.5 days for the males and 7.4 days for the females at the same above mentioned range of temperature.

The mating process is typical for the phytoseiids and as described by Ballard (1). It took place within a short time after maturation. The preoviposition period ranged from 24–48 hours with an average of 36 hours. Laing (7) found that the average of this period was 3.0 days.

The sex ratio for this species was about one male for 2.8 females. This agrees closely with the sex ratio of other phytoseiids such as *Typhlodromus rickeri* Chant whose sex ratio was reported by McMurtry and Scriven (8) as one male for two females. However, Laing (7) found that the sex ratio of males and females of *P. persimilis* for the stocks of the species originating from Chile and experimented under a wide range of temperature is 1:4.1.

The predatory mite was noticed to feed mainly on the egg stage of the phytophagous mite. It preyed on other stages when the eggs were scarce. Ragusa (11) found also that *Amblyseius tardi* (= *P. persimilis*) feeds on different stages of *Tetranychus urticae*, but Laing (7) had reported that *P. persimilis* feeds only on the eggs of *T. urticae*.

ACKNOWLEDGEMENT

The author wishes to thank both Dr. Edward Baker from the United States Department of Agriculture, Washington D.C., and Dr. Donald McFarlane from the Natural History Museum, London, England for identifying both the predatory and the phytophagous mite species used in this study.

LITERATURE CITED

1. Ballard, R. C. 1954. The biology of the predaceous mite *Typhlodromus fallacis* (Garman) (Phytoseiidae) at 78°F. Ohio Jour. Sci. 54:175–179.
2. Bravenboer, L., and G. Dosse. 1962. *Phytoseiulus riegeli* Dosse als Pradator einiger Schadmilben aus der *Tetranychus urticae* — Gruppe. Entomologia exp. appl. 5:291–304.
3. Chant, D. A. 1959. Phytoseiid mites (Acarina: Phytoseiidae). Part I. Bionomics of seven species in southeastern England. Part II. A taxonomic review of the family Phytoseiidae, with descriptions of 38 new species. Canad. Entomol. 91, Supplement 12. 166 pp.
4. Damiano, A. 1961. Elenco delle specie di insetti dannosi recordati per la Libia fino al 1960. Tipografia del governo. Nazirato dell Agriculture, Tripoli, 81 pp.
5. Dosse, G. 1958. Über einige neue Raubmilbenarten (Acar., Phytoseiidae). Pflanzenschutzber. 21:44–61.

6. Dosse, G. 1967. Schadmilben des Libanons und ihre Pradatoren. Zeitschr. angew. Ent. 59:16-48.
7. Laing, J. E. 1968. Life history and life table of *Phytoseiulus persimilis* Athias-Henriot. Acarologia 10:578-588.
8. McMurtry, J. A., and G. T. Scriven. 1964. Biology of the predaceous mite *Typhlodromus rickeri* (Acarina:Phytoseiidae). Ann. Entomol. Soc. Amer. 57:362-367.
9. McMurtry, J. A., and G. T. Scriven. 1964. Studies on the feeding, reproduction, and development of *Amblyseius hibisci* (Acarina:Phytoseiidae) on various food substances. Ann. Entomol. Soc. Amer. 57:649-655.
10. Oatman, E. R., J. A. McMurtry, and V. Voth. 1968. Suppression of the two spotted spider mite on strawberry with mass releases of *Phytoseiulus persimilis*. Jour. Econ. Entomol. 61:1517-1521.
11. Ragusa, S. 1965. Osservazioni preliminari sulla biologia dell *Amblyseius tardi* Lomb. (Acarina:Phytoseiidae), predator del *Tetranychus urticae* Koch. Boll. Inst. Entomol. Agraria Osserv. Fitopat. Palermo, 6:3-10.
12. Schuster, R. O., and A. E. Pritchard. 1963. Phytoseiid mites of California. Hilgardia, 34:191-285.

دراسات مورفولوجية وبيولوجية للحلم المفترس فيتوسيلس برسيميلس

عائلة فيتوسيدي - مجموعة الحلم

نوال أحمد حسين

المستخلص

تمت دراسة نمو الحلم المفترس فيتوسيلس برسيميلس في المعمل على درجة الحرارة المثوية $25 \pm 2^\circ \text{C}$ ونسبة الرطوبة ٤٥ - ٦٥ % .

كان متوسط فترة الحضانة للبيض ١٩ يوماً. متوسط الفترة اللازمة لنمو اليرقة أو الحورية الثانية كان يوماً واحداً. أما متوسط الفترة اللازمة للحورية الأولى لتكامل نموها فكان ١٩ يوماً. يتم التزاوج بعد فترة قصيرة من اكتمال نمو الحورية الثانية . كان متوسط الفترة السابقة لوضع البيض ٣٦ ساعة .

يعتبر بيض الحلم النباتي قترانيكس هيدرانجي هو الغذاء الرئيسي للحلم المفترس حتى يكتمل نموه .

لقد تم وصف الأطوار غير الكاملة مورفولوجيا لأول مرة أما الأنثى والذكر فقد أعيد وصفهما .