

FOUR NEW SPECIES OF EUPODID
MITES FROM EGYPT
(ACARI: EUPODOIDEA: EUPODIDAE)

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EUPODIDAE
EUPODES
COCCEUPODES

SUMMARY: Four eupodid mites, *Eupodes zaheri* n. sp., *E. bakeri* n. sp., *Cocceupodes sharkiensis* n. sp. and *Linopodes barnufi* n. sp. are described and illustrated.

RÉSUMÉ : Quatre eupodides sont décrits et illustrés *Eupodes zaheri* n. sp., *E. bakeri* n. sp., *Cocceupodes sharkiensis* n. sp. et *Linopodes barnufi* n. sp.

INTRODUCTION

Members of the Eupodoidea are terrestrial and cosmopolitan in distribution. The greatest numbers of eupodoid species are found in the top layers of grassland and woodland soils, where a wide range of habitats such as semiarid terrestrial localities, habitats with prevailing moist conditions, intertidal coastal regions, arctic regions and steam vents are exploited (STRANDTMANN & GOFF 1978). A comprehensive study of the Eupodidae was undertaken to supplement the only previous work by ABOU-AWAD (1984) and ABOU-AWAD & EL-BAGOURY (1984&1985). Through this work, four species were collected belonging to genera *Eupodes*, *Cocceupodes* and *Linopodes*, and described.

MATERIAL & METHODS

Specimens were mounted using HOYER's media. Body length of specimens was measured from the

posterior margin of the idiosoma to the anterior margin of the naso. Body width was measured as the distance between setae c_2 and the lateral margins of the body. Setal lengths represent the distance from the setal base to the tip. All dimensions are given as micrometers. Terminology and setal notation follow those proposed by LINDQUIST & ZACHARDA (1987) and BAKER (1990). Measurement criteria follow those of ZACHARDA (1980). Abbreviations are as follows: prodorsal setae: internal vertical (iv), external vertical (ev), trichobothria (T), scapular (sc); opisthosomal setae: internal humeral (c_1), external humeral (c_2), first dorsal (d_1), second dorsal (e_1), internal lumbar (f_1), external lumbar (f_2), internal sacral (h_1), external sacral (h_2); gnathosomal setae: basal subcapitular setae (sbc_1), apical subcapitular setae (sbc_2), cheliceral setae (cha); genital region: aggenital setae (ag), genital setae (g); anal region: adanal setae (a); pseudanal setae (ps); podosomal region: coxal setae (1a 3a, 2a, 3a-3d, 4a-4c). The holotype, allotypes and paratypes of the new species are deposited in the

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plant protection Department, National Research Centre.

FAMILY EUPODIDAE KOCH, 1842

GENUS *Eupodes* Koch, 1835

Eupodes zaheri n. sp.

(Figs. 1-4)

Affinities: This species is related to *E. temperatus* Shiba and *E. longisetatus* Strandtmann but differs consistently in the subcapitulum, there are two forms (cone shaped or ovoid shaped) in the same species; c_1 , d_1 , e , and f_1 setae longer than internal distance (surpassing setae) and all being less than $\frac{1}{2}$ as long as width of the body. Leg I and IV longer than the body. Famulus on tarsus I and dorsomedian solenidion on genua I and II absent.

Female. — (Figs. 1-4). Body length 338-486, body width 203-315. The type specimen 374 long, 230 wide. Idiosoma elliptic. Subcapitulum (FIG. 2A-B) with two forms, either narrowly cone shaped or ovoid shaped, length of first form 77, width 48, ratio length to width 1.60, length of second ones 70, width 57, ratio length to width 1.23. Subcapitulum with two subcapitular setae, sbc_2 subapical ventrally and tend toward clavate, sbc_1 basilateral and slightly spiculate. Palp (FIG. 2C) four-segmented, terminally slightly acicular, tarsi with eight short setae, short and slender, about $\frac{1}{2}$ as long as tibia and without a basal solenidion, tibia with three pinnated setae, femorogenu with two dorsal pinnated setae. Fixed digit of chelicera simple and slightly forked, weakly movable digit, one cheliceral seta (cha) smooth and located dorsally just proximal to fixed digit.

Dorsal idiosoma (FIG. 1A). — Sejugal furrow represented by faint line of striae, naso, semi-rounded lobe. Prodorsum subtriangular, surrounded with few faint broken lines just behind naso, with a pair of eye-spots and four pairs of setae: iv 26, ev 33, about $\frac{1}{2}$ as long as T, T 70 slender and minutely ciliated, sc 40 ciliated setae. Internal distances of prodorsal setae: iv-iv 9, ev-ev 64, T-T 59, sc-sc 96. Opisthosoma bears eight pairs of long ciliated setae: c_1 , d_1 , e_1 and f_1 setae longer than distance and each less than $\frac{1}{2}$ as long as width of the body; c_2 , f_2 and h_2 shorter. Lengths of opisthosomal setae: c_1 88; c_2 64; d_1 92; e_1 92; f_1 85; f_2

60; h_1 84; h_2 60. Internal distance: c_1 - c_1 35; c_1 - c_2 , 97; c_2 - c_2 218; c_1 - d_1 81; d_1 - d_1 77; d_1 - e_1 62; e_1 - e_1 53; e_1 - f_1 84; f_1 - f_1 18; f_1 - h_1 14; h_1 - h_1 15.

