

THE FAMILY PACHYLAELAPIDAE VITZTHUM, 1931
ON TENERIFE ISLAND (CANARY ISLANDS),
WITH DESCRIPTION OF SEVEN NEW SPECIES
OF THE GENUS *PACHYLAELAPS*
(ACARI, MESOSTIGMATA: PACHYLAELAPIDAE)

BY Maria L. MORAZA ¹ and Miguel A. PEÑA ²

(Accepted January 2005)

ACARI
PARASITIFORMES
MESOSTIGMATA
PACHYLAELAPIDAE
TAXONOMY
PACHYLAELAPS
NEW SPECIES
TENERIFE ISLAND
(CANARY ISLANDS)

SUMMARY: The family Pachylaelapidae Vitzthum, 1931, in Tenerife Island (Canarian Archipelago) is represented by *Pachyseius humeralis* Berlese, 1910, and twelve species of *Pachylaelaps*, seven of which are new for science — *P. silviae*, *P. mandibularis*, *P. auricularis*, *P. intermedius*, *P. glandularis*, *P. canariensis* and *P. subkarawaiewi*. *P. longisetis*, Halbert, 1915, *P. brachyperitrematus*, Koroleva, 1977, *P. regularis*, Berlese, 1921 are recorded, and two unknown species which are not considered new, because of the absence of female specimens, are described. The ontogeny and notation of the dorsal chaetotaxy is discussed.

ACARI
PARASITIFORMES
MESOSTIGMATA
PACHYLAELAPIDAE
TAXONOMÍA
PACHYLAELAPS
NUEVAS ESPECIES
TENERIFE
(ISLAS CANARIAS)

RESUMEN : La familia Pachylaelapidae Vitzthum, 1931, está representada en la isla de Tenerife (Archipiélago Canario) por *Pachyseius humeralis* Berlese, 1910 y doce especies del género *Pachylaelaps*, siete de las cuales se describen como nuevas para la ciencia — *P. silviae*, *P. mandibularis*, *P. auricularis*, *P. intermedius*, *P. glandularis*, *P. canariensis* y *P. subkarawaiewi*. Se citan *P. longisetis*, Halbert, 1915, *P. brachyperitrematus*, Koroleva, 1977, *P. regularis*, Berlese, 1921, y se describen dos especies desconocidas, no consideradas como nuevas dada la ausencia de ejemplares hembras. Se discute la ontogénea y notación de la chaetotaxia dorsal de este género.

INTRODUCTION

Tenerife Island (Canarian Archipelago) is located 307 kilometers off the west coast of Africa, at 28° north latitude. It is of volcanic origin, dating back 15.6 million years. It has an area of 2,034 square kilometers and has a maximum altitude of 3,717

meters. The island's mild climate, wide habitat diversity and annual rainfall of 420 mm have given rise to 1,396 species of vascular plants. One third of its biota is endemic. The family Pachylaelapidae Vitzthum, 1931 is represented by a numerous group of free-living predatory mites of variable body size. They typically live in forest litter, superficial layers of soil,

1. Departamento de Zoología y Ecología, Facultad de Ciencias, Universidad de Navarra, C/ Irunlarrea s/n, Pamplona 31080 (Navarra), España. E-mail: mlmoraza@unav.es

2. Area del Medio Ambiente del Cabildo de Gran Canaria, C/ Prof. Agustín Millares Carló, s/n, 1°, 35003, Las Palmas de Gran Canaria, España, e-mail: mapena@grancanaria.com

compost, dung, moss and intermareal zones although they can also be found in caves, nests of small mammals, ant nests and in association with other arthropods (ALEXANDROVA, 1980; COSTA, 1971; GU & HUANG, 1991; HIRSCHMANN & KRAUSS, 1965; KARG, 1971; KOROLEVA, 1977 a, b; VISHNUPRIVA & MOHANASUNDARAM, 1988). Currently, the family consists of seven genera, *Pachylaelaps* Berlese, 1888, *Sphaerolaelaps* Berlese, 1903, *Pachyseius* Berlese, 1910, *Olopachys* Berlese, 1910, *Pachyseius* Moraza and Johnston, 1990, *Pseudopachyseius* Moraza and Johnston, 1993, and *Zygoseius* Berlese, 1916 (provisionally considered to be a member of this family) (LINDQUIST & EVANS, 1965, HALLIDAY, 1997). This is the first study of the family Pachylaelapidae on the Canary Islands and the diversity has been surprising.

MATERIALS AND METHODS

Mites were collected by MIGUEL ÁNGEL PEÑA ESTÉVEZ. The specimens were extracted using the Berlese-Tullgren method. Mites were rinsed in Nesbitt's solution before mounting in Hoyer's medium on microscope slides. Males were dissected in order to facilitate observation of the spermatodactyl structure. Measurements are presented as ranges (minimum to maximum) or mean size or as approximations. Shield lengths were measured along their midlines, widths at their broadest point. Setae were measured from the bases of their insertion to their tips; distance between setae as the distance between their insertions. Idiosomal setal notation follows LINDQUIST & EVANS (1965), with modifications for the caudal region as given by LINDQUIST (1994) and LINDQUIST & MORAZA (1999). Leg chaetotaxy follows EVANS (1963). Idiosomal notation of glands and lyrifissures follows JOHNSTON & MORAZA (1991).

In the discussions following descriptions of new species, comparisons with previously described species based only on previous descriptions.

The specimens come from different locations and sampling dates. On their labels a sample code was used: the letter T -for Tenerife- followed by a correlative number. The codes are indicated for each species. The implicit information of these codes is the

given in the TABLE 1. Holotypes and paratypes are deposited in the Museum of Zoology of University of Navarra.

RESULTS

A total of 13 species of this family were identified. They belong to the genera *Pachylaelaps* Berlese, 1888, and *Pachyseius* Berlese, 1910.

Pachyseius Berlese, 1910

The genus *Pachyseius* exhibits the following characteristics: female with sternal setae *st4* on metasternal platelets; genital shield with straight posterior margin; ventro-anal shield present; narrow peritrematal shield; one or two distal spine-like setae on tarsus II. These mites live in the litter and upper layers of the soil, in moss, in caves and in nests of small mammals. The genus has been reported from Western Europe (Spain, France, Russia, Netherlands, Poland, and Romania), China, Japan and Australia (introduced into this continent by human activities).

Pachyseius humeralis Berlese, 1910

This is the type species of the genus. The specimens from Tenerife have characteristics which coincide exactly with the description provided by HYATT (1956) and KOROLEVA (1977 a). *P. humeralis* shows a wide distribution in Western Europe and has been found in forest litter, cultivated soils, moss, compost and in association with nests of small mammals.

Studied material: In Tenerife, the species was found in litter, humus and high humidity soil. Six specimens were studied: two females and two deutonymphs from sample T-41, one female from T-59 and one female from T-48.

Pachylaelaps Berlese, 1888

The genus *Pachylaelaps* is rich in species. HIRSCHMANN & KRAUSS (1965) diagnosed 53 species, KOROLEVA (1977 a, b) added twenty more and in the recent years several more have been described from Africa (VAN DRIEL *et al.*, 1977), Poland (MAJEWSKI, 1982),

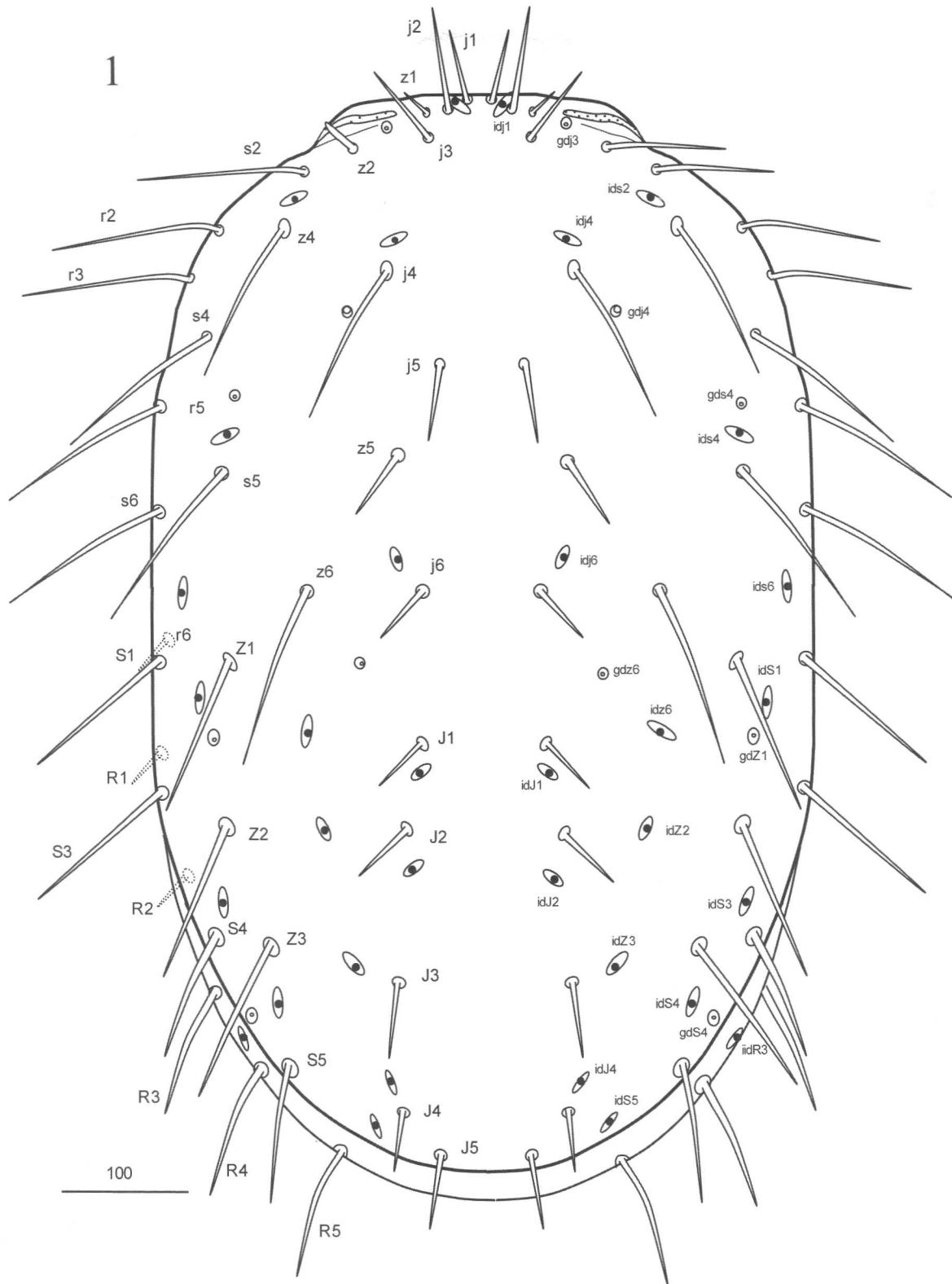


Fig. 1. — *Pachylaelaps silviae*, female, dorsal idiosoma view. Dorsal chaetotaxy follows LINDQUIST & EVANS, 1965 and LINDQUIST, 1994.

TABLE I

Ref.	Sample	Vegetation	Habitat	Altitude	UTM 28RCS	Locality	Date
T-13		Laurisilvae forest	riverbed	850 m	211 352	Monte del Agua (Bco. de Blas)	9.12.1995
T-15	soil & litter	Laurisilvae forest	riverbed	750 m	212 350	Monte del Agua (Bco. de Blas)	9.12.1995
T-40	soil & litter		Close to permanent rivulet	750 m	744 562	Llano de los Viejos	25.1.1997
T-41	soil & litter	Laurisilvae forest	grove forest	800 m	741 565	Llano de los Viejos	25.1.1997
T-42	soil	<i>Erica arborea</i>	grove forest	950 m	749 565	Cruz del Carmen	25.1.1997
T-46	soil & litter	Fayal-heath		950 m	756 572	Pico del Inglés	25.1.1997
T-48	soil & litter	<i>Senecio tussilaginis</i> , <i>Gesnouinia arborea</i> , <i>Echium sp.</i> , <i>Erica arborea</i>	stone area	850 m	740 569	Las Yedras	25.1.1997
T-49	earth walls	lichens, mosses, <i>Aeonium sp.</i> ,	north-oriented walls	850 m	739 569	Las Yedras	25.1.1997
T-54	soil	<i>Artemisa canariensis</i> <i>Rumex lunaria</i> , <i>Ricinus communis</i> , grasses	nitrophyle thicket	250 m	817 594	Taganana	25.1.1997
T-59	soil	<i>Canarina canariensis</i> , <i>Cedronella canariensis</i> <i>Erica arborea</i>	close to cascade	650 m	865 600	Las Bodegas	25.1.1997
T-63	soil	<i>Grenovia aurea</i> , <i>Sonchus sp.</i> , <i>Senecio tussilaginis</i> <i>Teline sp.</i> , etc..	hillside	400 m	827 576	San Andrés	25.1.1997
T-73	soil	<i>Pinus canariensis</i> , <i>Cistus symphytifolius</i>	grove forest	1950 m	567 389	Fuente Joco	29.5.1997
T-81	soil	<i>Populus alba</i> , <i>Rubus ulmifolia</i> , <i>Tropaeolus major</i>	grove forest	500 m	610 505	San Nicolás	29.5.1997
T-84	soil & litter	<i>Pinus canariensis</i> , <i>Rubus ulmifolia</i> , <i>Pteridium aquilinum</i>	reforested forest	1100 m	647 472	La Montañeta	30.5.1997

China (MA, 1885; GU & HUANG, 1991; MA & WANG, 1997; MA & YIN, 2000), India (VISHNUPRIYA & MOHANASSUNDARAM, 1988) and Europe (SCHMÖLZER, 1992).

