

**MORPHOLOGICAL STUDIES ON SYCAMORE FIG PSYLLID,
PAUROPSYLLA WILLCOCKSI DÇBSKI (HOMOPTERA-
PSYLLOIDEA-TRIOZIDAE)**

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Abstract

The five nymphal instars of the sycamore fig psyllid *Pauropsylla willcocksii* Dçbski belonging to family Triozidae were collected on *Ficus sycomorus* L. The collected specimens were identified, described, and illustrated. A key to differentiate the five nymphal instars was constructed.

INTRODUCTION

The psylloidea, (jumping plant-lice) are an important component of the homopterous fauna of many plants. At present, 14 species are known to occur in Egypt (Awadallah and Swallem, 1971; Samy, 1972; Nada, 1994). The generally accepted system of classification divided the psylloidea into six families: Triozidae, Liviidae, Carsidaridae, Aphalaridae, Psyllidae and Spondyliaspidae (Hodkinson and White, 1979; White and Hodkinson, 1982 & 1985).

The sycamore fig psyllid *Pauropsylla willcocksii* Dçbski, belong to family Triozidae, is one of the most dangerous insects infesting sycamore fig *Ficus sycomorus* L. trees in Egypt. This insect suck the sap from the leaves causing the galls in which the immature stages live.

The aim of the present work is to make a systematic study including description of the nymphal instars of the mentioned species according to the new taxonomic status; and making a key to differentiate between the nymphal stages.

MATERIALS AND METHODS

Five nymphal instars of *Pauropsylla willcocksii* Dçbski (Homoptera-Trioizidae),

were detected during the present study. The specimens were collected, from *Ficus sycomorus* L plants at Giza governorate.

The specimens were collected by cutting the infested part of the host plant, they were separated and sorted. Collected specimens were prepared on clean microscope slides according to Hodkinson and White method (1979) due to their minute size.

Taxonomic studies were carried out by examining and identifying the collected specimens according to all available descriptions and keys. The diagnostic characters and key to each stage were given provided with illustrations in plates. Each plant has a central body outline of the whole slide mounted specimen.

The left half of the drawing represents the dorsal surface. The right half represents the ventral surface. Each dermal enlargements in the drawing of the first, second and third nymphal instars represents setaseta. Simple seta enlarged to 4000x, while enlargements to 2000x in the drawing of the fourth and five nymphal instars. The anal ring has been enlarged to 2800x, 2000x, 1200x, 750 x and 550 x, respectively. Measurements were rounded up to the nearest micron by ocular micrometer.

RESULTS AND DISCUSSION

1. Systematic position

Systematic position of *Pauropsylla willcocksii* Dębski.

Synonymy

1918, *Pauropsylla willcocksii* Dębski as quoted by Hollis (1984)

This species was collected on fig trees at Giza, and the trees were heavily infested with this pest.

Specimens sent to the British Museum, were identified by Mr. Lee Rogers. He determined this species as *Pauropsylla willcocksii* Dębski, Homoptera, family Trioziidae and he kindly sent a paper of Hollis (1984). From this paper important comments are quoted here .

Pauropsylla willcocksii is very close to *Pauropsylla trichaeta*. Adults of the

two species appear to be almost indistinguishable but males of *Pauropsylla trichaeta* tend to have more peg-like setae on the inner surface of the lateral expansions of the proctiger (25-30) on each side as opposed to a maximum of 22 on each side in *Pauropsylla willcocksii*. However, the nymphs of the two species appear to be quite distinct.

II Morphological Characteristics

1. Description of the Egg, (Pl.1)

Egg shining, smooth, white in colour, about 0.2 mm long and 0.1 mm wide, provided at the broadest side with a stalk which serves to attach it to the plant about 0.02 mm long, and with a hollow thread-like stalk about 0.3 mm long.

2. Description of the first nymphal instar, (Pl.2)

Body dorso-ventrally flattened, oval, light white, red eye, with white setae around the body. Body breadth (BB) about 0.1 mm and body length (BL) about 0.2 mm. Body breadth: Body length ratio (BBBL) = 0.5.

