

DESCRIPTION OF IMMATURE STAGES OF THREE PREDACEOUS MITES
BELONGING TO THE GENUS *AMBLYSEIUS* BERLESE (MESOSTIGMATA:
PHYTOSEIIDAE).

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A B S T R A C T

Immature stages of *Amblyseius barkeri* (Hughes), *A. rubini* Swirski and Amital, *A. swirskii* Athias are described. The anterior coxae of *A. barkeri* and *A. swirskii* (but not *A. rubini*) carry "structures", their number being characteristic for each stage.

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I N T R O D U C T I O N

The phenology and overwintering of various predator mites of the family Phytoseiidae have been studied recently (Wysoki and Swirski, 1971a, 1971b). For these studies the position of the mite population (according to stages) at various seasons had to be determined.

In the present study we describe the immature stage of three *Amblyseius* species; descriptions of other species will be given elsewhere. To the best of our knowledge, only few papers describing young stages of phytoseiid mites have been published (Chant, 1958; Westerboer and Bernhard, 1963; Schuster, 1966; van der Merwe, 1968; Karg, 1971).

We report herein on structures found on the anterior coxae of various mites (coxal glands of A. Fain, 1966), in which their numbers differ according to the stage. In *Amblyseius rubini*, these structures are missing. This character was therefore also used to differentiate between various species

The setal nomenclature used is according to Garman (1948). It is worthwhile mentioning that Karg (1965) developed a larval taxonomic system in the Gamasina. All the specimens were cleared in Nesbitt's solution (chloral hydrate, 40 g; hydrochloric acid, 2.5 ml; dis. water 25 ml.) and most of them were mounted in Hoyer's solution. Some of them were dyed by iodine.

Amblyseius barkeri (Hughes)

Larva (17 larvae). Dorsal shield 172-197 μ long, divided in two plates posterior to D_4 ; bearing eleven pairs of setae: 4 IM, 6L. Setae L_9 are the longest; $L_4 > D_1 > L_1 > D_4$; D_2, D_3, M_1, L_2 are very small, L_5 is minute. Setae L_9 are slightly knobbed. Measurements of setae are given in Table 1.

Three para-anal setae present; a pair of minute pores anterior to the anal plate. Six pairs of setae on the ventral posterior integument.

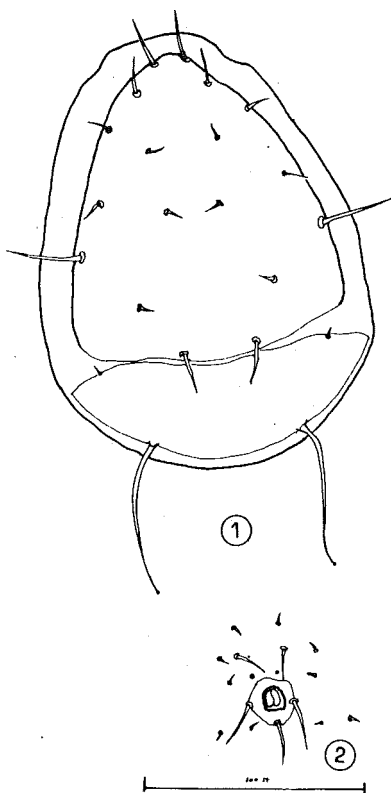
Hind legs without any macrosetae; for measurements segments of legs, see Table 2. Anterior coxa carries one "structure" (Fig. 8).

Table 1: Setae of the dorsal shield (Measurements in μ).