Ventral idiosoma (FIG. 1B). — Coxae in two groups defined. Trochanteral formula 1 1 1 1, epimeral formula I-IV, 3-1-4-3; inner setae of coxa IV 4a not separated from its plate. All coxal setae of about the same length, except 1c, which are simple and shorter, about $\frac{1}{2}$ as long as 1b. Most ventral setae ciliated and blunt. Genital region (FIG. 3B) with seven pairs of aggenital setae, each genital flap with six genital setae, in which the 4th is more lateral than the others. Length of genital cover flaps 73; with two pairs of medium size genital papilla. Anal pore terminal, with three pairs of setae; ps_3 18 about $\frac{1}{2}$ length of ps_2 , ps_1 46, the longest.

Legs (FIG. 4). — With finely ciliated setae. Leg I and IV longer than the body. Femur I partially divided; femora III and IV with distinct divisions. Femur IV prominently enlarged, width 68.

Leg chaetotaxy (adult):

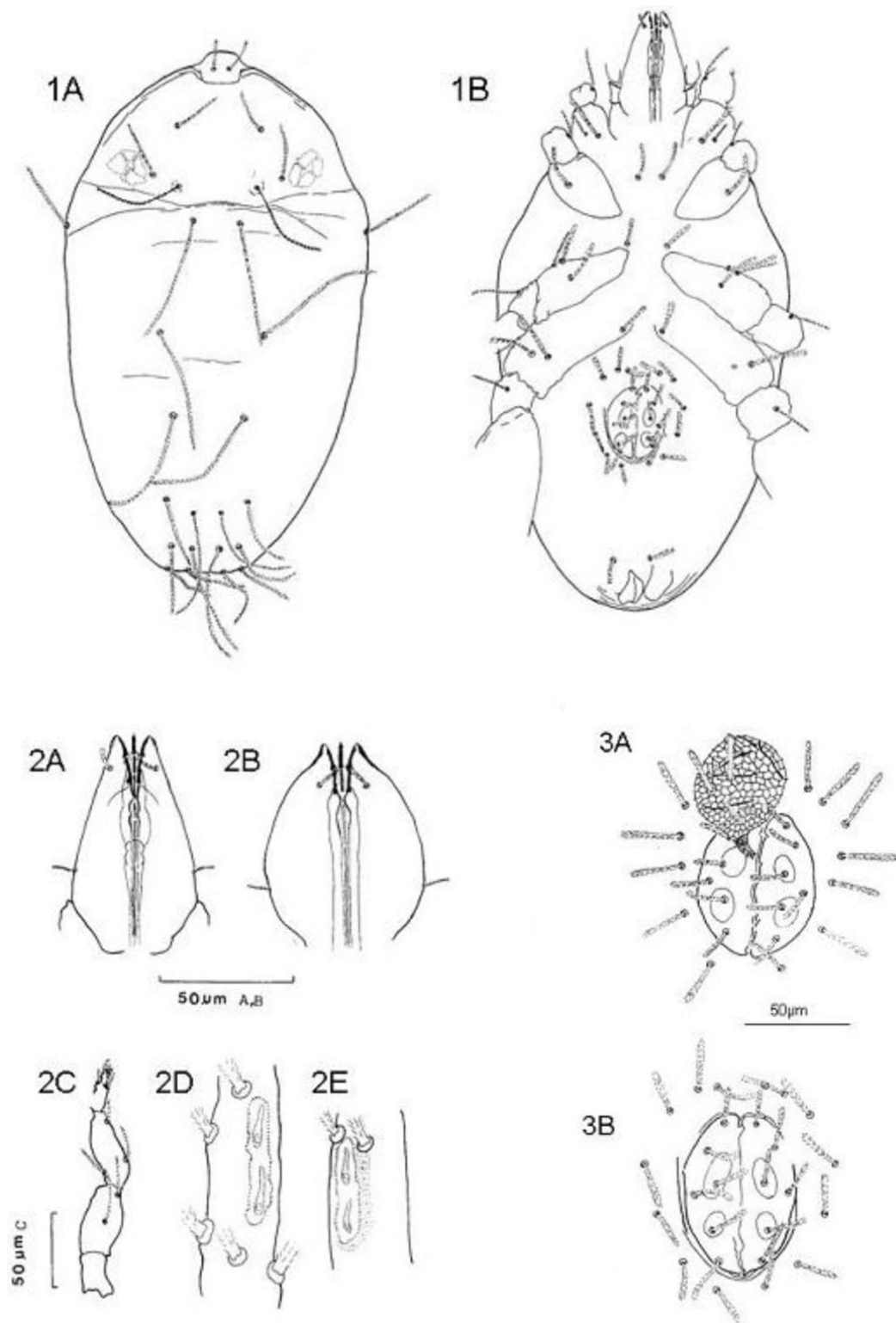
	Femur	Genu	Tibia	Tarsus
I	18	14	17	31
II	15	7	9	17
III	4	5	5	15
IV	7	5	6	15

Measurements of leg segments:

	Troch.	Femur	Genu	Tibia	Tarsus	Total
I	27	185	104	113	117	546
II	27	90	41	50	63	271
III	32	86	41	54	68	281
IV	45	149	63	68	95	420

Length of tarsus I 117; width 13, ratio length to width 9. Length of tarsus II 63; width 15, ratio length to width 4.2. Tarsus I and II (FIG. 2 D-E), each with one rhagidial organ with two rhagidial solenidia in tandem and in a common insertion pit. Famulus of tarsus I absent. Tibia I with apical dorsal rhagidial seta (one dorsodistal solenidion). Solenidia on genua I and II absent. Apotele. Claw longer than pad-like empodium.