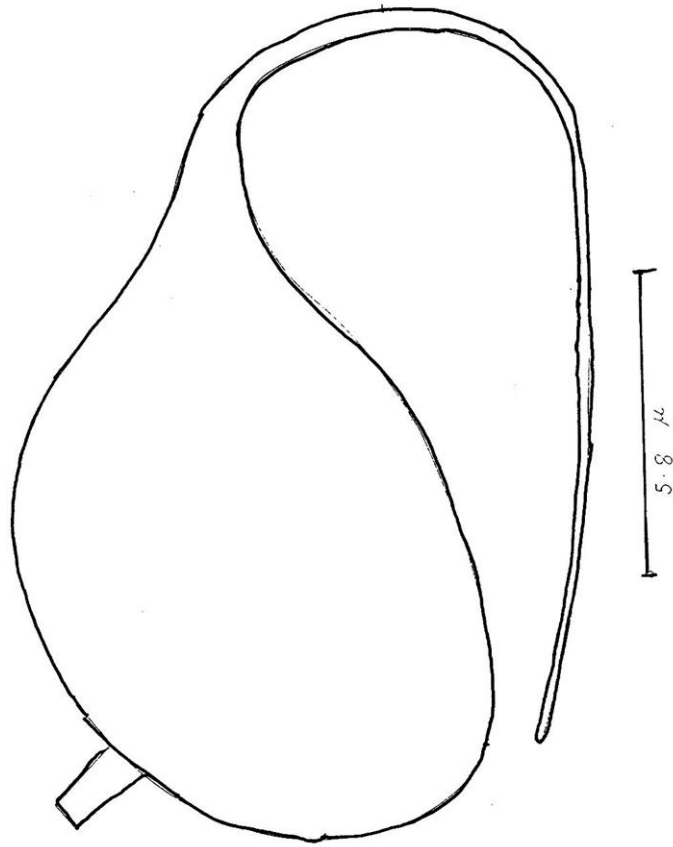
Head: Antenna (A) 2-segmented; measurements in microns, about as follows: I, 11x15, II, 38x14; with apex extends ventrally, with 1 rhinaria (R). Antennal length (AL) about 0.04 mm. Eye (E) about 0.01 mm in diameter and about 0.01 mm high. Labium (L) two-segmented, conical about 0.04 mm long and 0.02 mm wide at base.

Thorax: Thorax without depressed area forewing-pad length (WL) about 0.05 mm, forewing-pad hind margin rounded, antenna length: forewing-pad length ratio (AWL) = 0.04:0.05 = 0.8.

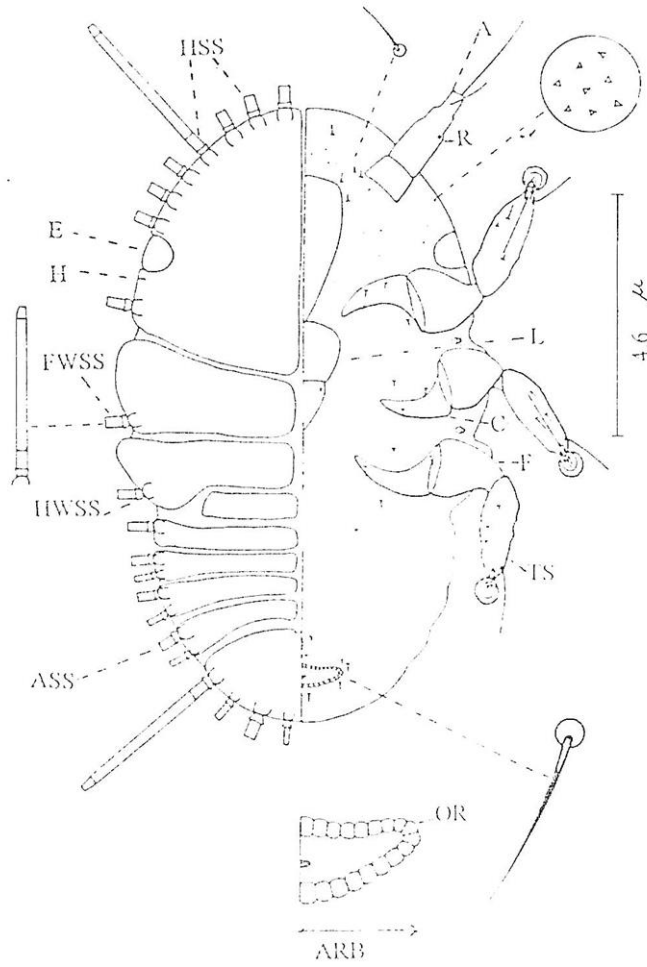
Humeral lobe (H) adjacent to the eye. All the thoracic sclerites fused with the wing-pad. Wing-pad margins tend to be confluent with the general body margin. The three pairs of legs similar in size, the hind-leg measurements in microns, about as follows: Coxa (C), 33 x 24; femur (F), 30 x 24; tibia tarsus (TS), 45x15; claw, 9x9; arolium semicircular.