Species	Stage	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	M ₁	M ₂	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇	L ₈	L ₉	
<i>A. barkeri</i> (Hughes)	Larva	21 18-25	8 7-10	6 5- 8	19 17-22	-	-	7 7- 8	-	17 13-20	9 8-10	9 7-12	33 30-38	4 3- 5	-	-	-	-	71 60-78
	Protonymph	15 10-17	12 10-13	12 12-15	15 13-17	14 12-15	7 5- 8	12 10-13	31 28-33	17 17-18	15 12-17	16 15-17	23 20-27	13 12-15	14 12-17	11 10-13	10 3-12	33 30-37	
	Deutonymph	17 15-20	16 15-17	15 13-18	16 15-17	19 17-20	10 8-12	15 13-17	37 35-40	21 20-25	19 17-22	19 17-22	24 23-27	18 17-20	21 17-23	19 17-22	17 15-20	44 40-50	
<i>A. rubini</i> S. and A.	Larva	27 20-30	7 7-10	7 7- 8	27 22-33	-	-	8 7- 8	-	11 8-12	16 12-17	18 15-22	63 56-71	-	-	-	-	-	175 138-199
	Protonymph	26 23-30	12 8-15	12 10-15	22 18-23	22 18-25	6 5- 7	9 8-10	27 22-33	27 23-32	26 23-32	32 25-33	53 46-58	17 10-23	25 18-33	19 17-28	18 17-20	40 32-43	
	Deutonymph	31 28-33	20 17-22	18 17-23	27 25-33	31 30-35	6 5- 7	15 10-17	33 32-38	38 33-45	38 33-45	42 38-50	61 58-71	27 25-35	35 30-43	31 25-35	30 27-33	50 48-61	
<i>A. swirskii</i> Athias	Larva	30 25-33	6 5- 7	6 5- 7	12 10-15	-	-	5 3- 7	-	25 18-30	11 10-13	12 10-15	68 61-78	4 3- 7	-	-	-	-	165 146-183
	Protonymph	22 20-25	7 5- 8	6 4- 7	8 7-10	8 7-10	8 7-10	6 5- 7	63 56-70	36 32-45	14 12-15	14 11-17	54 48-60	9 7-12	11 8-13	6 4- 8	7 5- 8	40 38-43	
	Deutonymph	28 27-30	9 7-10	7 7- 8	9 8-10	8 7-10	9 8-10	7 5- 8	68 61-75	46 43-48	17 15-20	17 13-20	63 56-66	10 8-13	17 15-18	9 8-10	9 8-10	64 60-66	

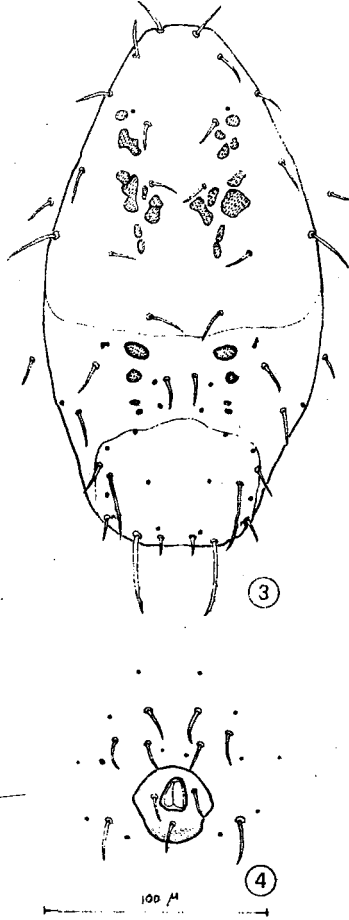
Table 2: Amblyseius barkeri (Hughes), A. rubini Swirski and Amitai, A. swirskii Athias - hind legs, measurements of segments and of setae (in μ).

Species	Stage	Segments			Macrosetae		
		genu	tibia	tarsus	genu	tibia	tarsus
<u>A. barkeri</u>	Larva	21(20-23)	22(20-23)	45(42-50)	-	-	-
	Protonymph	31(28-32)	35(32-38)	77(66-81)	-	-	61(50-66)
	Deutonymph	37(33-42)	42(37-45)	94(85-100)	-	-	64(60-70)
<u>A. rubini</u>	Larva	32(27-35)	32(30-33)	80(75-86)	48(42-58)	50(43-60)	-
	Protonymph	37(32-42)	43(37-48)	106(95-116)	55(50-61)	57(50-70)	73(63-85)
	Deutonymph	47(43-50)	54(38-56)	136(120-146)	56(51-60)	46(42-50)	73(66-81)
<u>A. swirskii</u>	Larva	25(23-27)	27(25-30)	66(61-68)	59(51-71)	44(37-63)	-
	Protonymph	35(32-38)	42(35-40)	101(91-108)	57(50-63)	57(51-63)	78(71-83)
	Deutonymph	42(40-45)	48(43-51)	124(118-129)	60(56-63)	51(43-58)	79(71-83)



Figs. 1,2. *Amblyseius barkeri* (Hughes), larva; 1-dorsal shield, 2- venter.

Protonymph (18 protonymphs). Dorsal shield 256-383 μ long, smooth, divided into two plates. It carries 17 pairs of setae: 6D, 2M, 9L; seta L₉ is the longest one; L₉ > M₂ > L₄ > L₁ \approx D₁; D₄ is usually longer than D₅, sometimes equal to and only in one specimen shorter; D₂ \approx D₃; L₂ \approx L₃ \approx L₅ \approx L₆ \approx L₇ \approx L₈; for measurements of setae, see Table 1; S₁ = 14 (13-15 μ); S₂ = 12 (10-13 μ); setae M₂ and L₉ serrated. Pores and minute structures: between D₂ and L₃, between D₄ and L₅, anterior to L₅, lateral to L₆, lateral to D₅ (two), on the posterior plate (six). Many spots are present on the anterior shield as well as on the integument between the two plates.