Male (FIG. 3 A). — Length of body 369; width of body 203. Sperm sac length 53, large, capitate and shorter than the genital coverflaps, with conspicuous



FIGS. 1-3. *Eupodes zaehri* n. sp. female. 1.A. — Dorsal view. 1B. — Ventral view. 2A, 2B. — Subcapitulum. 2C. — Palp. 2D. — Tarsus I. 2E. — Tarsus II. 3A. — Male genitalia. 3B. — Female genitalia.

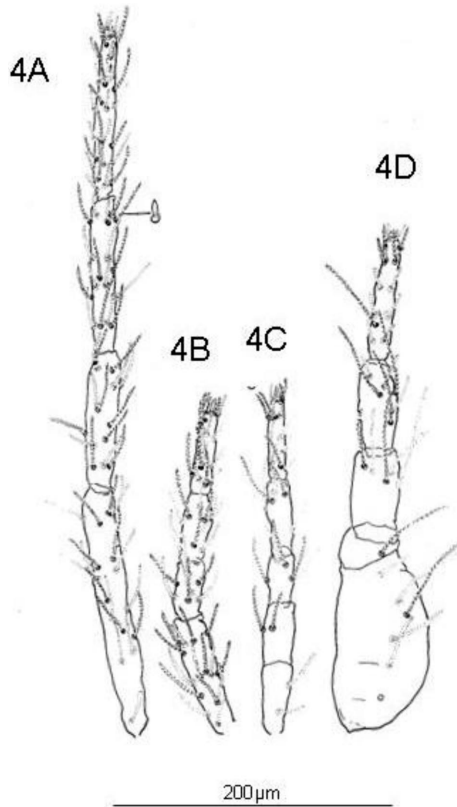


FIG. 4. — *Eupodes zaheri* n. sp. Legs I, II, III & IV, femur to tarsus.

ornamentation, aggenital setae relatively longer than in female. Leg I 576. Leg IV 396

Material examined. — Egypt: Northern Province. Holotype ♀, Rashid, El-Behera, regularly occurring in winter, soil depth 0-5 cm, under fruit trees, B. A. ABOU-AWAD, 9. III. 1997. Paratypes: 11 ♀, Rashid, El-Behera, 5. XI 1998; 9 ♀ Shebin-Elkoom, El-Menufiya, 11. IX. 1999; 7 ♀, Shiplinga, El-Qaliubiya, 3. XII. 1999. Allotype: 2 ♂, same data as holotype.

ETYMOLOGY. — The mite is named Dr. M. A. Zaher, Professor of Acarology, Faculty of Agriculture, Cairo University.

Eupodes bakeri n. sp.
(FIGS. 5-8)

Affinities: *E. bakeri* is similar in appearance to *E. zaheri* in having two forms of the subcapitulum, but

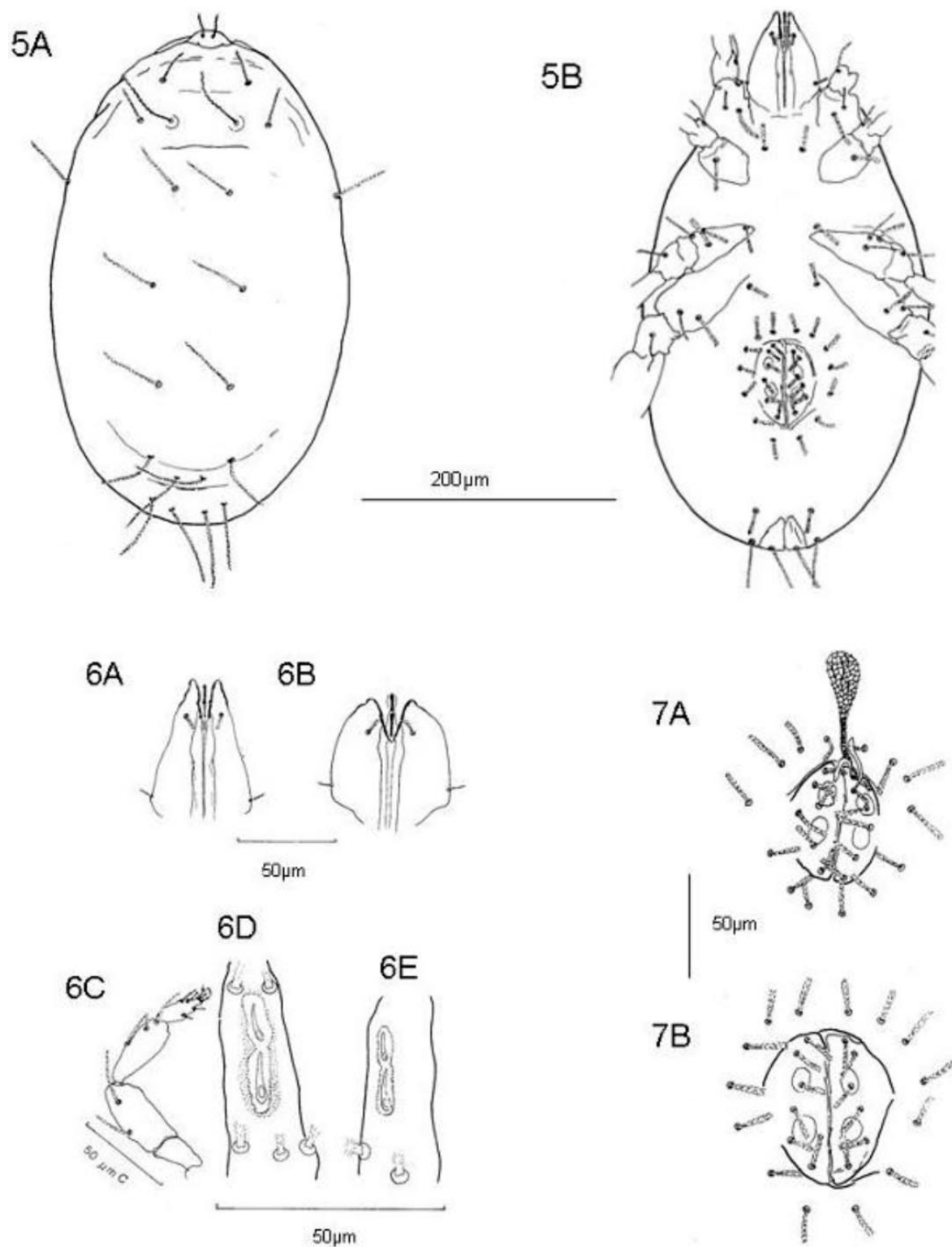
differs consistently from the latter by dorsal opisthosomal setae that are shorter than intersetal distances (non-surpassing setae). Rhagidial solenidia are distinct only in tarsus I and II. Chaetotaxy of leg setae and intersetal distance between idiosomal setae are different.