Anterior and posterior spiracular apodemes small, similar about 4.2 microns long and 2.1 microns wide at atrium.

Addomen: Caudal plate breadth (CPB) about 0.06 mm and caudal plate length (CPL) about 0.07 mm. Caudal plate breadth: caudal plate length ratio (CPR) = 0.8 mm. Apical margin of caudal plate without tooth-like processes. The sclerites arranged 1 + 1



Pl. 1. The egg of *Pauropsylla willcocksii* Dębski.



PL. 2. First nymphal instar of *Pauropsylla willcocksii* Dębski.

per segment but in the apical area the individual sclerites fused to form one sclerites.

Anal opening ventral, sub-apical in position with an outer circumanal pore ring (OR) comprised of single row of pores (AP) = 18 + 18. Outer circumanal pore ring breadth (ARB) about 0.03 mm.

Dermal structures: Simple setae present ventrally on head, thorax, abdomen and leg ranging from 0.006 to 0.03 mm long.

Truncate ringed sectasetae (SS) present on margin only about 0.07 mm long; on head margin sectastae (HSS) = 7+7, forewing-pad margin sectasetae (FWSS) = 1+1, hindwing-pad margin sectasetae (HWSS) = 1+1, and abdomen margin sectasetae (ASS) = 11+11; ratio of number of sectasetae on abdomen margin to number of sectasetae on forewing-pad margin (FWASS)=11.

-Material examined : 10 specimens on *Ficus sycomorus*, L. 11, 4, 1993, collector authors.

N.B. : Abdominal spiracles not appearing.

3. Description of the second nymphal instar, Pl.3

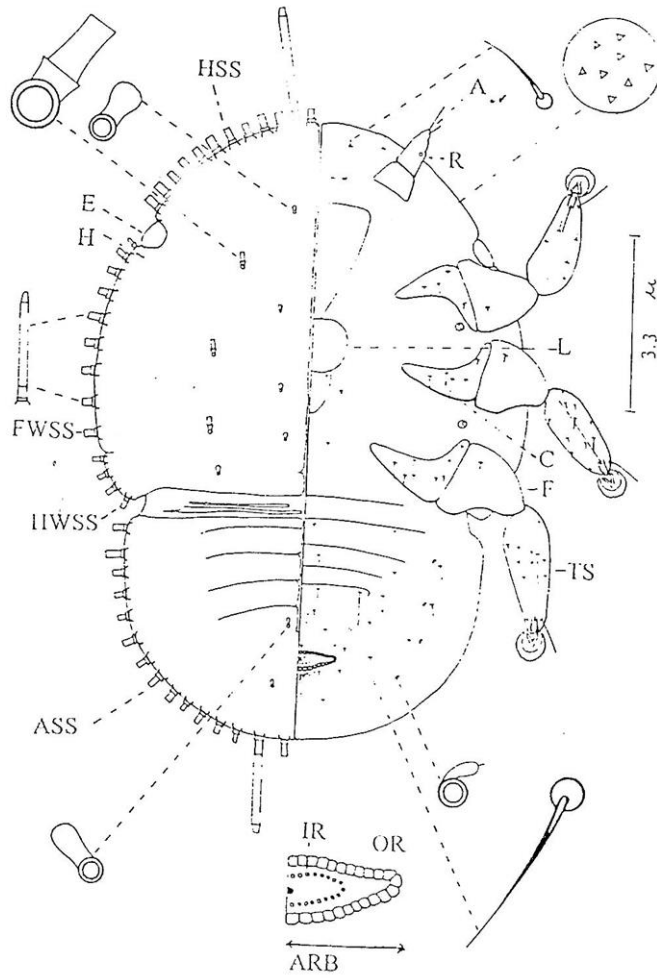
Body dorso-ventrally flattened, oval, white yellow, red eye, with white sectasetae around the body, body breadth (BB) about 0.2 mm and body length (BL) about 0.3 mm. Body breadth: Body length ratio (BBBL)= 1.5.

Head: Antenna (A) 2-segmented; measurements in microns, about as follows: I, 13.8x22.8; II, 27.6x12.3; with apex extends ventrally, with 1 rhinaria (R), antennal length (AL) about 0.03 mm. Eye (E) about 0.01 mm in diameter and about 0.01 mm high. Labium (L) two-segmented, conical about 0.03 mm long and 0.05 mm wide at base.