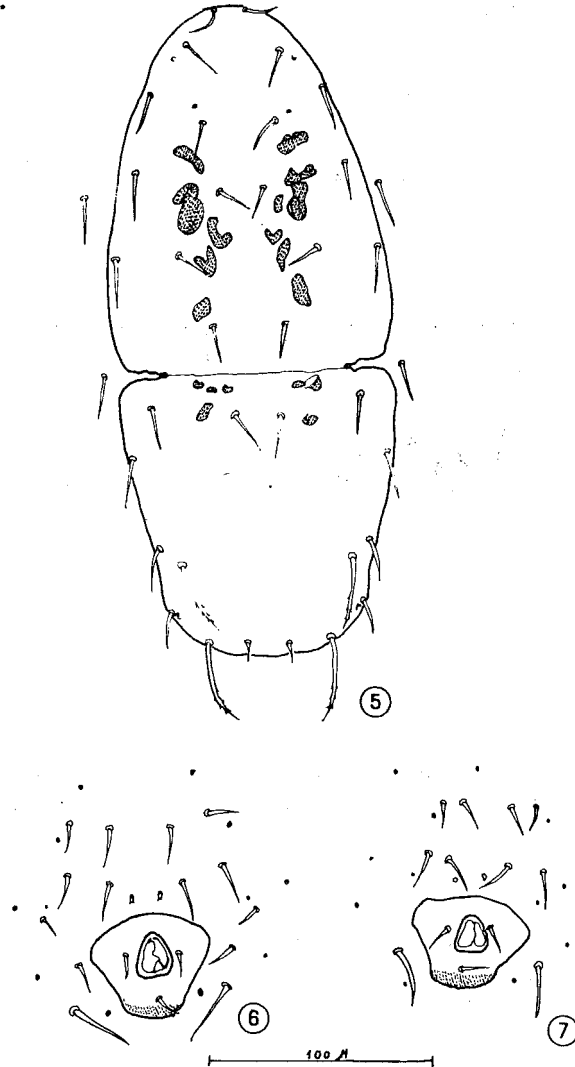
Figs. 3,4. *Amblyseius barkeri* (Hughes), protonymph; 3-dorsal shield, 4-venter.

Anal plate with three setae. Three pairs, besides VL_1 , surrounding the anal plate; a pair of minute pores anterior to the plate; six pairs of minute round structures on the ventro-posterior integument. Seta $VL_1 = 17(15-18\mu)$. Apex of peritreme reaches L_4 or almost so.

Fourth leg carries a macroseta on basitarsus; third leg has none. For measurements of segments and macrosetae of legs, see Table 2. Anterior coxa carries two "structures" (Fig. 9).

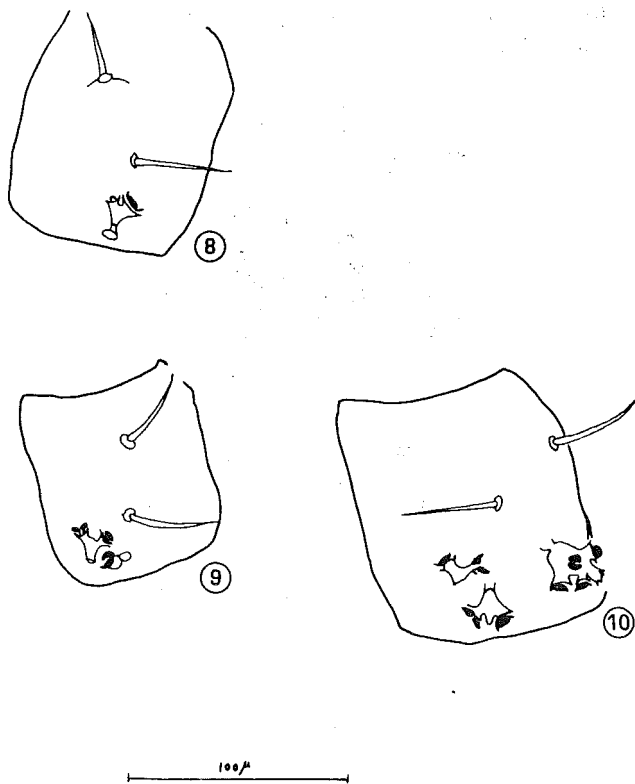
Deutonymph (18 deutonymphs). Dorsal shield 262-300 μ long, smooth, with a pair of clefts near S_2 ; a thin barely prominent

line connects the two clefts, so that the dorsal shield is really divided into two plates. It carries 17 pairs of setae: 6D, 2M, 9L; L_9 is the longest seta on the dorsal shield; $M_2 > L_4 > L_1$; L_2, L_3, L_5-L_8 are subequal; $D_5 \approx D_4$, D_1-D_3 are subequal; for measurements of setae, see Table 1; $S_1=17(15-20\mu)$, $S_2=17(15-18\mu)$. Setae M_2 and L_9 are slightly serrated. Pores and minute structures: between L_1 and L_2 , between D_2 and L_2 , mesad to the cleft, mesad to L_8 . A number of spots are present between D_2 and D_5 .