Female (FIG. 5-6). — Length of body 302-410. Width of body 171-265. The type specimen 396 long, 230 wide. Sejugal furrow not prominent, tapers slightly forward to broadly rounded posterior. Subcapitulum (FIG. 6A-B), with two forms, either narrowly cone shaped or ovoid shaped. First form length 70, width 48, ratio length to width 1.46. Second ones length 68, width 59, ratio length to width 1.15. Each subcapitulum with two subcapitular setae, sbc_2 subapical, sbc_1 basilateral and slightly spiculate setae. Palpus setal formula 0-2-3-8 respectively, spiculate setae. Tarsus of palp short and slender, about $\frac{1}{2}$ as long as tibia and without solenidion. Fixed digit of chelicera simple, slightly forked, cha seta smooth and located dorsally.

Dorsal idiosoma (FIG. 5A). — Sejugal furrow not visible, represented by a faint line just behind trichobothria. Naso, a clear subtriangular lobe. Prodorsum subtriangular with faint broken lines and four pairs of prodorsum setae: iv 20, ev 29, sc 31, about $\frac{1}{2}$ the length of T. Internal distance of prodorsum setae: iv-iv 7, ev-ev 64, T-T 51 and $\frac{1}{2}$ as long as sc-sc. Opisthosoma with eight pairs of short ciliate setae, c_1 equal to c_2 , d_1 equal to F_2 and e_1 equal to h_2 . Setae lengths: c_1 44, c_2 45, d_1 46, e_1 51, f_1 59, f_2 46, h_1 64, h_2 51. Internal distance :

c_1 - d_1 79 equal to d_1 - e_1 , c_1 - c_1 46, c_1 - c_2 88, c_2 - c_2 222, d_1 - d_1 73 subequal to e_1 - f_1 , e_1 - e_1 57, f_1 - f_1 26, f_1 - h_1 26, h_1 - h_1 22.

Ventral idiosoma (FIG. 5B). — Coxae in two groups defined. Trochanteral setal formula :1-1-1-1. Epimeral formula 1-IV: 3-1-4-3, inner seta of coxa IV (4a) separated from its plate. All coxal setae of about same length, except (1c), which are simple and shorter, more than $\frac{1}{2}$ as long as (1b). Ventral setae ciliated. Genital region (FIG. 7B) with seven pairs of aggenital setae, each genital flap with six genital setae. Length of genital cover flaps 68, with two pairs of medium size genital papillae. Anal pore terminal, with three pairs of setae, ps_3 18 about $\frac{1}{2}$ as long as the ps_2 , ps_1 50, the longest.



FIGS. 5-7. *Eupodes bakeri* n. sp. 5A. — Dorsal idiosoma, female. 5B. — Ventral idiosoma, female. 6A, 6B. — Subcapitulum. 6C. — Palp. 6D. — Tarsus I. 6E. — Tarsus II. 7A. — Male genitalia. 7B. — Female genitalia.