Pachylaelaps exhibits two morphological patterns previously noted by KOROLEVA (1977 a) in his identification key:

Type I: females with long, narrow and well-sclerotized corniculi; spermathecae usually well-sclerotized, starting from coxa IV or from coxa III and IV, extending toward the central zone of the body; two spine-like distal setae on tarsus II; and nine pairs of ventral setae (*Zv4* and *Zv5* present). Males with outgrowths on palp-tibia.

Type II: females with less sclerotized corniculi with a wider base; spermathecae long and thin, tubular,

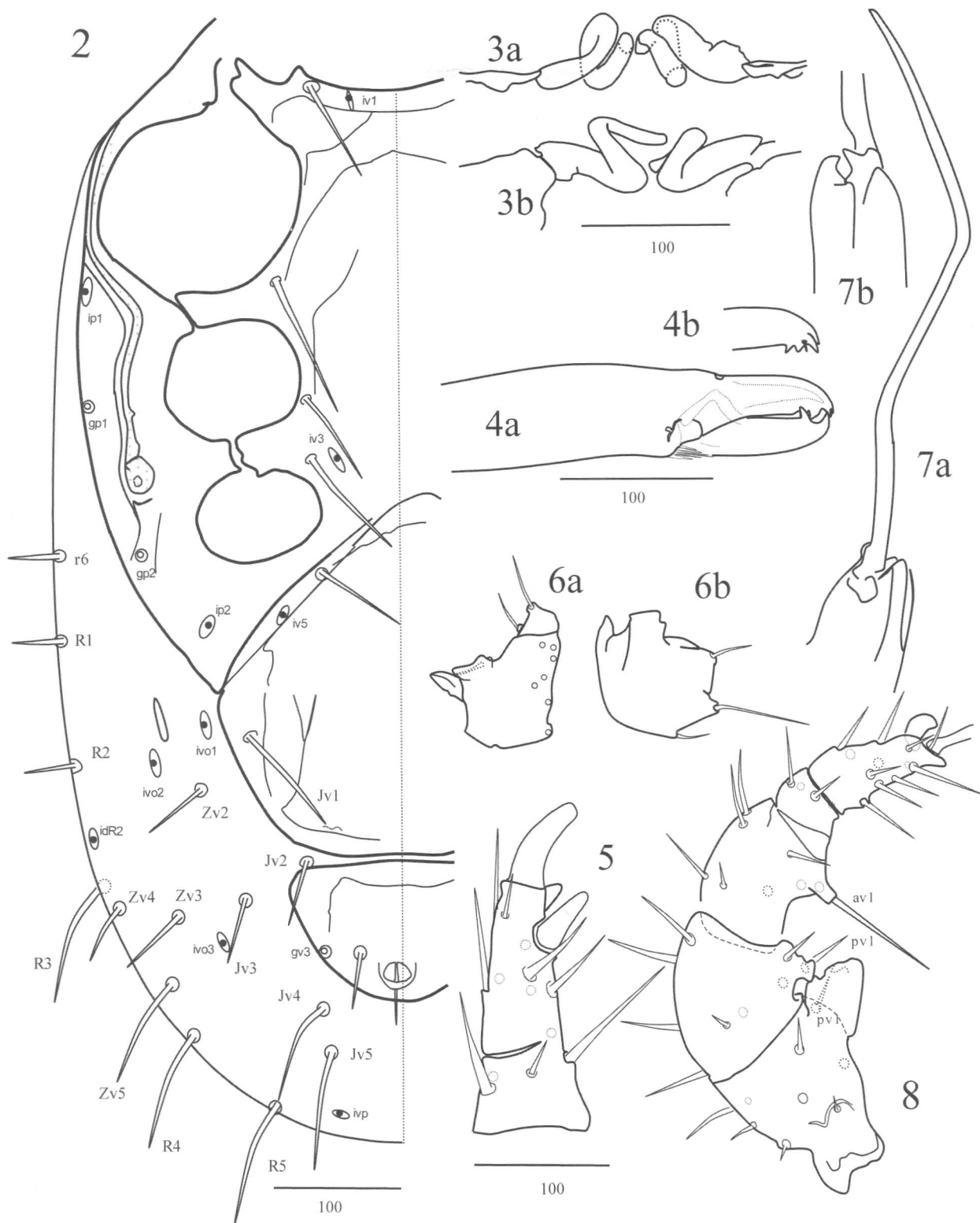
starting from coxa III, extending toward the posterior region of the body; one spine-like distal seta on tarsus II; and seven pairs of ventral setae (*Zv4* and *Zv5* absent). Males without palp-tibial outgrowths.

Species of *Pachylaelaps* belong to the type I morphological pattern

Pachylaelaps silviae n. sp. FIGS. 1-8

TYPES: Holotype: female, in high humidity soil and litter from a closed laurisilvae forest, altitude 800 m., UTM 28RCS 741 565, 25 I 1997, Llano de los Viejo (T-41).

Paratypes: one female and two males from the same locality and date.



FIGS. 2-8. — *Pachylaelaps silviae*: 2. — Female, ventral idiosoma. 3 a-b. — Spermatheca; 4a. — Female, chelicera, antiaxial view. 4b. — Apical detail of fixed digit; 5. — Female, Tarsus II, lateral view; 6 a. — Male, tibia and tarsus of the palp; 6b. — Male, palptibia; 7a. — Detail of distal region of chelicera and spermatodactyl, ventral view; 7b. Detail of the distal region of the chelicera, lateral view; 8. — Male, leg II, anterolateral view.

FEMALE DESCRIPTION (based on two specimens).

Measurements. Adults of this species are large: mean length 836 μm ; width 286 μm .

Gnathosoma. Subcapitulum normal for the genus. Corniculi narrow, long and heavily sclerotized. Tectum with a long neck and expanded and dentate distal-margin. Chelicera (Figs. 4 a-b): movable digit with one tooth and fixed digit with one apical bifid tooth (FIG. 4b); pilus dentilis short. Tritosternum: base covered by sternal shield (normal for the genus) and with two pilose lacinae.

Dorsal idiosoma (FIG. 1). Dorsal shield reticulated, with thin, smooth setae of heterogeneous length. The shield bears 29 pairs of dorsal setae (19 pairs podonotal and 10 pairs opisthonotal); six pairs of dorsal setae are in soft cuticle (*r6*, *R1-R5*). Setae of the series *j* (with exception of *j4*), *J* and *z5* are short, 1/3 of the length of the series *s*, *r*, *S* and *Z*; setae *z1* are the shortest, 1/3 of *j1* ($z1 = 1/3 j1$); setae *r6*, *R1*, *R2* more than 2.5 times shorter than setae *R3-R5*; setae *j5* subequal to setae of the serie *J* and 0.7 times the distance *j5-z5*. Setae *J1-J4* in line. Seta *J1* shorter than distance *J1-J2* ($J1 < J1-J2$); setae *J4* and *J5* subequal ($J4 \geq J5$) (FIG. 67); distance *J1-J1* similar to distance *J2-J2* ($J1-J1 = J2-J2$); distance *J4-J4* nearly twice that *J5-J5* ($J4-J4 = 2 J5-J5$). Dorsal poroidotaxy and adenotaxy as in the figure, with glands *gdZ1* nearly in longitudinal alignment with *Z1* and *Z2* and *gdS4* in alignment with *S4* and *S5*.

Ventral idiosoma (FIG. 2). Ventral shields slightly reticulated. Sternal shield with slightly concave anterior margin and four pairs of thin, smooth sternal setae with *st3* slightly shorter. Peritrematal shield with a long peritrema extending to the anterior margin of the dorsal shield (surpassing the insertion of *z2*); sculptural line of peritrema descending to the posterior border of coxa IV. Genito-ventral shield as long as wide (width 200 μm), with straight posterior margin; genital setae *st5* 0.8 times shorter than ventral setae *Jv1*; pair of lyrifissures *iv5* close to setae *st5*; the spermatheca (FIGS. 3 a-b) associated with coxa IV is well-sclerotized and with a short, wide and spiraled tubular structure. Anal shield contiguous to genito-ventral shield, with circumanal setae short. Metapodal platelets reduced and long. Eight pairs of opistogastric setae on the soft cuticle: setae *Jv4*, *Jv5* and *Zv5*

similar in length to *Jv1*; other opistogastric setae slightly shorter and similar in length. Sternal, ventral and peltidial poroidotaxy and adenotaxy, as in the figure.

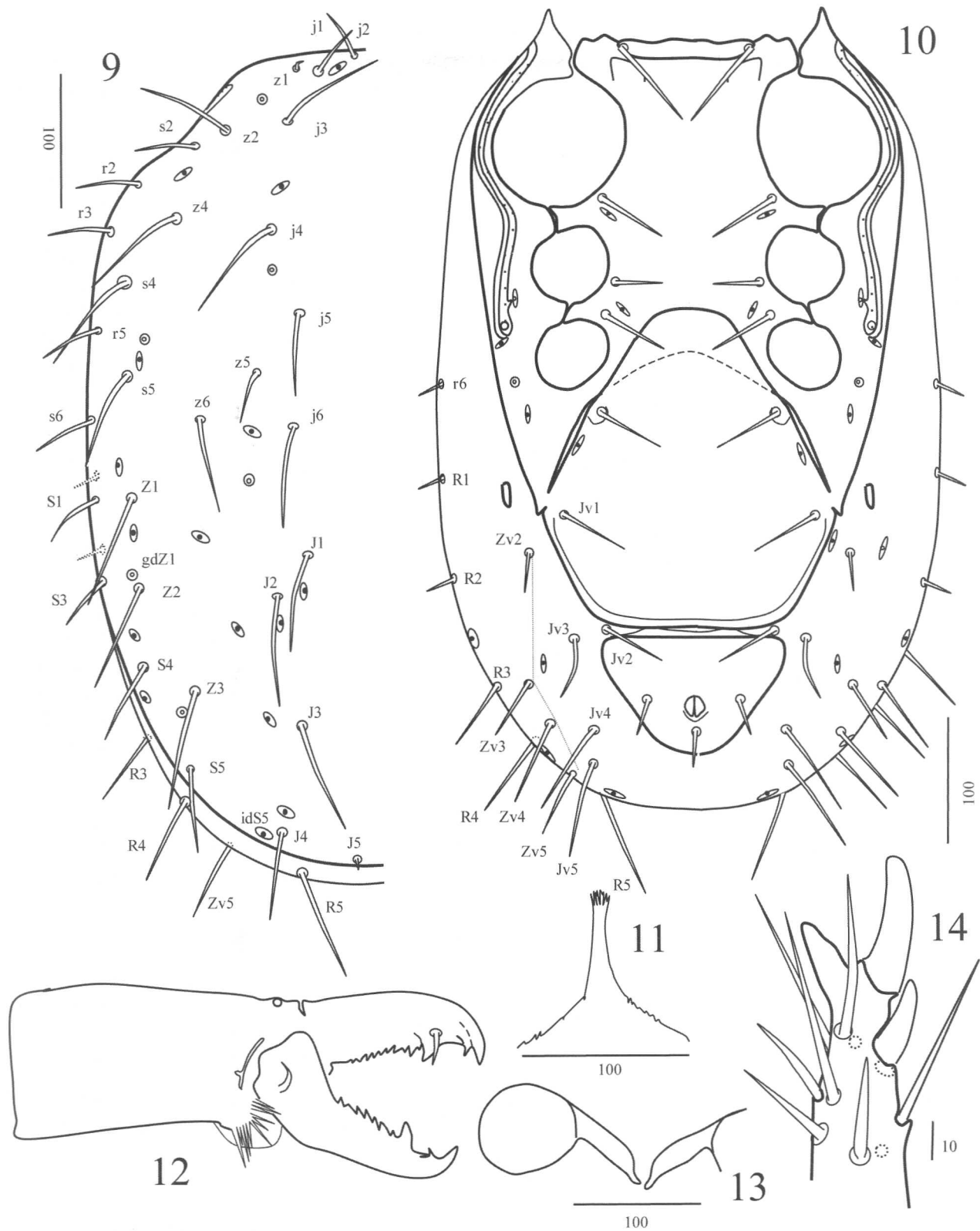
Legs. Tarsus II (FIG. 5) with two strong spine-like setae with blunt apex, the apical being the largest. Leg chaetotaxy normal for the genus.

MALE DESCRIPTION. *Gnathosoma.* Tectum and corniculi similar to the female. Palp-tibia (FIG. 6 a-b) with two antiaxial outgrowths: one lobated with hyaline cuticle and the second spatulated, well-sclerotized with curved margin; the palp bears two thick setae on small rounded tubercles. Chelicera (Figs. 7 a,b): movable digit with an apical tooth basal to the spermatodactyl; fixed digit bidentate. Spermatodactyl is long, slightly sinuous, tubular and with a lanceolate apex.

Dorsal shield similar to the female. Sterno-genito-ventral shield with eight pairs of setae (*Jv3* present and circumanal setae not included).

Legs. Tarsus II (FIG. 8) with only one wide apical spine-like seta; tibia II with long *av1* on a cylindrical tubercle; genu II with a small and spatulated ventral outgrowth with *pv1* at its base; femur II with a wide, solid, anteroventral outgrowth with *pv1* at its base. Seta *av3* on a small tubercle on tarsi II-IV.