Figs. 5-7. *Amblyseius barkeri* (Hughes), deutonymph; 5-dorsal shield; 6-venter of female; 7-venter of male.

Anal plate with three setae; setae surrounding anal plate increase to seven pairs in the female and to five pairs in the male deutonymph; a pair of minute pores anterior to the anal plate; six pairs of minute round structures on the ventro-posterior integument; seta $VL_1 = 31$ ($27-35\mu$). Apex of peritreme reaches L_1-L_2 .



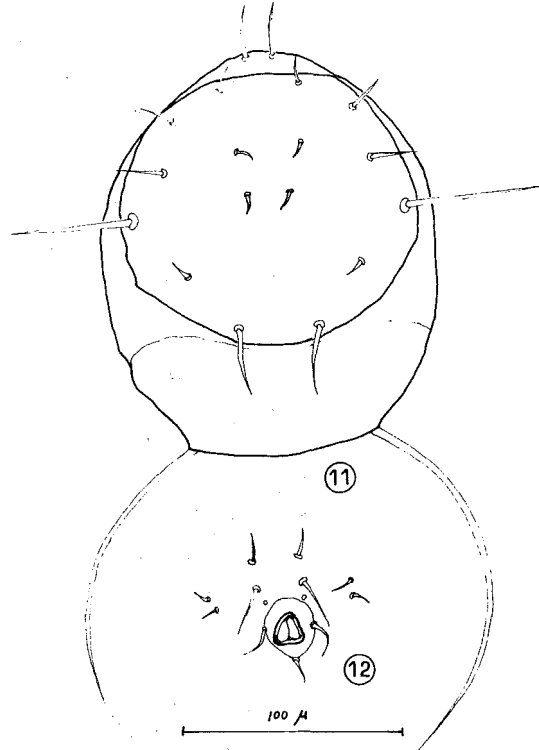
Figs. 8-10 *Amblyseius barkeri* (Hughes), structures on anterior coxae; 8-larva, 9-protonymph, 10-deutonymph.

Fourth leg carries a macroseta on basitarsus, third leg without one; for measurements of segments and macrosetae of the legs, see Table 2. Anterior coxa carries three "structures" (Fig. 10).

Amblyseius rubini Swirski and Amitai

Larva (18 larvae). Dorsal shield $158-188\mu$ long, smooth, divided into two plates. It carries ten pairs of setae: 4D, 1M, 5L. Setae L_9 are very long and whip-like, slightly knobbed; setae

D_2, D_3, M_1 minute; seta L_1 small; $L_4 > D_4$; D_4 usually longer than D_1 , but in some specimens they are equal in length and in one specimen only is D_1 longer than D_4 ; $L_3 > L_2$; measurements of setae are given in Table 1.



Figs. 11, 12 *Amblyseius rubini* Swirski and Amitai, larva; 11-dorsal shield; 12-venter.

Three para-anal setae present; a pair of anal pores is prominent. Four pairs of setae surrounding anal plate, the one anterior to anal plate is the longest.

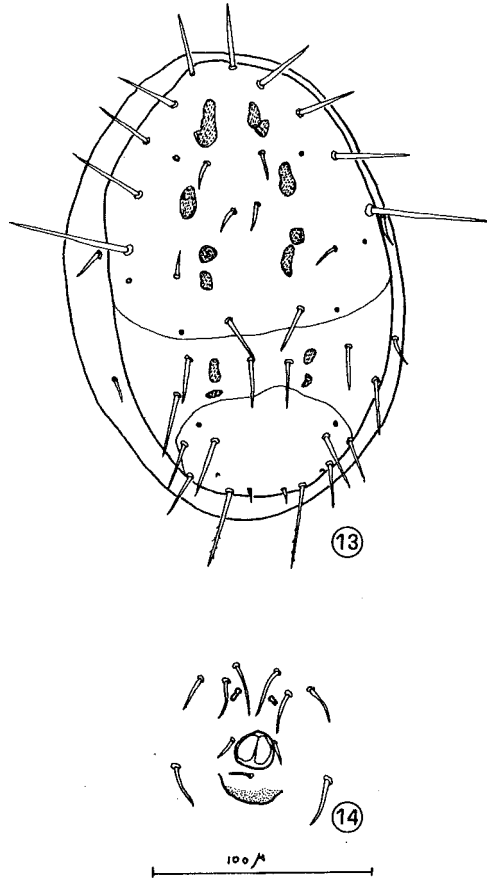
Third leg carries two macrosetae; for measurements of segments and macrosetae, see Table 2. No "structures" on the anterior coxae.