Thorax: Thorax without depressed areas, forewing-pad length (WL) about 0.1 mm, forewing-pad hind margin rounded, antenna length: forewing-pad length ratio (AWL) = 0.03 : 0.1 = 0.3.

Humeral lobe (H) adjacent to the eye. All the thoracic sclerites fused with the wing-pad. Wing-pad margin tend to be confluent with the general body margin.

The three pairs of legs similar in size; the hind-leg measurements in microns, about as follows: coxa (C) 48x42; femur (F) 45x42; tibia tarsus (TS) 69x24; claw,



Pl. 3. Second nymphal instar of *Pauropsylla willcocksi* Dębski.

15x15, arolium semicircular. Anterior and posterior spiracular apodomes similar about 0.006 mm long and 0.006 mm wide at atrium.

Abdomen: Caudal plate breadth (CPB) about 0.09 mm and caudal plate length (CPL) about 0.1 mm. Caudal plate breadth: Caudal plate length ratio (CPR) = 0.9 mm.

Apical margin of abdomen without tooth like processes. caudal plate covers the whole abdomen with a few small transverse sclerites at the base of the abdomen. Anal opening ventral, sub-apical in position with an outer circumanal pore ring (OR) comprised of single row of pores (AP) = 23+23 and inner circumanal pore ring (IR) = 17+17. Outer circumanal pore ring breadth (ARB) about 0.04 mm.

Dermal structures: Simple setae present ventrally on head, thorax, abdomen and legs ranging from 0.006 to 0.03 mm long. Large truncate ringed sectasetae (SS) about 0.01 mm long present dorsally on cephaloprothorax (CP) = 1+1, metathoracic sclerites (MS) = 2+2; sectasetae (SS) ranging from 0.05 to 0.07 mm long present dorsally, head margin sectasetae (HSS) = 12+12, forewing-pad margin sectasetae (FWSS) 9+9, hindwing-pad margin sectasetae (HWSS) = 4+4, and on abdomen margin sectasetae (ASS) = 15+15; ratio of number of sectasetae on abdomen margin to number of sectasetae on forewing-pad margin (FWASS) = 1.6, small truncate ringed sectasetae (SS) about 0.006 mm long scattered on cephaloprothorax (CP) = 2+2, mesothoracic sclerites (MS) = 3+3, metathoracic sclerites (MT) = 1+1, and on abdomen = 2+2.

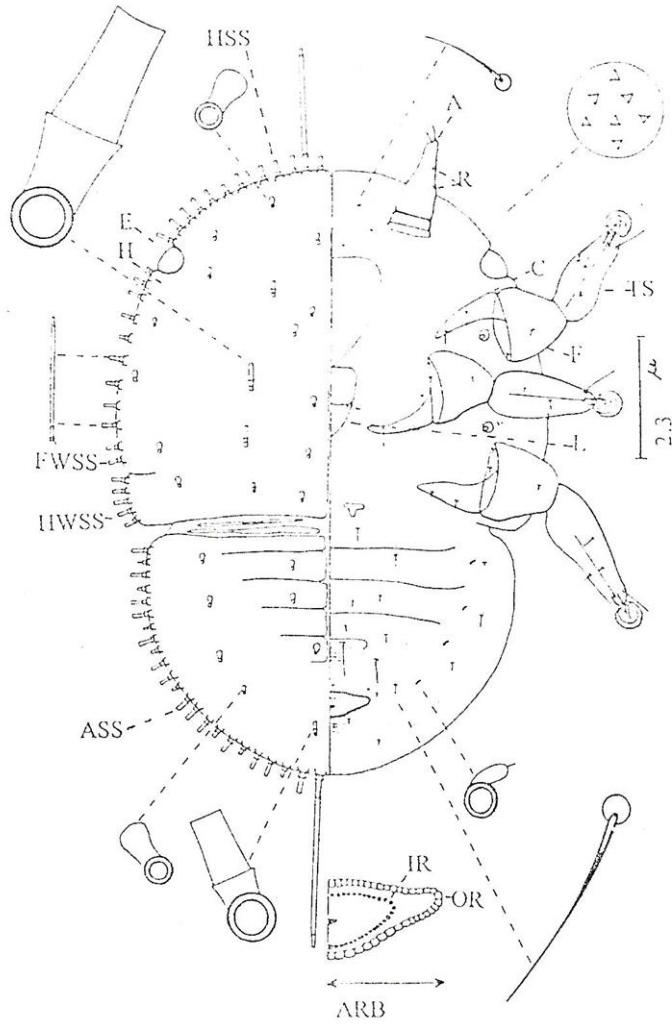
Four abdominal spiracles present, about 0.003 mm long and 0.009 wide.