Discussion. *P. silviae* belongs to the group of species with setae *j5* shorter than distance *j5-z5* ($j5 < j5-z5$), *j5* equal to *J4* and *J5* ($j5 = J4 = J5$), and *J1* shorter than distance *J1-J2* ($J1 < J1-J2$). Within this group, *P. dubius* Hirschmann & Krauss, 1965, shares this characteristic, however its dorsal setae are homogeneous in length in such a way that central, lateral and marginal dorsal setae are similar; genito-ventral shield is longer than wide and the spermatheca has a different morphology; the spermatodactyl is shorter (two times the movable digit), ribbon-shaped with a slightly narrowed apex. *P. bifurciger* Berlese, 1920, has a dorsal chaetotaxy very similar to that of the new species, however setae *z6* and *Z1* are shorter (no more than 1.5 times the length of *j5*), the male bears two spine-like setae on tarsus II and the spermatodactyl is wider and shorter than the movable chelicerid digit. *P. concinus* Hirschmann, 1965, has setae *j5* similar to *z6* and *Z1*.



FIGS. 9-14. — *Pachylaelaps mandibularis*, female: 9. — Dorsal idiosoma; 10. — Ventral idiosoma; 11. — Tectum; 12. — Chelicera, antiaxial view; 13. — Spermatheca; 14. — Distal detail of tarsus II, posterolateral view.

Etymology. The epithet "silviae" refers to SILVIA GARCÍA, esteemed friend and colleague of the senior author.

Pachylaelaps mandibularis sp. n.

FIGS. 9-14

TYPES. Holotype: female, from soil taken from beneath *Populus alba* in a forest grove of *Rubus ulmifolia* and *Tropaeolum major*, altitude 500 m., UTM 28RCS 610 505, San Nicolás (s. El Sauzal), 29 V 1997, T-81.

Paratypes: 10 females from T-48; two females from T-41; one female from T-49 and one female from T-51.

FEMALE DESCRIPTION. *Measurements.* Mean length: 676 μm ; width: 421 μm .

Gnathosoma. Tectum (Fig. 11) with a long, smooth, narrow neck and slightly expanded and dentate distal margin (several spines bifid). Hypostosomal lacineae wide, lobated and barbed. Corniculi long, narrow, and well sclerotized. Chelicera multidentate (Fig. 12) and strong: fixed digit with an apical bifid tooth, a second tooth with pilus dentilis insert at its base and a basal saw with approximately 10 small teeth; movable digit with three distal teeth (medial less developed) and a basal saw with approximately seven small teeth.

Dorsal idiosoma (Fig. 9). Idiosoma with humeral process well expressed. Dorsal shield reticulated, with thin, smooth setae of homogeneous medium length (19 pairs podonotal and 12 pairs opisthonotal); six pairs of dorsal setae in the soft cuticle (*r6*, *R1-R5*). Setae *z1* very short ($z1 < 1/5 j3$); $j1, j2 \leq 0.5 j3$; $z5$ measuring 53 μm , nearly half $j3$; $r6, R1, R2 = 0.5 R5$; $j5 \geq j5-z5$; $j5 \leq J1$; $z2 \geq j5$. Setae *J5* are microsetae (Fig. 73); setae *J1, J3* and *R5* aligned. Setae $J1 = 2.5 J1-J2$; distance $J2-J2 = 1.5$ times $J1-J1$; distance $J4-J4 = 3 J5-J5$. Dorsal poroidotaxy and adenotaxy such as in figure 9: glands *gdZ1* in alignment with *Z1* and *Z2* (closer to *Z2*) and *gdS4* slightly antiaxial to alignment $S5-J4$.

Ventral idiosoma (FIG. 10). Sternal shield with an even reticulation and with irregular and rather straight anterior margin. Sternal setae heterogeneous in length: *st1* as long as dorsal setae and two times

longer than *st3*; *st2* longer than *st3* and *st4*. Peritrematal shield fused to posterior border of genito-ventral shield. Peritrema long, extending to dorsal shield beyond the insertion point of *z2*. Genito-ventral shield as long as wide (length 237 μm) and setae *st5* and *Jv1* similar in length. Spermatheca (FIG. 13) poorly sclerotized, wide and tubular in shape, extending from coxae IV towards the middle of the body. Anal shield subtriangular, with rounded corners, wider than long (width 140 μm , length 105 μm) and contiguous with genito-ventral shield. Circumanal setae similar in length to *Zv2*. Eight pairs of opistogastric setae on the soft cuticle: *Jv4, Jv5, Zv4* and *Zv5* as long as opisthonotal setae *J4*. Metapodal platelets poorly developed.

Legs. Tarsus II (FIG. 14) with two spine-like distal setae, apical being the largest and extending beyond the tip of the tarsus.

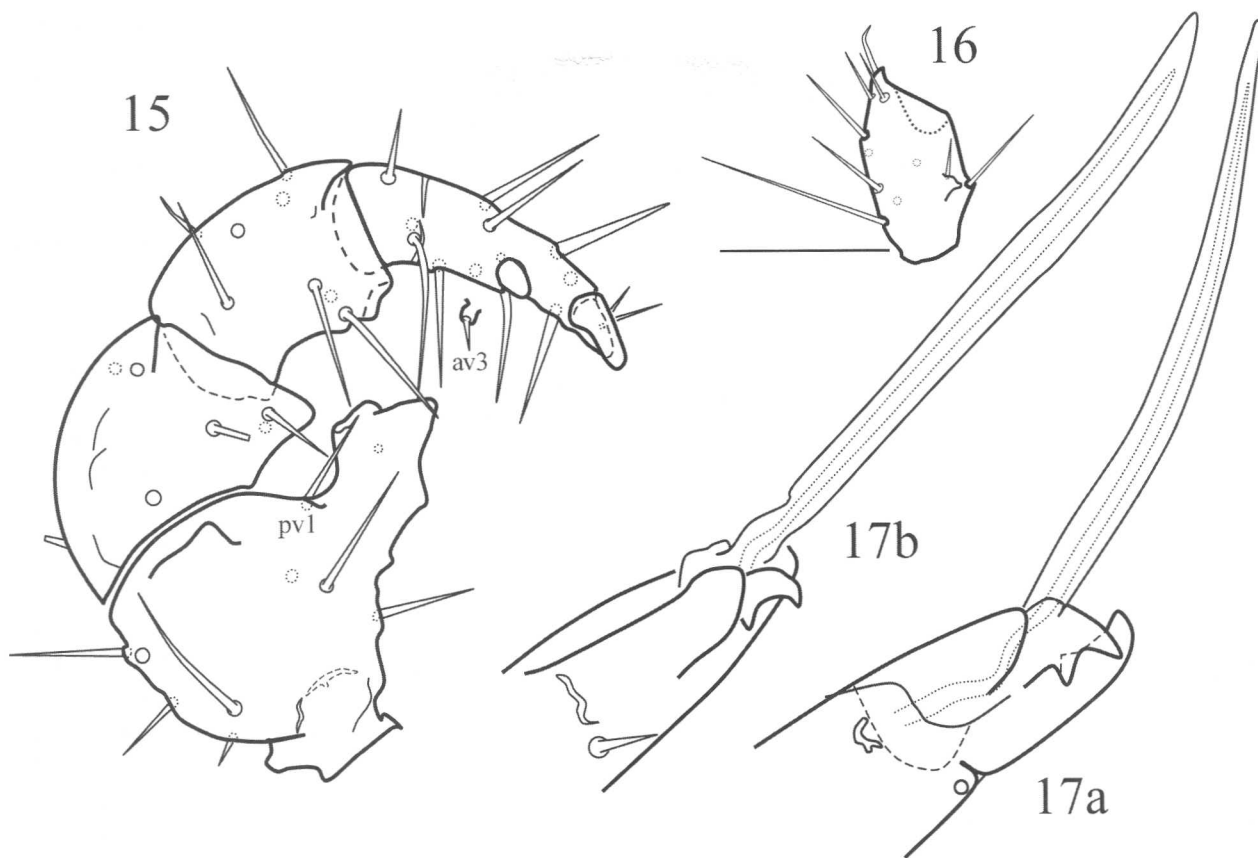
Male unknown.

Discussion. The number of species with setae *J5* as microsetae is numerous. However, the body size of *P. mandibularis* is small in comparison with the group of species related to it. Two species have been described with a body length less than 700 μm : *P. tianschanicus* Koroleva, 1977 and *P. kirghizorum* Koroleva, 1977, although both have standard chelicerae for the genus (fixed digit bidentate, movable digit unidentate). The spermatheca is similar in *P. tianschanicus* but we found significant differences in dorsal setae. The chelicera is similar to *P. multidentatus* Hyatt, 1956, however dorsal chaetotaxy exhibits, among others, the following differences: setae *J5* length is approximately half $j5$ (they are not microsetae), *s6* similar or longer than *s5*, and *Z3* equal to distance $Z3-S5$. The similarity of dorsal chaetotaxy of *P. ineptus* Hirschmann & Krauss, 1965 is great. Nevertheless this species belongs to the morphological group which has only one spine-like distal seta on tarsus II.

Etymology. The species name "mandibularis" refers to its strong and multidentate chelicerae.

Pachylaelaps longisetis Halbert, 1915

Female measurements. Length 758 μm ; width 461 μm . The Canarian specimens are in the rank of



Figs. 15-17. — *Pachylaelaps* sp., male: 15. — Leg II, femur, genua, tibia and tarsus, anterolateral view; 16. — Palptibia, anterolateral view; 17a. — Chelicera, antiaxial view; 17b. — Distal detail of the chelicera, dorsal view.

size given by other authors (length 730-860 μm , width 420-540 μm).

Idiosoma. Dorsal shield with strong reticulation. Dorsal setae of moderate length, their tips extending beyond the bases of the setae behind them. Setae *J5* more than three times longer than *J4* (FIG. 71); *J1* alignment with *J3* and *J4* and widely separated. Setae *R4* and *R5* on the soft cuticle, as long as setae *J*. Glands *gdZ1* paraxial to longitudinal alignment *Z1-Z2*, *gdS4* in alignment with *S4* and *S5*. Ventral shields strongly reticulated. Sternal shield with concave anterior margin and setae *st1* widely separated. Peritrematal shield with posterior region curved outward. Genito-ventral shield longer than wide, with posterior straight margin contiguous to anal shield. Anal shield is wider than long, with pointed anterior corners. Opisthogastric setae long (except *Zv2* = $1/3$ *Jv5*). Spermatheca extends from coxa IV, although it may also be connected to coxa III. Tarsus

II with two spine-like distal setae, the apical well developed.

Geographical distribution. This species has been found in Western Europe (Leningrado, Kursk, Ukraina, Dagestan) KOROLEVA (1977 a), in forest litter, woody remains, soil, and in the nests of small mammals. In Tenerife only one female specimen was found, in sample T-15.

Pachylaelaps species incerta n° 1

Two large-bodied male specimens were found. Females accompanying these males were not present. The deteriorated condition of the dorsal chaetotaxy prevented accurate description..

Measurements. Length 1226-1385 μm , width 903-961 μm . Idiosoma ovate, with sub-parallel lateral margin and humeral processes well expressed.

Gnathosoma. Tectum with a long neck and expanded and dentate apex poorly notched. Palp-tibia with a small chitinous outgrowth (FIG. 16). Cheliceral fixed digit bidentate; movable digit slightly shorter than fixed digit (FIGS. 17a, b); spermatodactyl long, nearly 2.5 times the movable digit, ribbon shape and with a blunt apex.

Dorsal idiosoma sopp. Dorsal shield with heavily reticulated ornamentation and 31 pairs of setae of moderate length (the tips of several setae extending beyond the bases of the setae behind them). Setae *J5* microsetae. Six pairs of dorsal setae are in the soft cuticle (*r6*, *R1-R5*).

Ventral idiosoma sopp. Holoventral shield with reticulated ornamentation and nine pairs of setae in addition to the three circumanal setae (setae *Jv1-Jv3* and *Zv2* on the shield); setae *Jv4*, *Jv5*, *Zv3-Zv5* on the soft cuticle.

Legs. Tarsus II (FIG. 15) with two apical spine-like seta, the distal one reaches the tip of the tarsus and the basal is half the size of the first; seta *av3* in a small ventral tubercle. Tibia II with irregular, small, inconspicuous ventral outgrowth; genu II with wide anterior edge; femur II with a wide, solid, anteroventral outgrowth with *pv1* at its base.

Studied material. One male from sample T-41; one male from sample T-81.

Species belonging to the Type II

The following species belong to the morphological group characterized by: females with only one spine-like seta on tarsus I; corniculi poorly sclerotized with a wide base; spermatheca long, thin and tubular, extending backwards from coxae; setae *UR* absent; opisthogaster with seven ventral setae and males without palp-tibial outgrowths.

Pachylaelaps auricularis sp. n. FIGS. 18-31

TYPES Holotype: Female, from humid soil and decomposed litter from fayal-heath, altitude 950 m., UTM 28RCS 756 572, Pico del Inglés, 25 I 1997 (sample T-46).