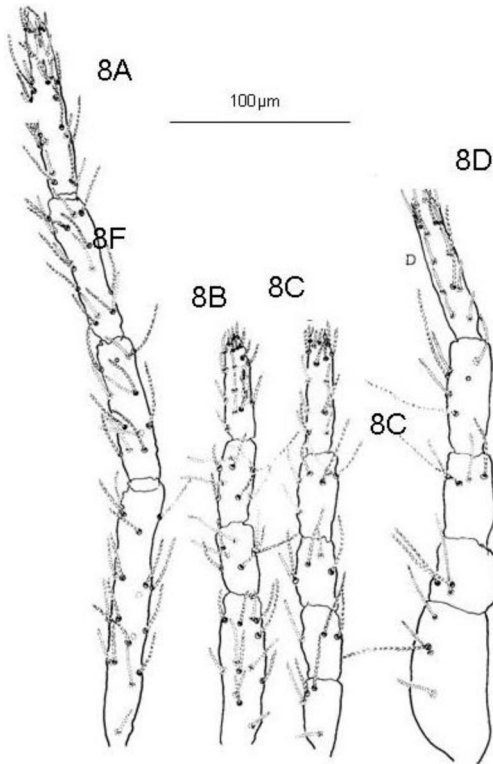


FIG. 8. *Eupodes bakeri* n. sp. — Legs I, II, III & IV, femur to tarsus.

Legs (FIG. 8). — With finely ciliated setae. Leg I longer than body. Femora III and IV distinct divisions. Femur IV somewhat enlarged width 37.

Leg chaetotaxy (adult):

	Femur	Genu	Tibia	Tarsus
I	19	13	15	28
II	13	7	9	17
III	7	5	6	18
IV	7	4	6	15

Measurements of leg segments:

	Troch.	Femur	Genu	Tibia	Tarsus	Total
I	40	126	77	81	90	414
II	24	81	36	45	48	234
III	32	72	36	45	63	248
IV	41	95	59	54	81	330

Length of tarsus I 90, width 15, ratio length to width 6. Length of tarsus II 48, width 15, ratio length to width 3. 2. Tarsus I and II (FIG. 6D-E) each with one rhagidial organ with two rhagidial

solenidia in tandem and in a common insertion pit. There are apparently no solenidia on any leg segments. Apotele. Claw longer than pad-like empodium.

Male (FIG. 7A). — Length of body 329; width of body 194. Sperm sac length 48, medium sized sac, clavate and about an equal to genital cover flaps, with conspicuous ornamentation, dividing into two-ducts before intering the genital atrium, associated with a complex of ducts and glands inside the latter. Measurements of legs are: I 378; II 243; III 284; IV 266.

Material examined. — Egypt: Northern Province. Holotype ♀, Rashid, El-Behera, regularly occurring in winter, under fruit trees, B. A. ABOU-AWAD, 3. XII. 1995. Paratypes: 7 ♀, Alexandria, 17. II. 1997; 5 ♀, El-Kassasin, El-Sharkiya, 23. I. 1998; 4 ♀ El-Qaliubiya, 9. IX. 1999; 7 ♀, El-Gharbiya, 11. II. 2000. Allotype: 2 ♂, same data as holotype.

ETYMOLOGY. — The mite is named Dr. A. S. BAKER (The Natural History Museum, London) for her remarkable contribution to the knowledge of eupodoid mites.

Genus *Cocceupodes* Sig Thor, 1934

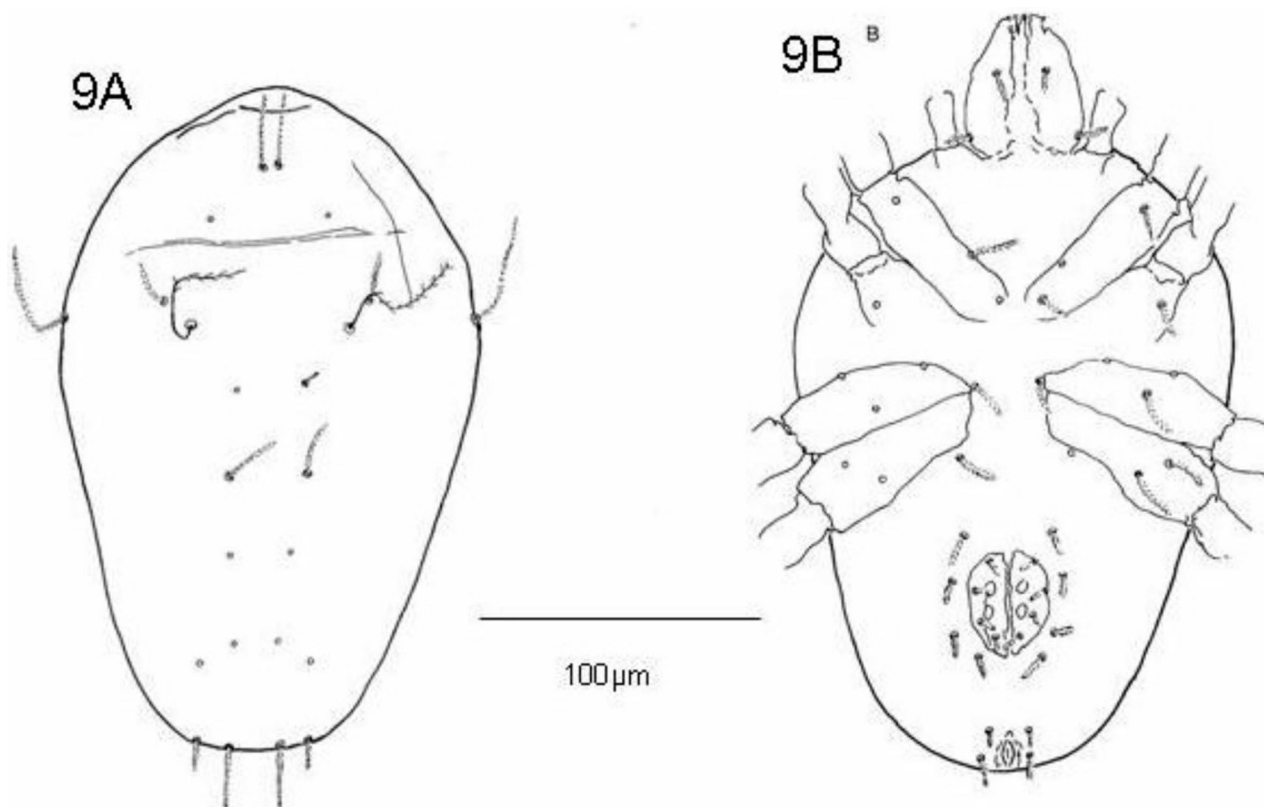
Cocceupodes sharkiensis n. sp.