Material examined: 10 specimens on *Ficus sycomorus* L. 13, 5, 1994, collector authors.

4. Description of the third nymphal instar, (Pl. 4)

Body dorso-ventrally flattened, oval, ranging from yellow to orange, red eye, with white sectasetae around the body. Body breadth (BB) about 0.3 mm and body length (BL) about 0.4 mm. Body breadth: Body length ratio (BBBL) = 0.75.

Head: Antenna (A) 3-segmented; measurements in microns, about as follows: I, 2.2x11.8; II, 3.7x10.3; III, 21.4x8.8; with apex extends ventrally, with 2 rhinaria (R), antennal length (AL) about 0.08 mm. Eye (E) about 0.02 mm in diameter and about 0.01 mm high. Labium (L) two segmented, conical about 0.05 mm long and 0.03 mm wide at base.



Pl. 4. Third nymphal instar of *Pauopsylla willcocksi* Dębski.

Thorax: Thorax without depressed areas, fore-wing-pad length (WL) about 0.1 mm, forewing-pad hind margin rounded, antenna length: forewing-pad length ratio (AWL) = $0.08 : 0.1 = 0.8$.

Humeral lobe (H) adjacent to the eye. All the thoracic sclerites fused with the wing-pad. Wing-pad margin tend to be confluent with the general body margin.

The three pairs of legs similar in size; the hind-leg measurements in microns, about as follows; coxa (C), 63x24; femur (F), 45x57; tibia tarsus (TS) 99x39; claw, 21x21, arolium semicircular. Anterior and posterior spiracular apodemes similar, about 0.009 mm long and 0.009 mm wide at atrium.

Abdomen: Caudal plate breadth (CPB) about 0.14 mm and caudal plate length (CPL) about 0.19 mm. Caudal plate breadth: caudal plate length ratio (CPR) = 1.4 Apical margin of abdomen without tooth like processes. Caudal plate covers the whole abdomen with a few small transverse sclerites at the base of the abdomen.

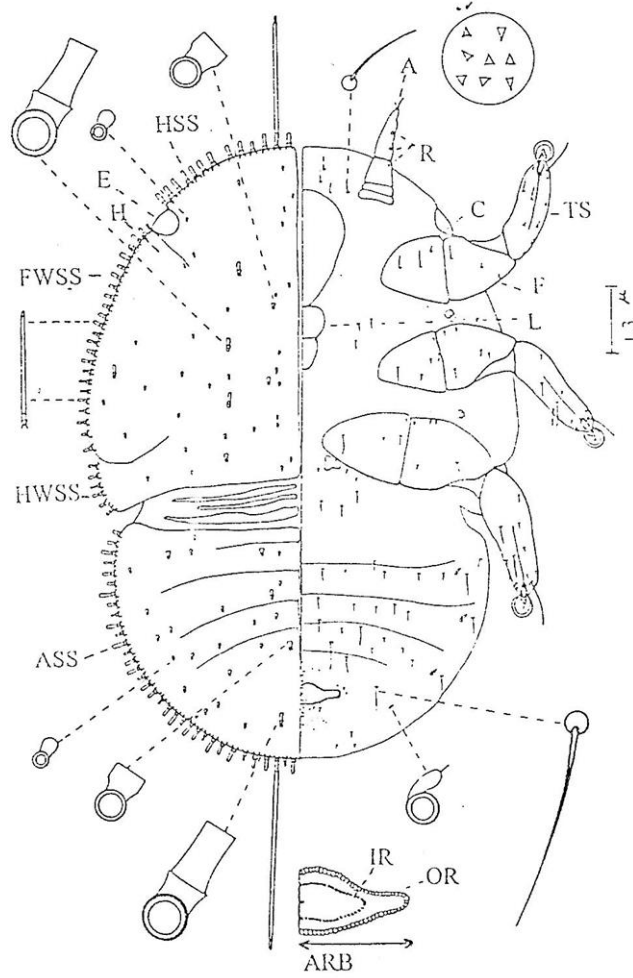
Anal opening ventral, sub-apical in position with an outer circumanal pore ring (OR) comprised of single row of pores (AP) = 35+35 and inner circumanal pore ring (IR) = 29+29. Outer circumanal pore ring breadth (ARB) about 0.06 mm.