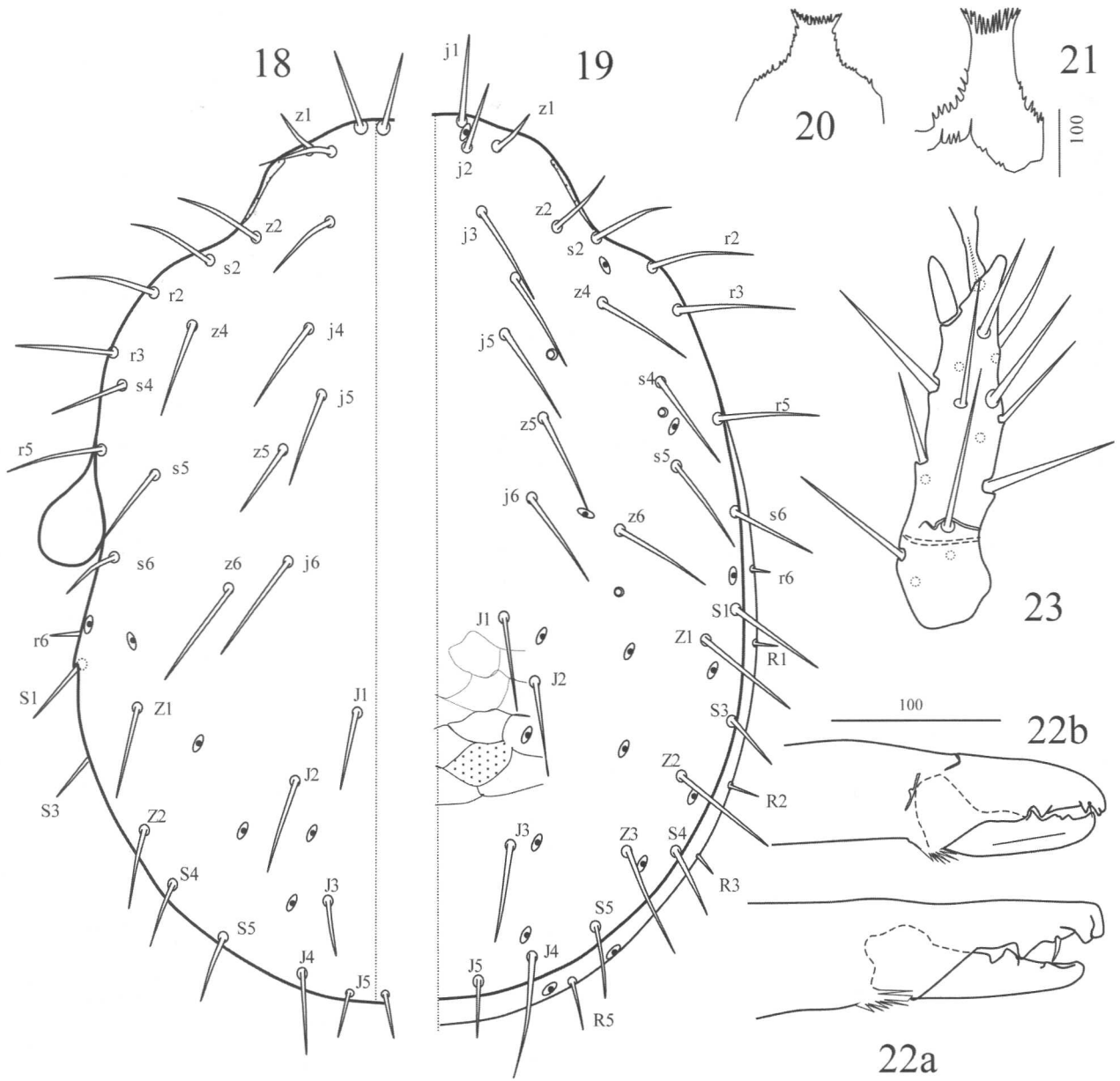
Paratypes: two males from the same locality and date; two females from sample T-13 and one female from sample T-41.

FEMALE DESCRIPTION. *Measurements*. Length 769-892 μm ; width 477-615 μm . This species is characterized by strong reticulated and granulated shielding, ovate idiosomal shape, well-developed humeral processes and a convex dorsum.

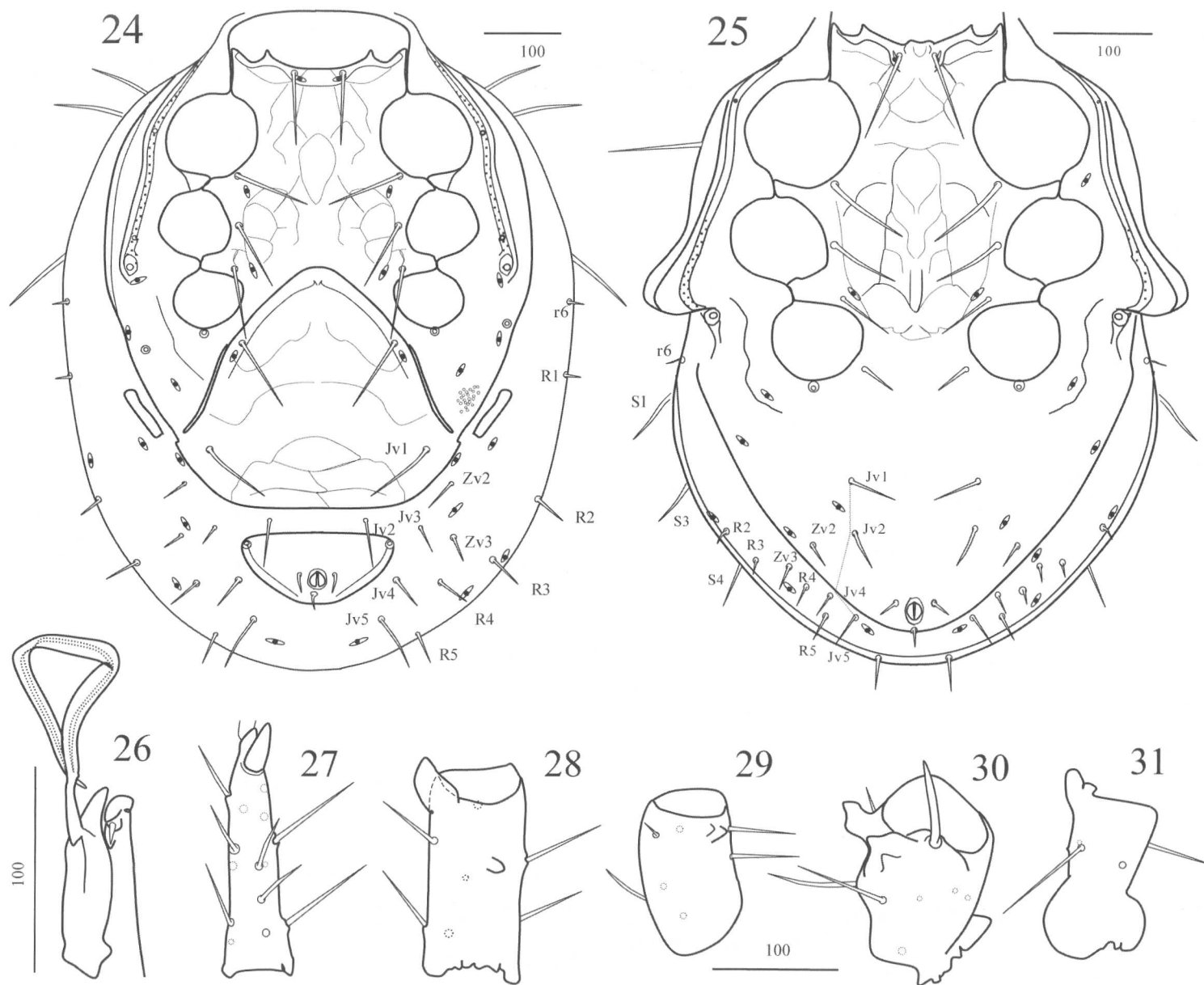
Gnathosoma. Tectum (FIG. 21) with a short, wide neck and dentate apex. Chelicera (FIGS. 22 a-b) large and strong; movable digit bidentate; fixed digit with one apical bifid rounded tooth and another basal and acute.

Dorsal idiosoma (FIG. 19). Dorsal shield with strong and granulated reticulation. This shield bears 31 pairs of setae (18 podonotal pairs and 12 opisthotal pairs); six pairs of dorsal setae are in soft cuticle. Dorsal setae are smooth, of moderate length, extending beyond the base of the setae behind them. Seta $z1 < j2 < j1 < j3-j6$; setae $r6, R1 = 0.5 R2, R3, R5; j5 > j5-z5$. Seta $J1 < J1-J2$; setae $J4 > 2 J5$ (FIG. 72); $Z1 = Z2 = Z3 = J4 > S3, S4, S5; J2-J2 > 1.4 J1-J1; J4-J4 = 2 J5-J5$.

Ventral idiosoma (FIG. 24). Sternal shield with a characteristic pattern (on the central region, at level of setae *st2*, an ovate or subpentagonal area, lightly reticulated) and wide concave anterior margin; sternal setae long and smooth, *st1* 1.2 times longer than other sternal setae and next to each other. Peritrematal shields wide, with rounded lateral margins, fused to sternal shield behind coxae IV. Peritrema long, extending to dorsal shield beyond the insertion of *z2*; poroidiotaxy and adenotaxy as in the figure, with *gv2* gland behind coxa IV very prominent; cultural peritrematal line does not extend beyond the stigma. Genito-ventral shield slightly wider than long (length 313 μm , width 342 μm) and fused to peritrematal shields; setae *st5* and *Jv1* similar in length. Anal shield separated from genito-ventral shield. Circumanal setae short and thin; three pairs of opisthogastric setae (*Jv3*, *Jv4* and *Zv3*) are shorter than setae *Jv5*. Metapodal platelets large, long and narrow. Spermatheca filiform and long, extending from coxa III.



FIGS. 18-23. — *Pachylaelaps auricularis*: 18. — Male, dorsal idiosoma; 19. — Female, dorsal idiosoma; 20. — Male, tectum; 21. — Female, tectum; 22a. — Chelicera, paraxial view; 22b. — Chelicera, anti-axial view; 23. — Tarsus II, posterolateral view.



FIGS. 24-31. — *Pachylaelaps auricularis*: 24. — Female, ventral idiosoma; 25. — Male, ventral idiosoma; 26. — Chelicera with spermatodactyl, ventral view. 27. — Tarsus II, dorsal view; 28. — Tibia II; 29. — Genua II; 30. — Femur II; 31. — Femur IV.

Legs. Tarsus II with one spine-like apical seta (FIG. 23).

MALE DESCRIPTION. *Measurements.* Mean length 737 μ ; mean width 579 μ m (at level of lateral protrusions).

Gnathosoma. Tectum (FIG. 20) with a short, wide serrated neck slightly expanded in its dentate apex. Chelicera (FIG. 26): with bidentate fixed digit and standard pilus dentilis; spermatodactyl long (length 220 μ m), more than twice the length of the movable digit, ribbon-shaped, wide and with a thin, truncated apex. Palp-tibia lack outgrowths.

Dorsal idiosoma (FIG. 18). Idiosoma ovate, slightly narrowing between dorsal setae *r5* and *r6*, with humeral processes well expressed and two lateral protrusions of the peritrematal shields overreaching the lateral margins of the dorsal shield in such a way that they are dorsally visible.

Dorsal chaetotaxy differs slightly from that of the females: setae *J1* \leq *J1-J2*; *J4* \geq *S5*; distance *J2-J2* is more than four times longer than distance *J1-J1*; distance *J4-J4* is almost three times longer than distance *J5-J5*; *Z2* = *S4* = *S5*; setae *R1* absent.

Ventral idiosoma (FIG. 25). Heavily sclerotized. Holoventral shield with strong reticulation and eight pairs of setae in addition to the three circumanal setae. Sternal setae *st1* and *st2* similar in length (*st1* slightly longer) and longer than the two other pairs of sternal setae. Genital setae short, 2.5 times shorter than *st1*. Three pairs of opisthogastric setae on holoventral shield: setae *Jv1* = *Jv2* and, together with *Jv5*, longer than other ventral setae (1/3 longer); circumanal setae short and thorny; three additional pairs of opisthogastric setae on the soft cuticle. Setae *Jv3*, *Zv4* and *Zv5* absent.

Peritrematal shields, contiguous to the stigma (at the level of coxa III), develop rounded protrusions. Peritrema long and extending to the anterior margin of the dorsal shield, as found in females.

Legs. Tarsus II (FIG. 27) with one blunt spine-like seta reaching the tarsal apex; tibia II (FIG. 28) with one anterodistal apophysis (ventral and conical in shape), and with a small medioventral apophysis; genua II (FIG. 29) with a poorly developed ventroapical apophysis; femur II (FIG. 30) has an irregular,

large, flat anterodistal spur with an axilar seta, two small conical apophysis and a thick, blunt seta. Genua IV has a short and spine-like ventral seta; trochanter IV with a distal projection (FIG. 31).

Discussion. The large size, ovate body shape, heavily reticulated ornamentation of shields, and body chaetotaxy distinguish this species from other related species. Seta *J1* longer than distance *J1-J2*, setae *J4* longer than *j5*, *j5* shorter or similar to distance *j5-z5* and *J5* less than half the length of *j5* similar to *P. costai* Hirschmann & Krawss, 1965, *P. humusorum* Schweizer, 1961, *P. brevisternalis* Kololeva, 1977 and *P. karawaiewi* Berlese, 1921. The male of these four species lacks lateral protrusions. *P. costai* has a smaller body size (660 \times 380 μ m), setae *J3* are longer than distance *J3-J4*, setae *Z3* are longer than distance *Z3-S5* and the spermatodactyl is more than five times the length of the movable digit. *P. humusorum* has setae *J2* as long as distance *J2-J3* and *z5* longer than distance *z5-j6*. *P. brevisternalis* has setae *J5* longer than *j5*, *J2* similar in length to distance *J2-J3* and a larger body size (720-800 \times 540-580 μ m). Males of *P. karawaiewi* have anterior margin of the femur, genua and tibia of legs IV with flat outgrowths; in tarsus II, a small spine-like epiphysis is opposite the spine-like distal setae; in the female, setae *S5* are similar to *J2*.