Protonymph (13 protonymphs). Dorsal shield 166-235 μ long, divided into two plates, with a broad integument between them. There are 17 pairs of setae on the dorsal shield: 6D, 2M, 9L.

L_4 is the longest seta; $L_4 > L_9 > L_3 > L_1 \approx L_2 > L_6 > L_7 > L_8 > L_5$;

$D_1 > D_5 > D_4 > D_2 \approx D_3 > D_6$; $M_2 > M_1$. For measurements of setae, see Table 1. $S_1 = 18 (17-22\mu)$, $S_2 = 11 (10-13\mu)$. Seta L_9 is slightly

serrated. Pores and minute structures: between D_2 and L_3 , posterior to L_4 , anterior to L_5 , antero-lateral to M_2 , mesad to L_8 . Spots of varying shape are present between L_2 and D_5 .



Figs.13,14 *Amblyseius rubini* Swirski and Amitai, proto-nymph; 13-dorsal shield; 14-venter.

The borders of the anal shield not seen prominently in our specimen; four pairs, besides the para-anals, surround the anus; anal pores present; seta $VL_1=21$ ($15-25\mu$). Apex of peritreme does not reach L_4 and almost reaches M_1 .

Fourth leg carries three macrosetae and the third leg, two; measurements of segments and macrosetae are given in Table 2. No "structures" on the anterior coxae.

Deutonymph (11 deutonymphs). Dorsal shield $249-294\mu$ long,

smooth, single, carrying 17 pairs of setae: 6D,2M,9L;

$L_4 > L_9 > L_3 > L_1 \approx L_2 > L_6 > L_5 \approx L_7 > L_8$; setae D_1, D_4, D_5 large;

$M_2 \approx D_1 < D_5 > D_4 > D_2 \approx D_3 > M_1 > D_6$; for measurements of setae, see Table 1;

$S_1 = 20$ (18-23 μ), $S_2 = 16$ (15-17 μ). Setae L_9 slightly serrated.

Pores and minute structures: between D_2 and L_3 , posterior to L_4 (sometimes two), anterior to L_5 , anterolateral to M_2 , mesad to L_8 . Spots of varying shape are present between D_2 and M_2 .



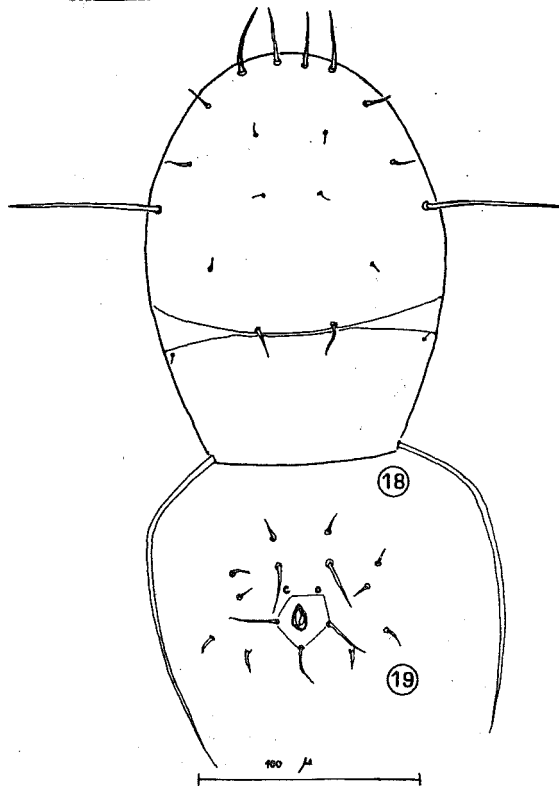
Figs.15-17. *Amblyseius rubini* Swirski and Amitai, deutonymph; 15-dorsal shield; 16-venter of male; 17-venter of female.

The borders of the anal shield are not prominent in our specimens. Ian pores present. In the female deutonymph five pairs of setae (and in the male - three pairs), besides VL_1 , surround the anal plate. Seta $VL_1=33(32-38\mu)$. Apex of peritreme reaches L_2-L_3 .

Fourth leg carries three macrosetae and the third leg, two. For measurements of segments and macrosetae, see Table 2. No "structures" on the anterior coxae.