Dermal structures: Simple setae present ventrally on head, thorax, abdomen and leg ranging from 0.006 to 0.04 mm long.

Large truncate ringed sectasetae ranging from 0.01 to 0.02 mm long present dorsally on cephaloprothorax (CP) = 1+1, mesothoracic sclerites (MS) = 2+2, metathoracic sclerites (mt) = 1+1, and on abdomen = 1+1; head margin sectasetae (HSS) = 12+12, forewing-pad margin sectasetae (FWSS) = 11+11, hind-wing-pad margin sectasetae (HWSS) = 5+5 and on abdomen margin sectasetae (ASS) = 23+23; ratio of number of sectasetae on abdomen margin to number of sectasetae on forewing-pad margin (FWASS) = 2.09. Small truncate ringed sectasetae about 0.006 mm long scattered on cephaloprothorax (CP) = 5+5, mesothoracic sclerites (MS) and forewing-pad (FW) = 6+6, metathoracic sclerites (MT) and hindwing-pad (HW) = 2+2, and on abdomen = 7.7.

Four abdominal spiracles present, about 0.006 mm long and 0.003 mm wide.
- Material examined: 10 specimens on *Ficus sycomorus* L., 11, 7, 1994, collector authors.

5. Description of the fourth nymphal instar, (Pl.5).



PL. 5. Fourth nymphal instar of *Pauopsylla willcocksi* Dębski.

Body dorso-ventrally flattened, oval ranging from orange or green yellow to brown, with white setae around the body. Body breadth (BB) about 0.6 mm and body length (BL) about 0.8 mm. Body breadth: Body length ratio (BBBL) = 0.75.

Head: Antenna (A) 4-segmented; measurements in microns, about as follows: I, 11x52; II, 11x48; III, 37x37; IV, 74x22; with apex extend ventrally, with 3 rhinaria (R), antennal length (AL) about 0.1 mm. Eye (E) bases about 0.04 mm diameter and about 0.03 mm high. Labium (L) two-segmented, conical about 0.09 mm long and 0.05 mm wide at base.

Thorax: Thorax without depressed areas, forewing-pad length (WL) about 0.3 mm, forewing-pad hind margin rounded, antenna length: forewing-pad length ratio (AWL) = 0.1: 0.3 = 0.33. Humeral lobe (H) adjacent to the eye. All the thoracic sclerites fused with the wing-pad. wing-pad margins tend to be confluent with the general body margin.

Fore-leg and middle-leg similar in size while hind-leg is the largest; fore-leg measurements in microns, about as follows: coxa (C), 96x90; femur (F), 105x84; tibia tarsus (T), 150x51. claw 27x30; arolium semicircular. Hind-leg measurements in microns, about as follows: Coxa (C), 120x105; femur (F), 126x102; tibia tarsus (TS), 186x63; claw, 27x30; arolium semicircular. Anterior and posterior spiracular apodemes similar 0.01 mm long and 0.01 mm wide at atrium.

Abdomen: Caudal plate breadth (CPB) about 0.2 mm and caudal plate length (CPL) about 0.3 mm. Caudal plate breadth: Caudal plate length ratio (CPR) = 0.6.

Apical margin of abdomen without tooth-like processes. The sclerites arranged 1+1 per segment but in the apical area the individual sclerites fused to form the caudal plate. Anal opening ventral, sub apical in position with an outer circumanal ring (OR) comprised of single row of pores (AP) = 60 +60 and inner circumanal pore ring (IR) = 38+38. Outer circumanal pore ring breadth (ARB) about 0.1 mm.

Dermal structures: Simple setae present ventrally on head, thorax, abdomen and legs ranging from 0.006 to 0.07 mm long.

Large truncate ringed setae about 0.02 mm long present dorsally on cephaloprothorax (CP) = 1+1, mesothoracic sclerites (MS) and forewing-pad (FW) = 3+3, on abdomen = 2+2, head margin setae (HSS) = 13+13, forewing-pad margin setae (FWSS) = 24+24, hindwing-pad margin setae (HWSS) = 6+6 and

on abdomen margin sectasetae (ASS) = 34+34, ratio of number of sectasetae on abdomen margin to number of sectaserae on forewing-pad margin (FWASS) = 1.41; small truncate ringed sectasetae ranging from 0.006 to 0.01 mm long scattered on cephaloprothorax (CP) = 9+9, mesothoracic sclerites (MS) and forewing-pad (FW) = 16+16, metathoracic (MT) and hind-wing-pad (HW) = 10-10, and on abdomen = 23+23.