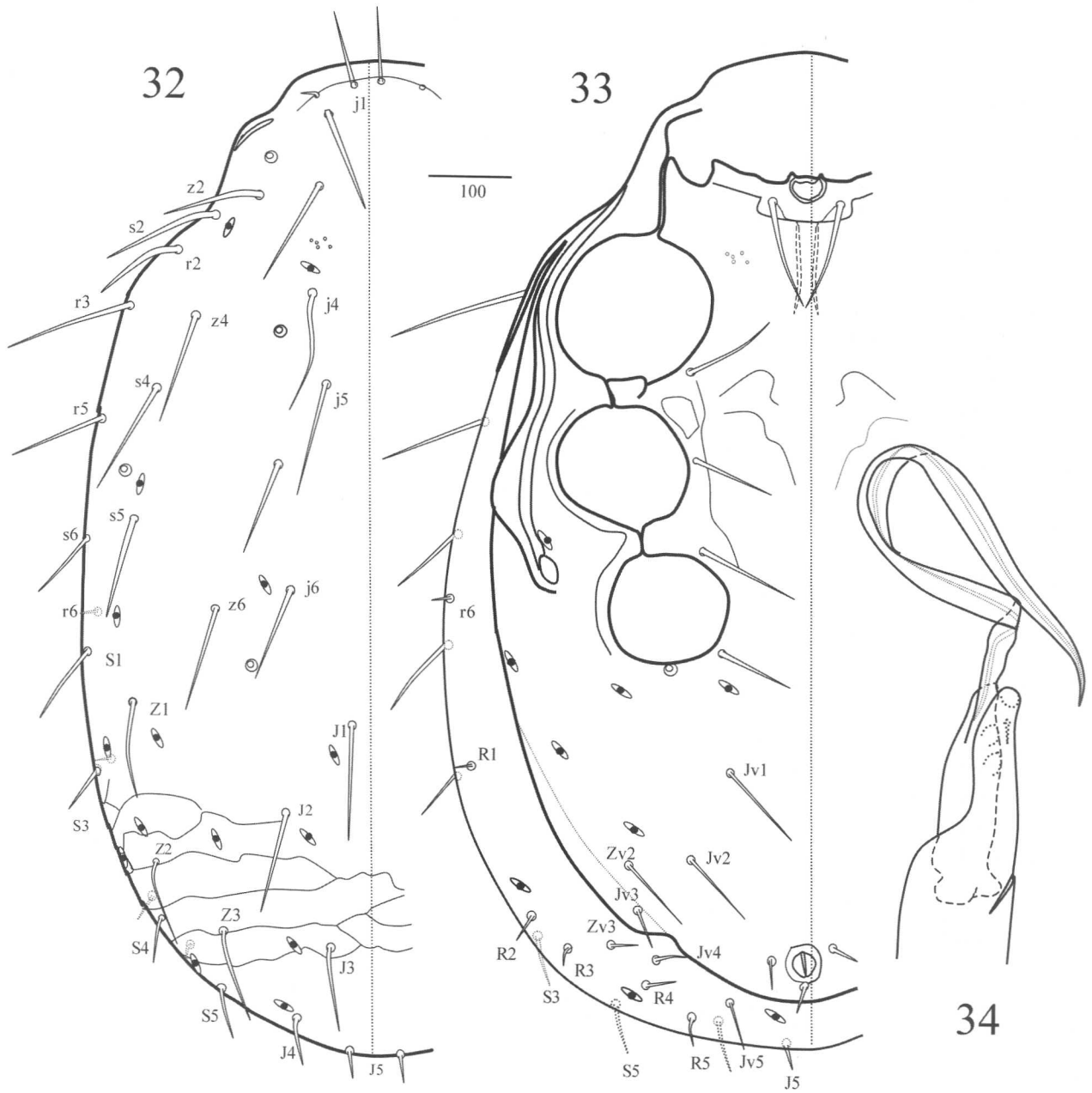
Etymology. Denomination of this species as *P. auricularis* refers to the lateral protrusions in the males which resemble a pair of auricles.

Pachylaelaps species incerta n° 2 FIGS. 32-34

Two males with several characteristics similar to *P. auricularis* but a smaller body size were found.

Measurements. Length 669-723 μ m, width 384-430 μ m. The idiosoma is ovate, with sub-parallel lateral margins, slightly concave, between dorsal setae *r5* and *r6* and humeral processes well defined.

Gnathosoma. Tectum without neck and distal dentate apex and poorly notched. Palp-tibia without chitinous outgrowths. Chelicera (FIG. 34): fixed digit bidentate; movable digit as long as fixed digit; spermatodactyl (FIG. 34) long, nearly three times the movable digit, ribbon shaped and with a thin, curved apex.



FIGS. 32-34. — *Pachylaelaps* sp. 2, male: 32. — Idiosoma, dorsal; 33. — Idiosoma, ventral; 34. — Chelicera.

Dorsal idiosoma (Fig 33). Dorsal shield with heavily reticulated ornamentation and serrated lateral margin. This shield bears 31 pairs of setae of moderate length (the tips of several setae extend beyond the bases of the setae behind them); setae $z1$ reduced; $j1 < j2$; $j5 > j5-z5$; $J1 \geq J1-J2$; $J4 = 2 J5$ (FIG. 74); $J1-J1 = 0.5 J2-J2$; $Z1, Z2, Z3 = 0.5 S3 = S4 = S5 = J4$; $S1 = s6, Z1$; $J3 = 2.5 J4$ and nearly four times longer than $J5$. Four pairs of short (one-third the length of $S2$) dorsal setae are on the soft cuticle; setae $r6$ and $R1$ are half the length of other setae R .

Ventral idiosoma (FIG. 32). Holoventral shield with light reticulated ornamentation and dense granulation. This shield bears eight or nine pairs of setae in addition to the three circumanal setae ($Jv3$ on or off the shield). Opisthogastric setae heterogeneous in length in such a way that $Jv1$ are the longest (more than twice $Jv5$ and more than four times $Jv4$); $Jv2$ and $Zv2$ of the same length and more than three times $Jv4$; the other setae on the soft cuticle are very short. Peritrematal shields, at level of coxae III, with a small protrusions which are not seen from the dorsum such as in *P. auricularis*.

Legs. Tarsus II with one spine-like apical seta. Femur, genua and tibia of legs II similar to *P. auricularis*. Legs IV as long as the idiosomal length.

Studied material. Two males from sample T-15.

***Pachylaelaps intermedius* sp. n.**

FIGS. 35-39

TYPES. *Holotype*: Female, from humid soil and decomposed litter from fayal-heath forest, altitude 950 m., UTM 28RCS 756 572, Pico del Inglés, 25 I 1997 (sample T-46).

Paratypes: two females from the same locality and date (sample T-46)

FEMALE DESCRIPTION. *Measurements*. Mean length 437 μm ; mean width 263 μm . Idiososomal shields with a dense granulation as main cuticular ornamentation.

Gnathosoma. Tectum (FIG. 38) without neck, with serrated lateral margin and expanded and dentate distal margin. Corniculi with a wide base and poorly

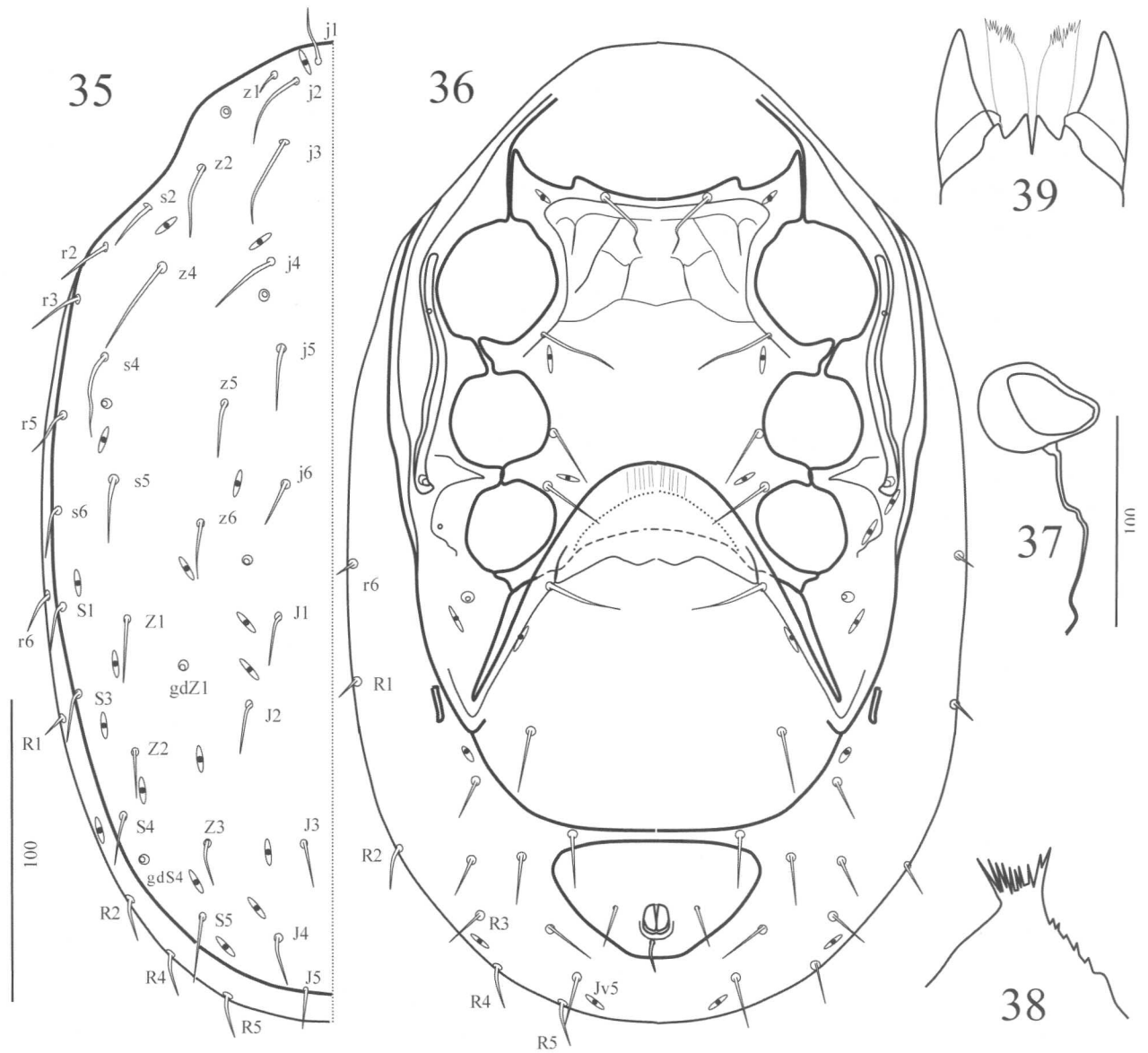
sclerotized. Hypostosomal lacinae extending beyond the apex of the corniculi and with distal margins notched (FIG. 39).

Dorsal idiosoma (FIG. 35). Humeral processes poorly defined. Dorsal shield with 30 pairs (18 podonotal pairs and 12 opisthonotal pairs) of setae, thin and heterogeneous in length. Six pairs of dorsal setae of similar length on the soft cuticle ($r6$ and $R1-R5$). Seta $z1 = 1/3 j3$; setae $j3$ and $z4$ are the longest (39 μm), twice the opisthonotal setae; $j5 < j5-z5$; $j5 > J1$; $z4 = z4-s4$; setae $j5, j6, J1$ and $J4$ aligned. Seta $J1 \leq 0.5 J1-J2$; $J4$ (20 μm) $\geq J5$ (16 μm) (FIG. 64); $J1=J2=J3=J4$; $S5 > J4$; $J3-J3 = J5-J5$. Poroidotaxy and adenotaxy as in the figure, with $gdZ1$ in alignment with $Z1-J2$ and $gdS4$ in alignment with $S4-S5$.

Ventral idiosoma (FIG. 36). Sternal shield with light reticulation between setae $st1$ and $st2$, the rest of the surface is granulated. Setae $st3$ and $st4$ slightly shorter than other sternal setae. Peritrematal shields fused to genito-ventral and with a structural line bordering the shields. Peritrema short, not reaching the anterior border of coxa II. Genito-ventral shield fused to peritrematal shields, nearly as long as wide, with a granulated cuticle; genital setae similar to $st2$ and longer than $Jv1$. Metapodal platelets poorly developed. Anal shield nearly twice as long as wide. Six pairs of opisthogastric setae on the soft cuticle: $Jv2$ insert in the space between anal and genito-ventral shield; setae $Jv5$ similar to other ventral setae. Spermatheca (FIG. 37) filiform and long, with a small vestibule at its origin in coxa III.

Legs. Tarsus II with one spine-like seta reaching the tarsal apex.

Discussion. Four species share with *P. intermedius* a short peritrema. *P. brachyperitrematus* Koroleva, 1977 has a larger body size (length 600 μm , width 360 μm), the peritrema extends beyond the anterior border of coxa II, idiosomal shields have a heavily reticulated pattern, dorsal setae are homogeneous in length (podonotal setae as long as opisthonotal setae) and hypostosomal laciniae are digitiform, narrow, without notches and not reaching the corniculi apex. *P. falcifer* Hirschmann & Krauss, 1965 has a longer peritrema which extends beyond the anterior border of coxa I and setae $z5$ is similar to distance $j5-z5$.



FIGS. 35-39. — *Pachylaelaps intermedius*, female: 35. — Idiosoma, dorsal; 36. — Idiosoma, ventral; 37. — Coxa III with the spermatheca; 38. — Tectum; 39. — Subcapitulum.

P. jurassicus Schweizer, 1961, has a dorsal chaetotaxy very similar to the new species, however $z4$ does not reach the insertion of $s4$, $j6$ is longer than $z6$ and the peritrema extends beyond the anterior border of coxa II. In *P. brevicrinitus* Hirschmann & Krauss, 1965, marginal setae $r5$, $s6$, $S1$ and $S3$ are one third the length of $j5$, $r3$ are longer than $s5$ (and twice $r5$), $z4$ are shorter than $j4$ and peritrema extends beyond posterior border of coxa I.

Etymology. Nomination of this species as *P. intermedius* is intended to indicate its intermediate taxonomic position between the other related species.