Amblyseius swirskii Athias

Larva (18 larvae). Dorsal shield smooth, $179-224\mu$ long; divided into two plates. It carries 11 pairs of setae: 4D, 1M, 6L; seta L_9 is very long, seta L_4 is long; setae D_2, D_3, M_1, L_5 , minute; $D_1 > L_1 > L_2 = L_3 = D_4$; measurements of setae are given in Table 1.



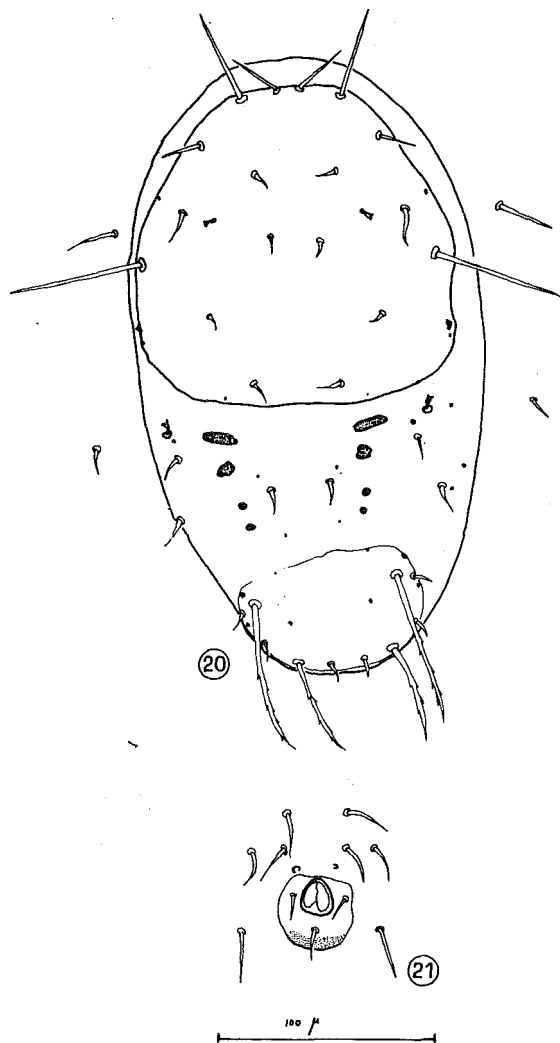
Figs. 18, 19. *Amblyseius swirskii* Athias, larva; 18-dorsal shield; 19-venter.

Three para-anal setae present, six pairs of setae surrounding the anal plate.

Third leg carries two macrosetae; measurements of segments and macrosetae are given in Table 2. Anterior coxa carries one "structure" (Fig. 25).

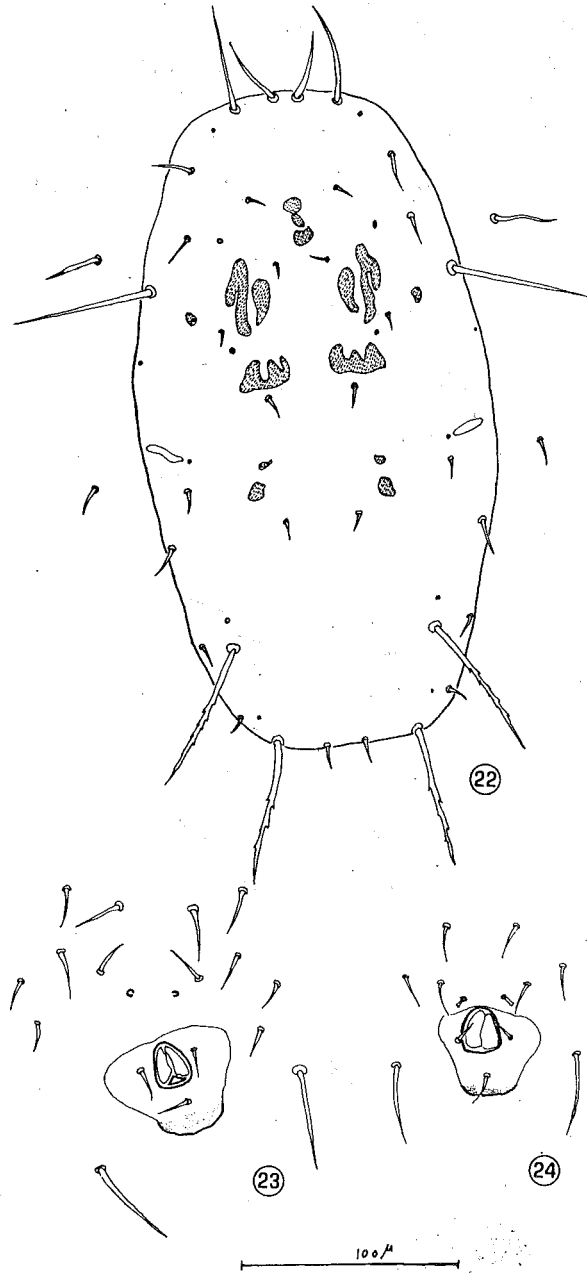
Protonymph (20 protonymphs). Dorsal shield 216-266 μ long, divided into two plates with a broad integument between them. There are 17 pairs of setae on the dorsal shield: 6D,2M,9L.