(FIGS. 9-10)

Affinities: This species is morphologically similar to *C. mollicellus*, but differs in having threadlike iv setae, roughly triangular peak of naso; c2 shorter than idiosomal dorsal setae; epimeral formula, 3-1-4-3; tarsus II with only two rhagidial organs tandem to each other.

Female (FIGS. 9-10). — Length of body 224. Width of body 145. Idiosoma not divided, tapers slightly from shoulders to broadly rounded posteriorly. Subcapitulum, conical, with two pairs of ciliated setae, sbc₂ approximately medial, sbc₁ basilateral, sbc₂ shorter than sbc₁. Palpus setal formula 0-2-3-7, short ciliated setae. Tarsus of palp subequal ½ as long as tibia, femorogenu 33, trochanter 13. Ciliated cheliceral seta cha, as in all *Cocceupodes*, located dorsally just proximal to the fixed digit.

Dorsal idiosoma (FIG. 9 A). — Sejugal furrow absent, as in all *Cocceupodes* species. Naso, distinct



FIGS. 9. *Cocceupodes sharkiensis* n. sp. female — A. — Dorsal view. B. — Ventral view.

and roughly triangular peak. Prodorsum subtriangular shaped, two faint broken parallel lines between ev and T setae, with four pairs of ciliated setae: iv threadlike and inserted far from posterior to base of naso, 26 in length; ev seta, broken off; T about 2× as long as iv; sc 18 and $\frac{2}{3}$ as long as iv setae. Internal distance of prodorsum: iv-iv, 7 about $\frac{1}{5}$ as long that of ev-ev; T-T 55; sc-sc 64. Opisthosoma with eight pairs of short ciliate setae, c_1 7 very short and about $\frac{2}{3}$ as long as h_2 , c_2 40 and about 6× as long as c_1 , d_1 20 subequal to h_1 . Other opisthosomal dorsal setae broken off. the distance between bases of opisthosomal setae c_2 - c_1 22, c_1 - c_2 62, 2× as long as c_1 - d_1 and e_1 - f_1 , c_2 - c_2 139, d_1 - d_1 equal to d_1 - e_1 , e_1 - e , equal to h_1 - h_1 , f_1 - f_1 15, f_1 - h_1 35.

Ventral idosoma (FIG. 9 B). — Coxae in two distinct groups. Trochanteral formula 1-1-1-1 setae. Epimeral formula I-IV, 3-1-4 3. Outer seta of coxa I equal to inner seta 1a. Middle seta 1b 18. Genital region with four pairs of short aggenital

setae. Each genital flap with four genital setae. Two pairs of genital papillae. Anal pore terminal, with only two pairs of pseudanal setae characteristic of genus. ps_1 absent, ps_3 about $\frac{1}{3}$ as long as ps_2 .

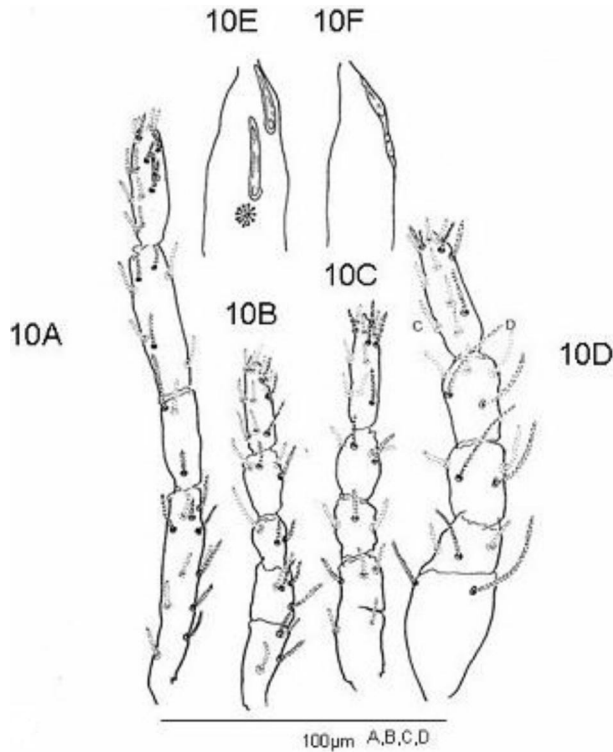
Legs (FIG. 10). — Leg I longer than body. Femora II partially divided, III and IV with distinct division. Femur IV somewhat enlarged.