P. brachyperitrematus Koroleva, 1977

Species with a moderate body size (length 600 μm , width 365 μm). Idiosomal shields reticulated and dorsal setae relatively short and homogeneous in length. Dorsal setae $J4$ and $J5$ subequal (FIG. 65). On the soft cuticle are 12 pairs of setae such as in *P. intermedius*. Glands *gdZ1* paraxial to alignment $Z1$ - $Z2$ and closer to $Z1$. Peritrema extends to the posterior border of coxa I.

Distribution. This species is found in decomposed wood and in nests of *Microtus arvalis* in Western Europe (Trans-Carpatia) (KOROLEVA, 1977 a). In Tenerife, three female specimens were found in sample T-63.

Pachylaelaps glandularis n. sp. FIGS. 40-49

TYPES. *Holotype:* Female from soil and humus from fayal-heath forest, altitude 950 m., UTM 28RCS 756 572, Pico del Inglés, 25 I 1997 (T-46).

Paratypes: One female and five males from the same locality and date; three females from sample T-59; one female from sample T-42; one female from sample T-73.

FEMALE DESCRIPTION. *Measurements.* Mean length 615 μm , mean width 385 μm .

Gnathosoma. Tectum (FIG. 45) with basal borders dentate, a short and narrow neck and an expanded dentate and notched apex. Corniculi wide. Chelicera standard for the genus: movable digit is bidentate and

fixed digit with an apical bifid tooth and a sharp-pointed basal tooth.

Dorsal idiosoma (FIG. 40). Humeral processes poorly expressed. Dorsal shield with a light reticulated pattern and bearing 30 pairs of thin, smooth and heterogeneous (short to medium size), dorsal setae. Several setae extend beyond bases of the setae behind them. Setae $z1 = 1/3 j3$; setae $z2$ are the longest, more than 1.5 times longer than other opisthonotal setae and 1.7 times $j5$; $j3 = j4$; $j5 = j5-z5 = J1$; $z4 = s4 = r2 > r3$; $z5 < z5-j6$. Setae $J1 < J1-J2$; $J1=J2=J3=J4$; $J4 \geq 2 J5$ (FIG. 70); $J5 < 0.5 j5$; $J1-J1 = 2 J2-J2 = J3-J3$; setae *R* similar to setae *S*. Idiosomal glands conspicuous; *gdZ1* anti-axial to alignment $Z1$ - $Z2$ and *gdS4* in alignment with $S4$ - $S5$.

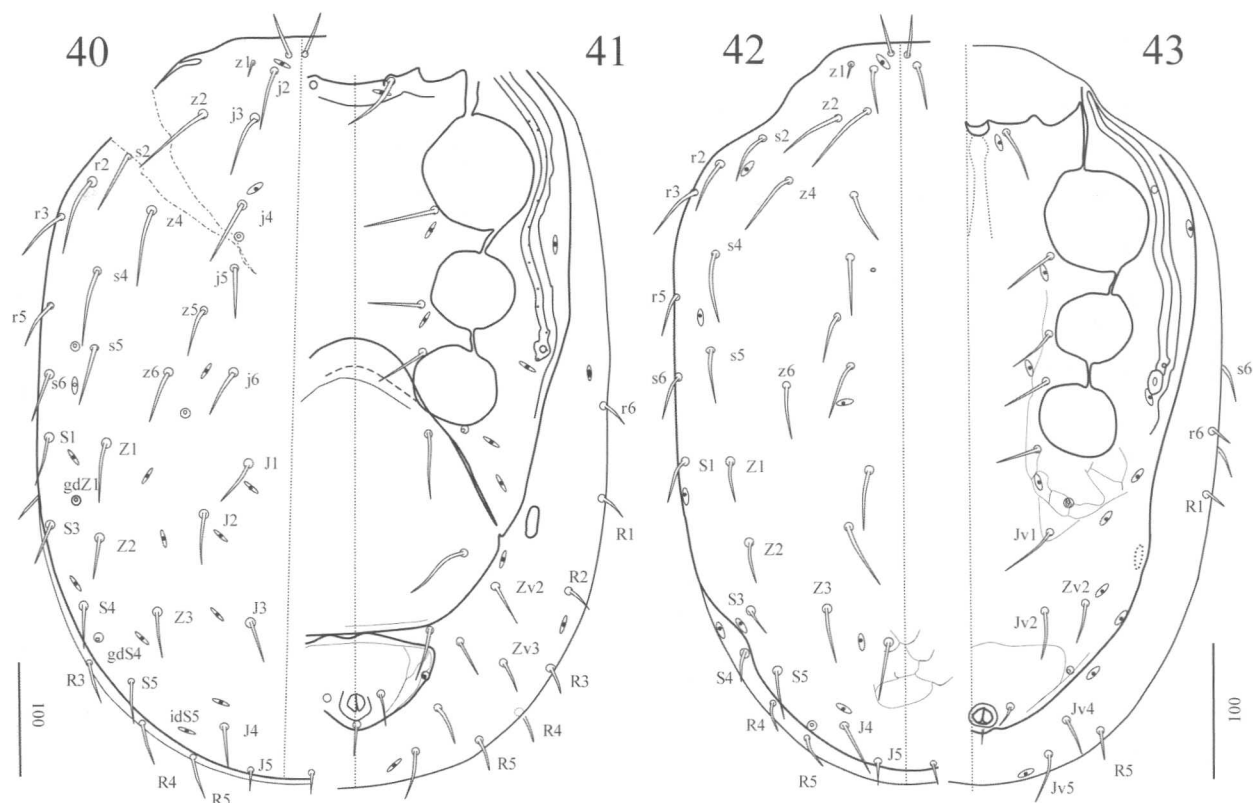
Ventral idiosoma (FIG. 41). Ventral shielding with reticulated ornamentation. Sternal shield with anterior slightly concave margin and setae *st1* set in small rounded tubercles; setae *st2* are the longest sternal setae, nearly 1.5 times *st4*. Genito-ventral shield as long as wide, fused to peritrematal shields and contiguous to anal shield. Anal shield wider than long, with sinuous anterior margin. Six pairs of opisthogastric setae on the soft cuticle. Metapodal platelets present. Peritrema long, extending to dorsal shield and reaching the insertion of $z1$; sculptural peritrematal line descends to the posterior border of coxa IV. Spermatheca extends from anterior margin of coxa IV.

Legs. Tarsus II with one spine-like apical setae which does not reach the tarsal apex.

MALE DESCRIPTION. *Measurements:* Length 550 μm , width 332 μm . Ornamentation of the shields similar to female.

Gnathosoma. Tectum (FIG. 44) curved toward the venter, with dentate margins, neck short and wide, and apex dentate and notched. Spermatodactyl (FIG. 49) long, ribbon shaped, curled in the middle of its length and with acute apex; at least five times longer than movable cheliceral digit. Movable cheliceral digit with one tooth and fixed digit bidentate.

Dorsal idiosoma (FIG. 42). Dorsal shield with 29 pairs of setae. Setae *S4* are on the soft cuticle and



Figs. 40-43. — *Pachylaelaps glandularis*: 40. — Female, idiosoma, dorsal; 41. — Female, idiosoma, ventral; 42. — Male, idiosoma, dorsal; 43. — Male, idiosoma, ventral.

setae $R2$ and $R3$ absent. Seta $z4 < z4-s4$; $J1 = J1-J2$; $J5 = 1/3 J4$.

Ventral idiosoma (FIG. 43). Holoventral shield slightly reticulated except in the axilar region, posterior to coxa IV, where the ornamentation is stronger. The shield bears eight pairs of setae in addition to the three-circumanal setae; opisthogastric setae $Jv4$ and $Jv5$ on the soft cuticle. Setae $Jv1$ are the longest opisthogastric setae; setae $Jv3$ and $Zv3$ absent. Metapodal platelets are incorporated into the holoventral shield. There is a light ornamental line delimiting the anal shield. Glands $gv2$ and $gv3$ are large and conspicuous.

Legs (FIGS. 46-48). Coxae I with a small apophysis, ventral and conical, on the anterior distal border. Tarsus II (FIG. 46 a-b) with one spine-like distal

seta and a strong apophysis or tubercle on the opposite side which reaches the tarsal apex; trochanter II with a small and rounded distoventral apophysis (FIG. 47); femur II with a ventrodistal digitiform spur with axilar seta, two small mamelliform apophysis (one is anterolateral and the second is ventral) and seta al is a thick, spine-like seta; genu II and tibia II with a small lamellar-shaped ventral apophysis. Femur IV (FIG. 48) with a conical ventral apophysis on the basifemur and a thick, straight or bent seta set in a tubercle on the ventrodistal border.

DISCUSSION. A high number of species share the condition of having setae $J1$ equal or shorter to distance $J1-J2$, $J5$ shorter than $J4$ and $j5$ by a factor of two or more and a long peritreme extending to the



FIGS. 44-49. — *Pachylaelaps glandularis*: 44. — Male, tectum; 45. — Female, tectum; 46a. — Male, tarsus II, dorsal view; 46b. — Male, tarsus II, apical detail; 47. — Male, leg II, trochanter, femur, genua and tibia, ventral view; 48. — Male, femur IV, ventral view; 49. Male, spermatodactyl.

dorsal shield. However, the group of species with $J5$ equal or shorter than 0.5 times $j5$, $z5$ shorter than distance $z5-j6$ and $j3$ equal or shorter than $j4$, is more reduced. In *P. volkovae* Goncharova et Koroleva, 1974, $z4$ are 0.5 times the distance $z4-s4$; in *P. brevis* $z4$ are longer than half the distance $z4-s4$ and in *P. parvulus* Koroleva, 1977, $z4$ are shorter than distance $z4-s4$. While females of *P. karawaiewi* Berlese, 1921, are very similar to the new species, the differences found in males are significant: the new species lacks flat excrescencies in the anterior margin of femur, genua and tibia of legs IV, and it only has the small rounded apophysis with a thick seta in the anterior margin of femur IV; in femur II, the digitiform spur is smaller and the other apophysis and thick seta are absent; the spermatodactyl in *P. karawaiewi* is clearly wider in its proximal region whereas in the new species the width is more or less consistent until the narrowing at the distal end. *P. bregetova* Koroleva, 1977, lacks distinctive ornamentation in the idiosomal shields; setae $J4$ are four or five times longer than $J5$; the peritrema is shorter and there are 12 pairs of setae in the soft cuticle, in addition to other important male characteristics. *P. alpinus* Willmann, 1953, has setae $z6$ twice as long as $j6$ and reaches the base of

$Z1$; $J3$ almost reaches the base of $J4$ and $Z1$ reaches $Z2$, among other important differential characteristics.

Etymology. The specific name “*glandularis*” refers to the fact that idiosomal glands are large and easily to recognize because of their well sclerotized openings.