Four abdominal spiracles present, about 0.009 mm long and 0.006 mm wide.

- Material examined : 10 specimens on *Ficus sycomorus* L.1, 8, 1994, collector authors.

Description of the fifth nymphal instar, Pl. 6

Body dorso-ventrally flattened, oval, ranging from green orange or green to brown, with white sectasetae around the body. Body breadth (BB) about 1.0 mm and body length (BL) about 1.3 mm. Body breadth: Body length ratio (BBBL) = 0.76.

Head: Antenna (A) 6. segmented: measurements in microns, about as follow: I, 12x90; II, 54x87; III, 9x45; IV, 18x45; V, 12x42; VI, 114x30; with apex extends ventrally, with 4 rhinaria (R), and with one row of setae located on the same margin as the rhinaria, antennal length (AL) about 0.01 mm. Eyes (E) bases about 0.004 mm in diameter and about 0.003 mm high. Labium (L) two-segmented, conical about 0.1 mm long and 0.07 mm wide at base.

Thorax: Thorax without depressed areas, forewing-pad length (WL) about 0.02 mm, forewing-pad hind margin rounded, antenna length: forewing-pad length ratio (AWL) = 0.01:0.02 = 0.5.

Humeral lobe (H) adjacent to the eye. All the thoracic sclerites fused with the wing-pad. Wing-pad margins tend to be confluent with the general body margin.

Fore-leg and middle-leg similar in size while the hind-leg is the largest; fore-leg measurements in microns, about as follows: coxa (C), 135 x 120; femur (F), 186x129; tibia (T), 233x78; tarsus (TS), 72x50; claw, 39x48; arolium semicircular.

Hind-leg measurements in microns, about as follows: coxa (C), 156x165; femur (F), 270x168; tibia (T), 317x61; tarsus (TS), 78x56; claw, 39x48; arolium semicircular. Anterior and posterior spiracular apodemes similar about 0.01 mm

long and 0.02 mm wide at atrium.

Abdomen : Caudal plate breadth (CPB) about 0.45 mm and caudal plate length (CPL) about 0.49 mm. Caudal plate breadth: Caudal plate length ratio (CPR) = 0.9. Apical margin of abdomen without tooth-like processes. Caudal plate covers the whole abdomen with a few small transverse sclerites at the base of the abdomen.

Anal opening ventral, sub-apical in position with an outer circumanal pore ring (OR) comprised of single row of pores (AP) = 83+83 and inner circumanal pore ring (IR) = 51+51. Outer circumanal pore ring breadth (ARB) about 0.1 mm.

DERMAL structures: Simple setae present ventrally on head, thorax, abdomen and leg ranging from 0.002 to 0.1 mm long.

Large truncate ringed sectasetae ranging from 0.01 to 0.03 mm long present dorsally on cephaloprothorax (CP) = 5+5, mesothoracic sclerites (MS) and forewing-pad (FW) = 8+8, metathoracic sclerites (MT) and hind-wing pad (HW) = 3 + 3, abdomen = 11+11, head margin sectasetae (HSS) = 18+18, fore-wing-pad margin sectasetae (FWSS) = 33+33, hind-wing-pad margin sectasetae (HWSS) = 5+5, and on abdomen margin sectasetae (ASS) = 38+38, ratio of number of sectasetae (HWSS) = 5+5, and on abdomen margin sectasetae (ASS) = 38+38, ratio of number of sectasetae on abdomen margin to number of sectasetae on forewing-pad margin (FWASS) = 1.15. Small truncate ringed sectasetae about 0.006 to 0.01 mm long scattered on cephaloprothorax (CP) = 20+20, mesothoracic sclerites (MS) and forewing-pad (FW) = 23 +23, metathoracic sclerites (MT) and hind-wing pad (HW) = 14+14, and on abdomen 48+48. Five abdominal spiracles present, about 0.01 mm long and 0.009 mm wide.