$M_2 > L_4 > L_1 > D_1 > L_2 \approx L_3 > L_6 > L_5 > L_7 \approx L_8$; for measurements of setae,



Figs.20,21. *Amblyseius swirskii* Athias, protonymph; 20-dorsal shield; 21-venter.

see Table 1; $S_1=23(22-25\mu)$; $S_2=9(7-10\mu)$. Setae M_2 and L_9 slightly serrated. Pores and minute structures: between L_3 and L_4 , between D_3 and L_3 , posterior to L_4 (two), posterolateral to D_4 , anterior to M_2 (two), postero-mesad to M_2 ,



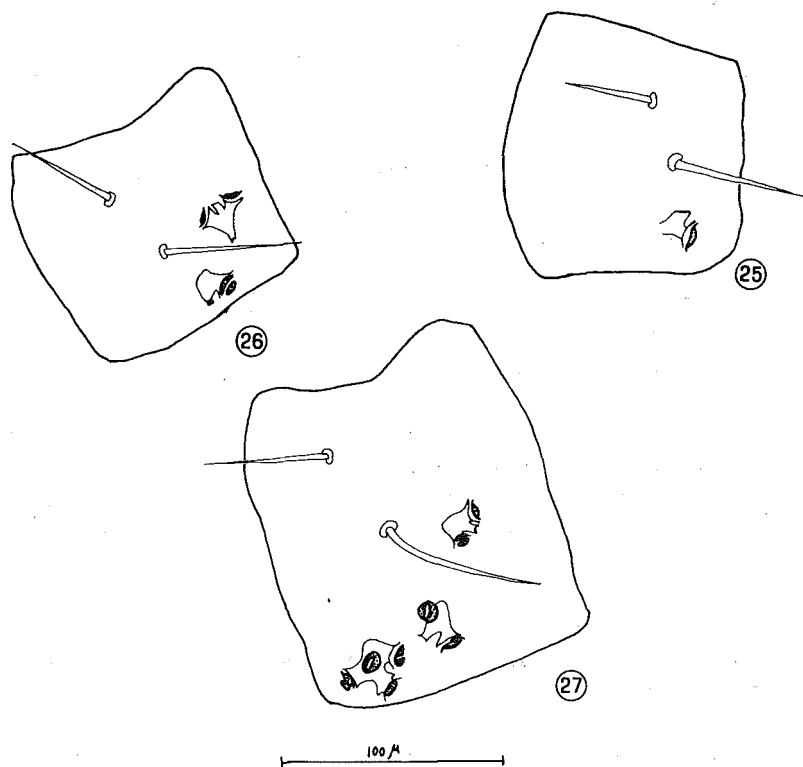
Figs.22-24. *Amblyseius swirskii* Athias, deutonymph; 22-dorsal shield; 23-venter of female; 24-venter of male.

between L_7 and L_8 , two anterior to L_5 (one of them calyx-shaped), lateral to L_6 , antero-lateral to L_6 , anterior to D_5 , posterior to D_5 . Four pairs of spots on the integument between the two dorsal plates.

Anal shield with three setae; three pairs of setae, besides VL_1 , surround the anal plate; anal pores present. Seta $VL_1=21(18-25\mu)$. Apex of peritreme almost reaches L_1 .

Fourth leg carries three macrosetae and the third leg, two; measurements of segments and macrosetae are given in Table 2. Anterior coxa carries two "structures" (Fig. 26).

Deutonymph (18 deutonymphs). Dorsal shield $281-315\mu$ long, smooth, with a pair of small holes anterior to L_5 , carrying 17 pairs of setae: 6D, 2M, 9L. $M_2 > L_9 \approx L_4 > L_1 > D_1 > L_2 \approx L_3 \approx L_6 > L_5 \approx L_7 \approx L_8$;



Figs.25-27 *Amblyseius swirskii* Athias, structures on anterior coxae; 25-larva, 26-protonymph, 27-deutonymph.

for measurements of setae, see Table 1; $S_1=26(25-28\mu)$, $S_2=13(12-15\mu)$. Setae M_2 and L_9 are serrated. Pores and minute structures: between L_1 and L_2 , between D_3 and L_3 , between M_1 and D_4 , posterior to L_4 , anterior to L_5 , anterior to M_2 , mesad to L_8 . Spots of varying shape between D_2 and D_5 .