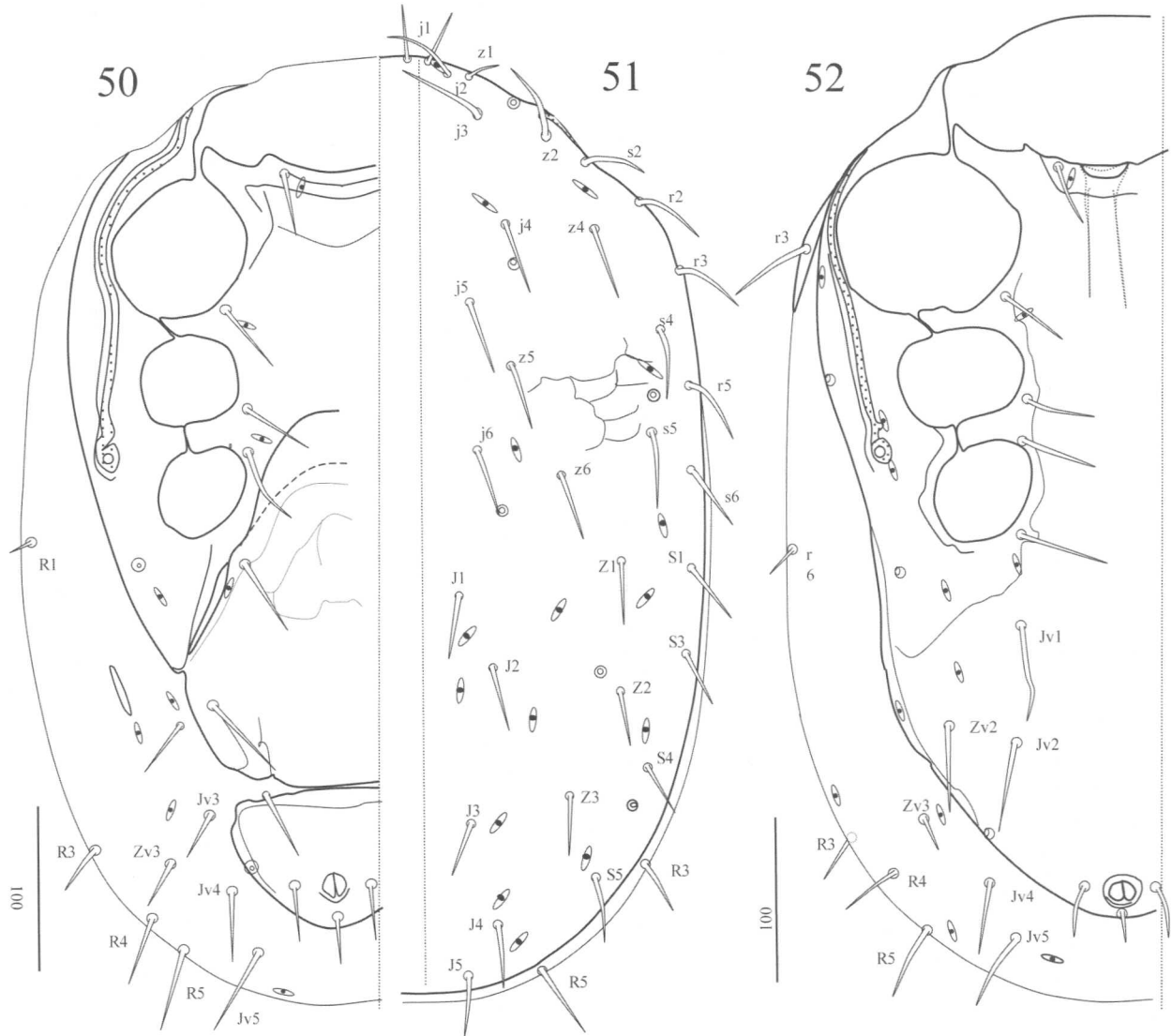
***Pachylaelaps canariensis* n. sp.**

FIGS. 50-57

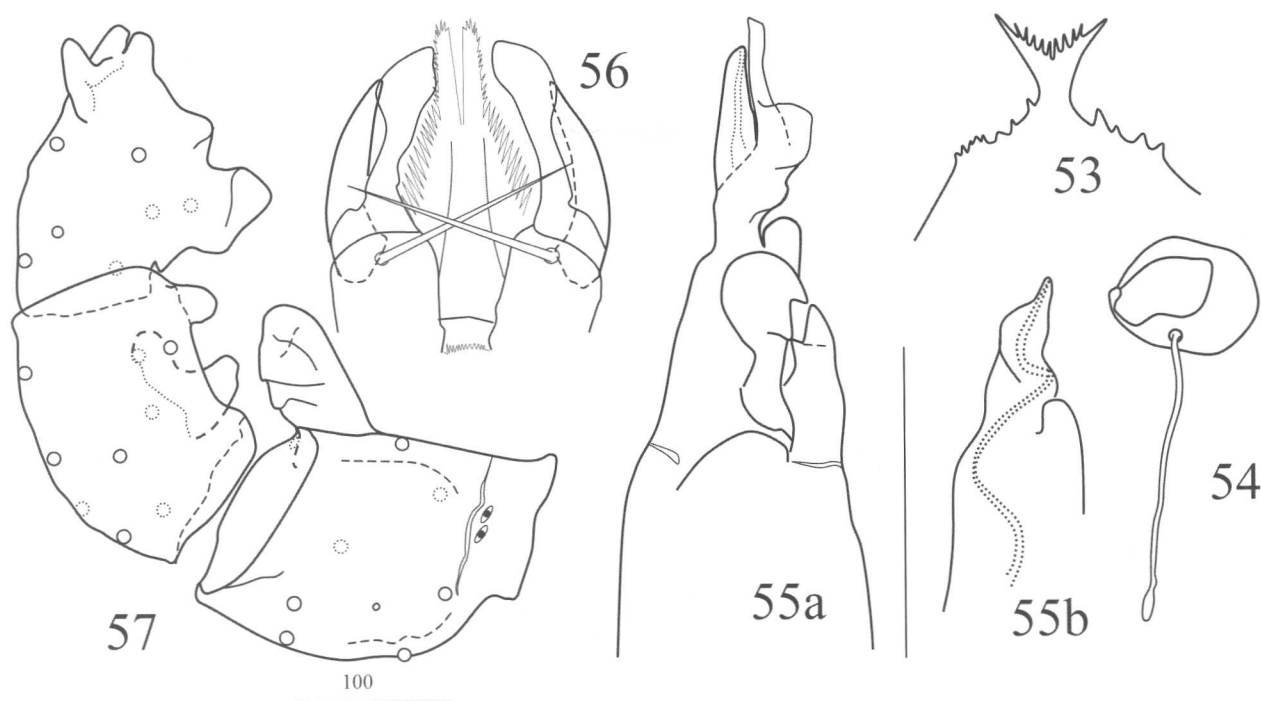
TYPES. *Holotype:* Female from wet soil of nitrophyl thicket with *Artemisa canariensis*, *Rumex lunaria*, *Ricinus communis* and grasses, altitude 250 m., UTM 28RCS 817 594, s. Taganana, 25 I 1997, sample T-54

Paratypes: one female and two males from the same locality and date.

FEMALE DESCRIPTION. *Measurements.* Mean length 764 μm , mean width 500 μm . Body elongated, with parallel lateral margins and poorly developed humeral processes. Cuticle with a slight reticulated pattern.



Figs. 50-52. — *Pachylaelaps canariensis*: 50. — Female, idiosoma, ventral; 51. — Female, idiosoma, dorsal; 52. — Male, ventral idiosoma.



Figs. 53-57. — *Pachylaelaps canariensis*: 53. — Male, tectum; 54. — Female, coxa III and spermatheca; 55a. — Male, chelicera, dorsolateral view, 55b. — Male, detail of ventral branche of spermatodactyl; 56. — Male, subcapitulum; 57. — Male, left leg II, femur, genu and tibia.

Gnathosoma. Tectum (Fig. 53) with lateral bases dentate, a short neck and an expanded dentate and notched apex. Corniculi narrow.

Dorsal idiosoma (FIG. 51). Dorsal shield with 30 pairs of homogeneous and smooth setae of moderate length, several setae reach the base of the setae behind them. Four pairs of dorsal setae on the soft cuticle $r6$, $R3-R5$ ($r6 > R3 > R4 > R5$), which means a reduction of dorsal chaetotaxy to 34 pairs of setae. Seta $z1 = 1/3 j3$; $j5 = j5 - z5 = z2$; $j5 \geq J1$. Setae $J4 \geq J5$ (FIG. 66); $J1 < J1-J2$; serie J similar in length; setae $J3$ and $J5$ aligned; $J1-J1 = 0.5 J2-J2$; setae $R5$ and $Jv5$ similar in length. Glands $gdZ1$ paraxial to alignment $Z1-Z2$ and closer to $Z2$; $gdS4$ in alignment with $S4-S5$ and closer to $S4$.

Ventral idiosoma (FIG. 50). Ventral shields with a reticulated pattern together with small luminous pits. Sternal shield with slightly concave anterior margin and sternal setae relatively long and similar in length. Peritrema extends to dorsal shield reaching the insertion of $j3$. Peritrematal and genito-ventral shields

fused. Genito-ventral shield contiguous to anal shield, 1.2 times longer than wide, with posterior margin irregular. Anal shield 1.5 times wider than long. Metapodal platelets narrow and long. Six pairs of opisthogastric setae on the soft cuticle, $Jv5$ are the longest setae. Spermatheca (FIG. 54) extend from posterior surface of coxae III.

Legs. Tarsus II with one spine-like distal setae.

MALE DESCRIPTION. *Measurements*. Length 618 μm , width 378 μm . Cuticular ornamentation similar to female.

Gnathosoma. Tectum similar to female, strongly notched and with a short neck. From the anterior region of the hypostoma, moving out toward the front, two hyaline expansions with expanded apex extending beyond the tips of the corniculi (FIG. 56). Internal malae ending in two thin hypostomal lacinae, digitiform in shape and pilose. Chelicera (FIG. 55 a, b): fixed digit unidentate with a basidorsal lyrifissure; movable digit with a sharp tooth; sperma-

todactyl short with three lobules or branches: a short and rounded basal branch; medial, hyaline and with a truncate apex; ventral branch (FIG. 55 b), well sclerotized with acute apex presenting the duct opening.

Idiosoma. Dorsal chaetotaxy similar to female, except *S3* on the soft cuticle. Ventrally (FIG. 52), holoventral shield, narrowing toward the posterior part of the body end and with three pairs of opisthogastric setae as long as *Jv5*; setae *Zv3* shorter than anal setae and *Jv3* absent.

Legs (FIG. 57). Tarsus II with one spine-like distal seta which does not reach the tarsal apex. Femur II with a large ventrodiscal digitiform spur with axilar seta; genua II with a posterolateral large, wide and flat apophysis and a rounded distoventral apophysis; tibia II with a medioventral large, wide and flat apophysis, a distal anterolateral rounded tubercle and a dorsodistal conical in shape apophysis.

Discussion. Length of setae *J4* and *J5* and length of the peritrema link this new species to *P. spectabilis* Berlese, 1910, from which may be easily differentiated by its body shape (ovate), and length of *s4* ($z4 > 2z4-s4$) and *z6* ($z6 > 2j6$). Differences with *P. kievati* Darydova, 1971, are few but significant: the peritrema in *P. kievati* reaches the insertion of *z1* and setae *J5* are slightly longer than *J4*. *P. falcifer* is perhaps the most related species and its differential characteristics are: dorsal setae are shorter, with $j2 < j2-j3$, $j5 < j5-z5$, $J2 = 2 J2-J3$, $J4 < J4-J5$ and *gdZ1* in the middle of the area enclosed by setae *Z1*, *J2* and *Z2*; the chelicerae in the male are very similar; the medial branch has a rounded apex and a narrow base; the hyaline hypostomal processes are shorter and tibia II has a large ventral apophysis and a second on the side opposite the first.

Etymology. The species name “canariensis” refers to the plant species — *Artemisa canariensis*— associated with the mite.

***Pachylaelaps minutus* sp. n. FIGS. 58-62**

TYPE. *Holotype:* Female, from soil and humus under rotten trunk in a wet laurisilvae forest, altitude 750 m., UTM 28RCS 212 350, Monte del Agua (Bco. Bucarón), 9 XII 1995, sample T-15;

Paratypes: three females and two males from the same locality and date.

FEMALE DESCRIPTION. *Measurements.* Mean length 392 μm , mean width 249 μm . Body ovate and sclerotized cuticle with a light reticulation.

Gnathosoma. Tectum (FIG. 61) with a short, wide neck and an expanded dentate apex poorly notched. Chelicera relatively large: movable digit bidentate and fixed digit with two basal teeth and one apical bifid tooth (FIG. 60).

Dorsal idiosoma (FIG. 58). Humeral processes well expressed. Dorsal shield ovate with light ornamentation. Dorsal setae (36 pairs) heterogeneous in length. Seta $z1 < 1/3 j3$; setae $j2, j3, j4, z2, z4, s2, r2$ y $r3$ nearly twice as long as the other dorsal setae; $j4 = z4 = 2 j5$; $j5 > j5-z5$; $j5 \geq J1$; $z4 \geq z4-s4$. Setae $J1 < J1-J2$; $J2 = 3 J2-J3$; $J4 = 2 J5$ (FIG. 68); $J1=J2=J3=J4$; distance $J2-J2 = 2 J3-J3$; $J1-J1 > J3-J3$. Dorsal setae on the soft cuticle slightly shorter than setae *S*; seta *R5* is the longest. Glands *gdS4* antiaxial to alignment *S3-S4*, near the base of *S4*.

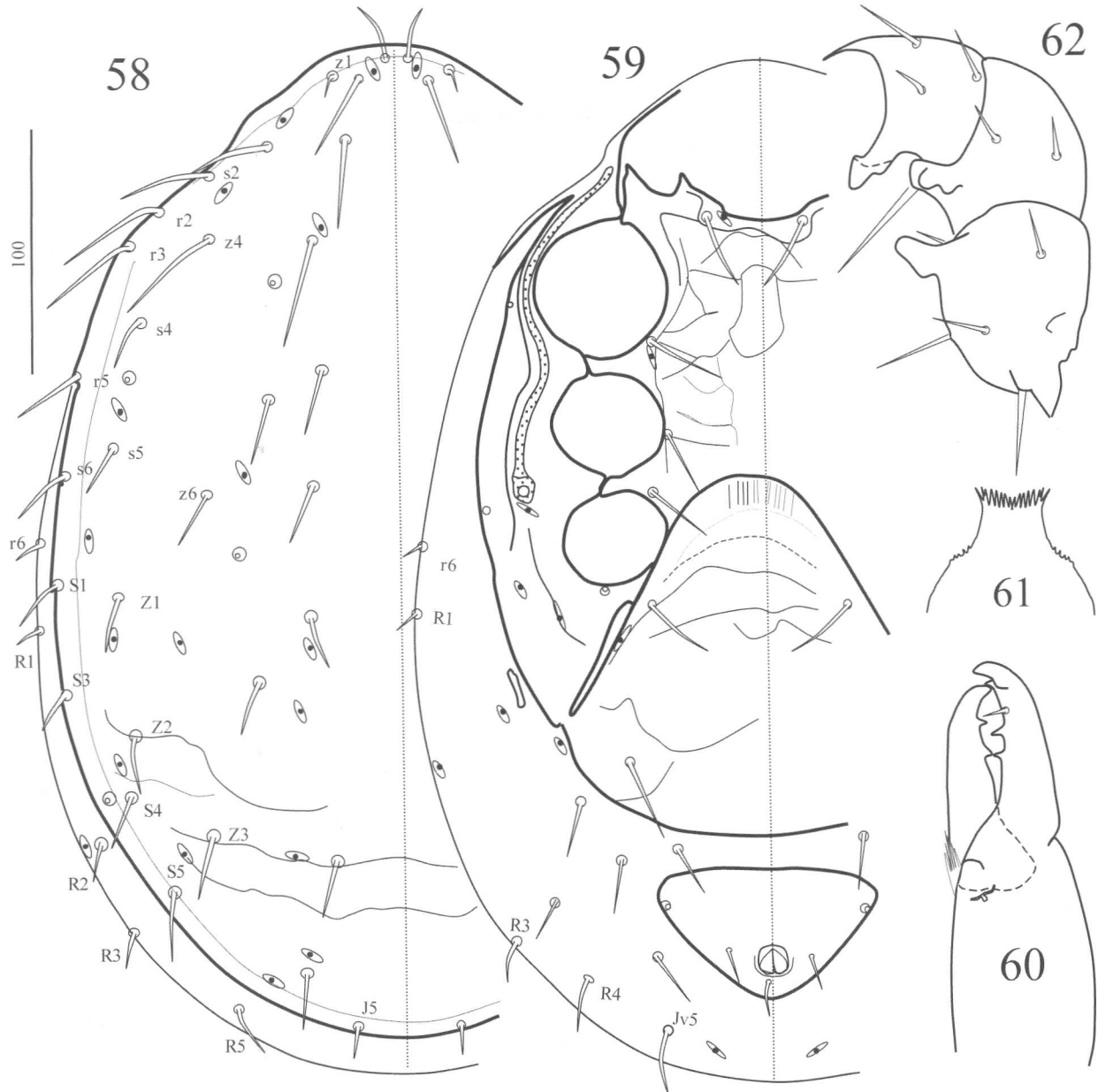
Ventral idiosoma (FIG. 59). Sternal shield with concave anterior margin and clear reticulation with a distinctive area between setae *st1* and *st2*. Peritrematal shield fused to genito-ventral, with curved lateral margins. Peritrema reach the posterior border of coxa I; sculptural peritrematal line descends beyond the stigma. Genito-ventral shield as long as wide and with transversal light lines as ornamentation; posterior border rounded. Anal shield 1.6 times wider than long. The six pairs of ventral setae on the soft cuticle are homogeneous in length and slightly shorter than *Jv1*.