Leg chaetotaxy (adult)

	Femur	Genu	Tibia	Tarsus
I	12	3	7	14
II	8	3	4	12
III	5	3	4	13
IV	5	4	5	12

Measurements of leg segments:

	Troch.	Femur	Genu	Tibia	Tarsus	Total
I	20	81	37	81	26	245
II	11	53	20	26	33	143
III	11	44	20	26	42	143
IV	18	53	31	31	44	177



FIGS 10. *Cocceupodes sharkiensis* n. sp. female. 10A, D. — legs I, II, III, IV. 10E. — Tarsus I. 10F. — Tarsus II.

Length of tarsus I 26, width 13, ratio length to width 2. Length of tarsus II 33, width 11, ratio length to width 3. Tarsus I (FIG. 10 E) with two rather long subequal rhagidial organs, one behind the other, with a famulus at the proximal end of the basal rhagidial organ. Tarsus II (FIG. 10 F) with two rhagidial organs tandem to each other. Apparently no other sensory setae on legs. Apotele. claw longer than pad-like empodium.

Material examined. — Egypt: Northern Province. Holotype ♀, El-Monagah, El-Sharkiya, collected from litter and upper soil layer under citrus trees, B. A. ABOU-AWAD, 9. XII. 1995.

ETYMOLOGY. — The mite is named for the name of locality (El-Sharkiya region), where it had been observed.

Genus *Linopodes* Koch, 1835

Linopodes barnufi n. sp.

(FIGS. 11-13)

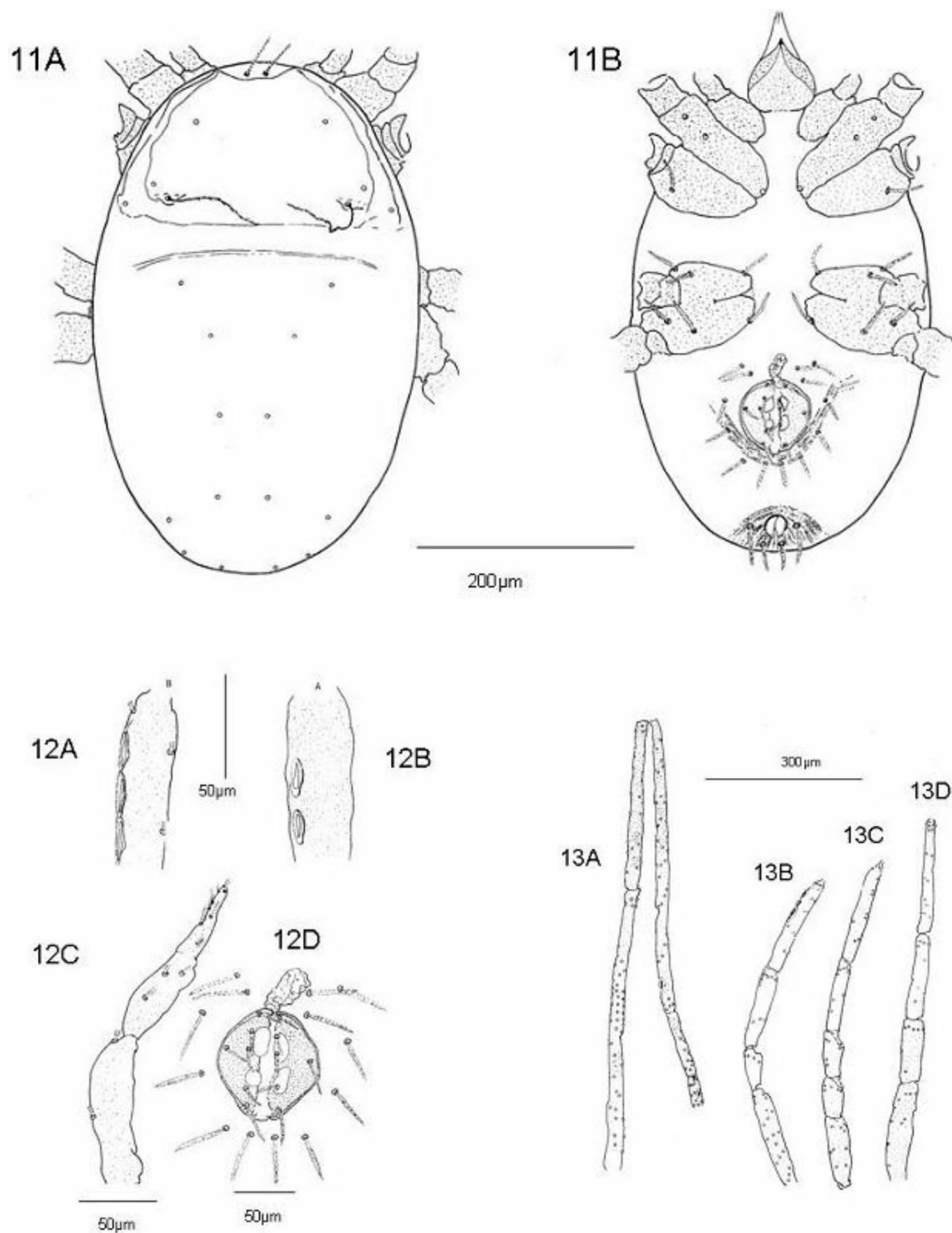
Affinities: This species is similar to *L. cameronesis*, but can be distinguished from it by setal formula of

palpal segments; I-IV, 0-2-3-7 with rhagidial organ, tarsus $\frac{1}{2}$ as long as the femorogenu. leg I is nearly four times as long as the body length. Aggenital region with 6-7 pairs setose setae, pointed apically. Two pairs of pseudanal setae. Tarsus II with three rhagidial organs.