Anal shield with three setae; anal pores present. In the female deutonymph six pairs of setae (and in the male, three), besides VL_1 , surround the anal plate. Seta $VL_1=43(40-46\mu)$. Apex of peritreme reaches L_1-L_2 .

Third leg carries two macrosetae and the fourth leg, four macrosetae. For measurements of segments and macrosetae, see Table 2. Anterior coxa carries three "structures" (Fig.27).

Key to the immature stages of *Amblyseius barkeri* A. *rubini* and *A. swirskii*.

1. Three pairs of legs. Dorsal shield carries 10-11 pairs of setae: 4D, 1M, 5-6L (Figs.1,11,18). Anterior coxa carries one "structure" or none ... larvae.. 2
- Four pairs of legs. Dorsal shield carries 17 pairs of setae: 6D, 2M, 9L (Figs. 3,13,20). Anterior coxa with 2-3 structures or none. .. protonymphs or deutonymphs..... 4
2. Seta L_5 absent; seta D_4 3-5 times longer than setae D_2 , D_3 (Table 1). Four pairs of setae surround the anal plate. No "structures" on the anterior coxa. Seta L_9 very long (138-199 μ). Third leg long, with two macrosetae.....
.....larva of *A. rubini*
- Seta L_5 present; seta D_4 approximately twice as long as setae D_2 , D_3 (Table 1). Six pairs of setae surround the anal plate. Anterior coxa carries "structures"..... 3
3. Hind leg without macrosetae, short (Table 2).
Seta L_9 long (60-70 μ). larva of *A. barkeri*
- Two macrosetae on hind leg, which is long (Table 2).
Seta L_9 very long (146-183 μ).larva of *A. swirskii*

4. Two "structures", or none, present on the anterior coxa. Dorsal shield divided into two plates, with a space between them protonymphs 5
- Three "structures", or none, present on the anterior coxa. Dorsal shield entire, or divided into two plates, with no space between them deutonymphs 7
5. Hind leg carries one macroseta; none on the third. Hind leg short (Table 2). Setae L_1 , L_4 , not prominently longer than other lateral setae; L_9 longest. Setae D_2 - D_5 short; D_4 , D_5 equal to or slightly longer than D_2 , D_3 . Peritreme short, its apex reaching L_4 , or almost so. "Structures" present on the anterior coxae... protonymph of *A. barkeri*
- Hind leg carries three macrosetae, third leg, two. Hind leg long (Table 2). 6
6. Seta L_1 longer than L_3 ; seta L_4 much longer than L_2 , L_3 . Setae D_2 - D_5 minute; setae D_4 , D_5 subequal in length to D_2 , D_3 (Fig. 20, Table 1). Apex of peritreme reaches L_1 . Anterior coxa with "structures". Preanal setae not arranged in a transverse row.....protonymph of *A. swirskii*
- Seta L_1 shorter than L_3 ; seta L_4 slightly longer than L_2 , L_3 . Setae D_2 - D_5 elongate, much longer than D_2 - D_3 (Fig. 13, Table 1). Apex of peritreme does not reach L_4 and almost reaches M_1 . Anterior coxa without "structures". Preanal setae arranged almost in transverse row (Fig.14)...deutonymph of *A. rubini*
7. Preanal setae arranged in a transverse row (Fig. 16). Six pairs of setae in the female deutonymph (five in the male) surround the anal plate (Figs. 16,17). Anterior coxa without "structures". Apex of peritreme reaches L_2 - L_3 . Setae D_4 , D_5 much longer than setae D_2 , D_3 (Fig. 15, Table 1). Hind leg carries three macrosetae and the third leg, two; hind leg long (Table 2).....deutonymph of *A. rubini*
- Preanal setae not arranged in a row (Figs. 6, 23). Seven pairs of setae in the female deutonymph (five in the male) surround the anal plate (Figs. 6,7,23,24). Anterior coxa with "structures". Apex of peritreme reaches L_1 - L_2 . Setae D_4 , D_5 subequal to or slightly longer than D_2 , D_3 (Figs. 5,22, Table 1). 8

8. Hind leg carries one macroseta and the third leg, none; hind leg short (Table 2). Seta L_4 slightly longer than L_2 , L_3 (Fig. 5, Table 1). deutonymph of *A. barkeri*
- Hind leg carries three macrosetae and the third leg, two; hind leg long (Table 2). Seta L_4 much longer than L_2 , L_3 (Fig. 22, Table 1). deutonymph of *A. swirskii*

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