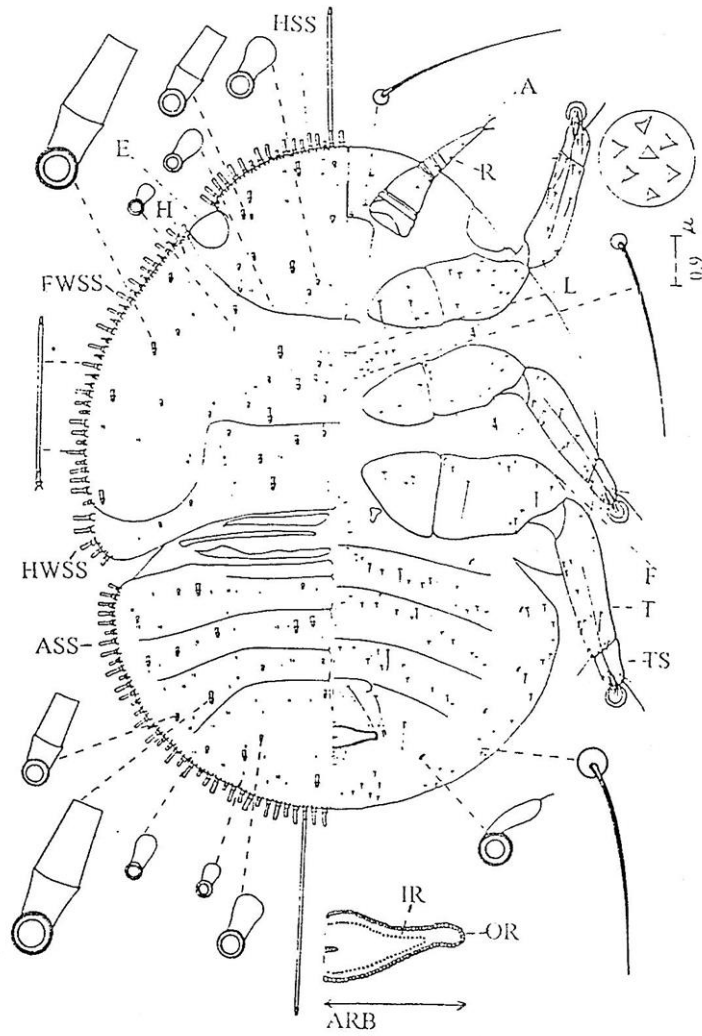
- Material examined: 20 specimens on *Ficus sycomorus* L. 15, 81, 1994, collector authors.

N.B. : Angularity pointed papellae scattered dorsally on all the body in first, second, third, fourth and fifth nymphal instars.

III Key to nymphal instar of species *Pauropsylla Willcocksii* Dębski.

1. Tibia - tarsus not differentiated into tibia and tarsus 2
 - Tibia-tarsus differentiated into tibia and tarsus
 Fifth nymphal instar

- 2 (1). Antenna 2-segmented only and with one rhinaria3
 - Antenna 3- segmented or more in number and with 2 rhinaria or more in number
 4
 3 (2). AP = 18+18, inner circumanal pore ring (IR) absent. Sectasetae (SS) entirely
 absent on head, thorax, and abdomen First nymphal instar
 - AP = 23+23, inner circumanal pore ring (IR) present. Sectasetae (SS) present
 Second nymphal instar
 4 (2). Antenna 3-segmented with 2 rhinaria. AP = 35+35. FWSS=11+11. ASS =
 23+23. FWASS = 2.09 Third nymphal instar
 - Antenna 4-segmented with 3 rhinaria. AP = 60+60. FWSS = 24+24. Ass = 34+34.
 FWASS = 1.41 Fourth nymphal instar



Pl. 6. Fifth nymphal instar of *Pauropsylla willcocksii* Dębski.

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دراسات مورفولوجية على حشرة بسيلليد الجميز (رتبة متشابهة الأجنحة
فوق فصيلة بسيللوديا فصيلة تريوزيدى)

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تعتبر حشرة بسيلليد الجميز (فصيلة تريوزيدى) من أهم الآفات التى تصيب أشجار الجميز فى مصر وتسبب لها اضراراً جسيمة كفاكهة وكاشجار خشبية وكاشجار زينة. وفيما يلى أهم النتائج التى تم التوصل إليها:-

١. تحديد الوضع التصنيفى لهذه الحشرة، حيث أرسلت عينات منها الى المتحف البريطانى.

٢. تم لأول مرة الوصف المورفولوجى لجميع الاطوار غير الكاملة للحشرة (طور البيضه - الأعمار المختلفة لطور الحورية).

٣. تم متابعة تطور الشكل الظاهرى للاعمار المختلفة نتيجة إختفاء أو ظهور بعض الصفات المورفولوجية.

٤. تم تصميم مفتاح تصنيفى للتمييز بين الاعمار الخمسة لطور الحورية.