It is of interest to note that the figures and descriptions are based on a single male. External morphology differences between males and females of the eupodid are usually very subtle. Sexual dimorphism is only marked in the genitalia, which are discernible in macerated specimens. Descriptions of other features therefore apply to both sexes. The ratio is almost female biased, although in some rare species, females have not been noted. However, STRANDTMANN (1971), SHIBA (1978) and OLIVIER AND THERON (1997) described the males of *Cocceupodes shepardi*, *Eupodes okinoshimaensis* and *E. hamatus* as a new species, respectively. Thereon, the present study applies these aforementioned note with this rare species.

Male (FIGS. 11-12). — Length of body 459, width of body 288. Idiosoma not divided, integument soft, showing dense of fine punctures, ovoid shaped. Subcapitulum cone elongated shaped, with two pairs of ciliated setae, sbc_2 approximately medial, sbc_1 basilateral, sbc_2 shorter than sbc_1 . Setal formula of slender palpal segments I-II (FIG. 12 c): 0-2-3-7, with rhagidial organ at approximately base of tarsus. Tarsus shorter than tibia and $\frac{1}{2}$ as long as the femorogenu. Fixed digit relatively large, chelicera 117 long, with one short nude seta cha, located dorsally.

Dorsal Idiosoma (FIG. 11 A). — Sejugal furrow represented by two broken parallel in complete faint lines. Naso, distinct and roughly triangular peak. Prodorsum, subtriangular shaped, with internal two fine sinuous lines from behind of each trichobothria, extending forward and surrounding margin of the prodorsum, forming internal subtriangular shaped, with four pairs of ciliated setae: iv inserted on naso and close to posterior margin, 38 in length, ev and sc broken off, T 86 in length. Internal distance of prodorsal setae: iv-iv 14, ev-ev 113, T-T 160, Sc-Sc 185. Opisthosoma with eight of broken setae. The distance between bases of opisthosomal setae: c_1 - c_1 131, c_1 - c_2 81, c_2 - c_2 234, c_1 - d_1 55, d_1 - d_1 , equal to F_1 - h_1 , d_1 - e_1 , equal to e_1 - F_1 , e_1 - e_1 44, about equal to F_1 - F_1 , h_1 - h_1 40.



FIGS. 11-13. *Linopodes barnuffi* n. sp. 11A. — Male, dorsal view. 11B. — Male, ventral view. 12A. — Tarsus I, 12B. — Tarsus II. 12C. — Palp. 12D. — Male genitalia. 13. — Legs I, II, III & IV, femur to tarsus.

Ventral idiosoma (FIG. 11 B). — Coxae in two distinct groups. Trochanteral formula 1-1-1-1 setae. Epimeral formula I IV: 3-1-3-3, pointed apically. Coxae finely punctured. Genital region (FIG. 12 D) with 6-7 pairs of aggenital setose setae and pointed apically. Genital cover flaps finely punctured, with 6 pairs of short ciliated setae, 4 th pair being more lateral in position than the others. Sperm sac 44 in length. Two pairs of genital papillae. Anal pore terminal, with only two pairs of pseudanal ciliated setae, pointed apically, ps₂ being the longest.

Legs (FIG. 13 B). — All legs longer than body and finely punctured. Leg I extraordinary long, characteristic of genus, and about four times as long as the body length, its tibia being the longest, following femur, genu and tarsus. Empodium and claws of tarsus I small.

Leg chaetotaxy (adult):

	Femur	Genu	Tibia	Tarsus
I	43	22	34	21
II	19	4	9	16
III	13	6	7	14
IV	9	7	9	16

Measurements of leg segments:

	Troch.	Femur	Genu	Tibia	Tarsus	Total
I	50	545	306	576	293	1770
II	27	243	81	153	189	693
III	27	311	90	135	194	757
IV	50	204	99	159	210	722

Length of tarsus I 293, width 15, ratio of length to width 19.53. Length of tarsus II 189, width 15, ratio of length to width 12.6. Solenidia. Tarsus I (FIG. 12 A) with two rhagidial organs, one behind the other in separated fields, tibia I has a dorsoapical rhagidial organ. Tarsus II (FIG. 12 B) with three rhagidial organs, one behind the other in separated fields, tibia II has a dorsoapical rhagidial organ. There are apparently no sensory setae on the other leg segments. Apotele. Claw longer than pad like empodium, empodium of leg I reduced.

Material examined. - Egypt: Northern Province Holotype ♂, Rasheed, El-Behera, collected from litter and upper soil layer under ploughman,s spike-nard (barnuf shrubs), B. A. ABOU-AWAD, 17. XII. 1998.

ETYMOLOGY.- This mite is named for the name of plant is widely spread in the region, where it had been found.

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