Legs. Tarsus II with one spine-like apical seta.

MALE DESCRIPTION. *Measurements.* Length 446 μm , width 277 μm .

Gnathosoma. Tectum similar to female. Spermatodactyl ribbon shaped, long (three times longer than movable cheliceral digit), medially curled and progressively narrowing toward the acute apex.

Idiosoma. Dorsal shield similar to the female. Holoventral shield with eight pairs of setae in addi-

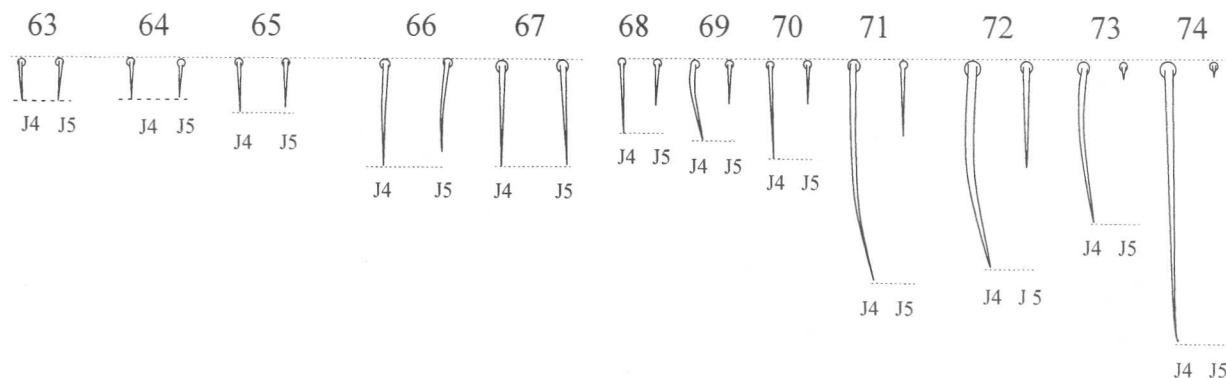


FIGS. 58-62. — *Pachylaelaps minutus*: 58. — Female, idiosoma, dorsal; 59. — Female, idiosoma, ventral; 60. — Female, chelicera; 61. — Female, tectum; 62. — Male, leg II, femur, genua and tibia.

tion to the three circumanal setae. Eight pairs of setae on the soft cuticle, three pairs of ventral setae (*Jv3*, *Jv4* and *Jv5*) and five dorsal (*r6* or *R1* absent).

Legs. Tarsus II with one spine-like apical seta, small apophysis on the opposite side present or absent. Femur II with a digitiform spur with axilar seta; genua and tibia II with a ventral small apophysis on the distal margin (Fig. 62).

Discussion. This new species differs from *P. jurassicus* Schweizer, 1961 and *P. falcifer* Hirschmann & Krauss, 1965, in the relative length of several dorsal setae: both species have setae *J4* and *J5* of similar development, $z4 = s4$ and setae *J2* twice *J2-J3*. In *P. falcifer*, the peritrema extends to the dorsal shield. The differences with *P. intermedius* are: relative length of setae *J5* and *J4* (similar in *P. intermedius*); relative



FIGS. 63-74. — Relative length of opisthonotal setae *J4* and *J5* (all setae of the same scale): 63. — *P. regularis*; 64. — *P. intermedius*; 65. — *P. brachyperitrematus*; 66. — *P. canariensis*; 67. — *P. silviae*; 68. — *P. minutus*; 69. — *P. glandularis*; 70. — *P. sp. 2*, male; 71. — *P. longisetis*; 72. — *P. auricularis*; 73. — *P. mandibularis*; 74. — *P. sp. 1*, male.

length of *z4* and *s4* ($z4 = 0.5 s4$ in *P. minutus*); $z2 > s2 = r2$, $r3$ and $z2 > s2 - r2$ in *P. intermedius* and $z2 = s2 < r2 = r3 = 2 s2 - r2$ in *P. minutus*; in *P. minutus* the peritrema reaches the posterior border of coxa I and in *P. intermedius* does not reach the anterior border of coxa II.

Etymology. The small body size, the smallest of the described species, is the reason for naming it “*minutus*”.

***Pachylaelaps regularis* Berlese, 1921**

It is an especially small mite (length 430-540 μm ; width 220-228 μm), elongate body-shape, with parallel lateral margins. Dorsal setae short and homogeneous in length: setae *j5* shorter than *j5-z5*; marginal setae *r5*, *s6*, *S2* and *S3* similar to *j5*; setae *s4* similar to *z4* and slightly longer than *j5*; setae *J4* and *J5* similar (FIG. 63); *J1* is half the distance of *J1-J2*; *J4* similar to *j5*; glands *gdZ1* paraxial to the line *Z1-Z2* and 12 pairs of setae on the soft cuticle. Spermatheca bulbous at the opposite end of the solenostome. Other characteristics of this species are included in the identification key.

Distribution. Species found in moss, soil and in the nests of small mammals. Cited in Western Europe (Trans-Carpatia) (Koroleva, 1977). In Tenerife, one female in sample T-40.

KEY FOR FEMALES OF PACHYLAELAPS
FROM THE TENERIFE ISLAND

In order to facilitate the species determination of the genus *Pachylaelaps* from Tenerife Island, a taxonomic key has been developed. The key includes characteristics considered by KOROLEVA (1977a) and other characteristics referring to the relative lengths and distances of several dorsal setae taken into account by HIRSCHMANN & KRAWSS (1965).

- 1 (6). Tarsus II with two distal spine-like setae; corniculi narrow and long, well sclerotized; spermatheca short, extending toward the middle region of the body; 14 pairs of idiosomal setae in the soft cuticle (*r6*, *R1-R5*, *Jv2-Jv5*, *Zv2-Zv5*) 6
- 2 (3). Setae *J5* microsetae (FIG. 73) ($J5 < 1/3 j5$); $j5 > j5-z5$; $J1 > J1-J2$; $J3 = J3-J4$; $J2 < J2-J3$; $j3 \geq j3-j4$; $S5 < S5-J4$; $J4 = S5$; $j6 < j6-J1$; $Z3 > Z3-S5$; $r2 = r3$; $s6 < s5$; chelicera with both digits multidentate; measurements 676 x 421 μm *P. mandibularis*
- 3 (2). Setae *J5* normally developed, no microsetae ($J5 \geq 1/3 j5$)
- 4 (5). Setae *J5* one-third as long as *J4* (FIG. 71); dorsal setae long, extending beyond bases of the setae behind them; $j5 > j5-z5$; $J1 > J1-J2$; $J5 > 0.5 j5$; $J3 > J3-J4$; $j6 = j6-J1$; genito-ventral and anal shields contiguous; setae *Zv2* shorter than rest of the ventral setae; spermatheca poorly sclerotized, associated with coxa IV; measurements 795 x 480 μm *P. longisetis*
- 5 (4). Setae *J5* as long as or slightly longer than *J4* (FIG. 67); setae *J* one-third shorter than setae of series *Z* and *S*; $j5 < j5-z5$; $J1 < J1-J2$; $J4 = j5$; $j5 > 0.5 j5-z5$; $r5$, $s6$, $S1$, $S2 > 1.5 j5$; $z6$, $Z1 > 2 j5$; $j4$, $z4$, $s4$, $s5$, $z6 = 2 j5$; spermatheca tubular, long, spiraled, solenostoma opening in coxa IV; setae *Jv2* between anal and genito-ventral shield; measurements 836 x 286 μm *P. silviae*

KEY FOR MALES OF PACHYLAELAPS
FROM THE TENERIFE ISLAND

- 6 (1). Tarsus II with one spine-like distal seta; corniculi short and wide; spermatheca filiform, long, extending toward the posterior part of the body; no more than 12 pairs of idiosomal setae on the soft cuticle.
- 7 (8). Body length superior to 800 μm . Idiosoma ovate with strong granulated reticulation; setae $J5 < 0.5 J4$ (FIG. 72) ($J5/J4 = 0,4$), other dorsal setae long, extending beyond bases of the setae behind them; $j5 > j5-z5$; $J1 > J1-J2$; $J5 = 0.5 j5$; $s6 \leq s5$; $J3 < J3-J4$; peritrema extending to dorsal shield; measurements $847 \times 526 \mu\text{m}$.
..... *P. auricularis*
- 8 (7). Medium to small body sized species (body length inferior to 800 μm)
- 9 (14). Peritrema short, not extending to dorsal shield; $J1 < J1-J2$
- 10 (13). Setae $J4$ and $J5$ equal or subequal in length (FIG. 64, 65)
- 11 (12). Small body size species (length 437 μm ; width 263 μm); granulated cuticle with light reticulation; $j2$, $j3$, $z2$, $z4$ and $s4$ longer than other dorsal setae, reaching the bases of setae behind them; $z4 > s4 > j5$; $z4 = z4-s4$; $J2 = 3 J2-J3$; 12 pairs of idiosomal setae on the soft cuticle; peritrema do not reach the anterior border of coxae II
..... *P. intermedius*
- 12 (11). Moderate body sized species (length 600 μm ; width 365 μm); idiosomal shields reticulated; dorsal setae short and homogeneous in length: $z4 = j5$; $z4 = 0.5 z4-s4$; peritrema extend beyond the anterior border of coxa II
..... *P. brachyperitrematus*
- 13 (10). Setae $J5$ half as long as $J4$ (FIG. 68) ($J5/J4 = 0,6$); podonotal setae $j2$, $j4$, $z2$, $z4$, $s2$ and $r3$ longer, nearly twice other dorsal setae, reaching the bases of setae behind them; $j5 > j5-z5$; $J1 < J1-J2$; $J5 = 0.5 j5$; $z5 = j5$; $z4 = 2 s4$; $J2 = 3 J2-J3$; peritrema short, reach the posterior border of coxa I; measurements $392 \times 249 \mu\text{m}$.
..... *P. minutus*
- 14 (9). Peritrema extend to dorsal shield
- 15 (16). Setae $J5$ less than half as long as $J4$ (FIG. 69) ($J5/J4 = 0,4$), podonotal setae $j2$, $j4$, $z2$, $z4$ and $s2$ longer than other dorsal setae, reaching the bases of setae behind them; $j5 \geq j5-z5$; $J1 < J1-J2$; $J4 < j5$; $J5 < 0.5 j5$; $z5 = j5$; $s4 = z4$; $J2 > J2-J3$; measurements $615 \times 585 \mu\text{m}$.
..... *P. glandularis*
- 16 (15). Setae $J5$ and $J4$ similar in length (FIGS. 63, 66)
- 17 (18). Idiosoma long and ovate with parallel lateral margins; dorsal setae short, similar in length: $j5 < j5-z5$; $J1 < J1-J2$; $j5 = z5$; $J4 = j5$; $J4 > 2 j5$; $J5 > 1.5 j5$; measurements $430-540 \times 220-280 \mu\text{m}$.
..... *P. regularis*
- 18 (17). Dorsal setae short and homogeneous in length, only podonotal setae $j2$, $j3$, $z2$, $s2$, $s4$ and $s5$ reach the bases of setae behind them; $j5 \geq j5-z5$; $J1 < J1-J2$; $J4 = j5$; $J5 \leq j5$; $r5$, $s5$, $s6$, $S1$, $S3$, $j5$ similar in length; $J2 = 2.5 J2-J3$; 11 pairs of setae on the soft cuticle; measurements $763 \times 500 \mu\text{m}$.
..... *P. canariensis*
- 1 (2). Tarsus II with two spine-like distal setae (FIG. 15); femur II with a large, flat spur; genua and tibia II with distal projections (FIG. 15); small chitinous tubercle in palp-tibia (FIG. 16); $J5$ microsetae (FIG. 74); chelicera with unidentate digits; spermatodactyl ribbon shaped, nearly 2.5 times the movable digit (FIG. 17a, b); nine pairs of setae on the holovenal shield in addition to the three circumanal setae; 15 pairs of setae on the soft cuticle; measurements $1326-1385 \mu\text{m} \times 903-961 \mu\text{m}$.
..... *P. species incerta* n° .1
- 2 (1). Tarsus II with one spine-like distal seta
- 3 (4). Palp tibia with one hyaline, finger-shaped and other sclerotized and spatulate chitinous apophysis; setae $J5$ as long as $J4$; spermatodactyl tubular, more than three times as long as movable digit; nine pairs of setae in holovenal shield in addition to the three circumanal setae; genua II with apophysis flat and small; tibia II with a cylindrical distal tubercle bearing a long seta; 11 pairs of idiosomal setae on the soft cuticle *P. silviae*
- 4 (3). Palp tibia without chitinous apophysis
- 5 (6). Tarsus II with a ventral tubercle opposite dorsal spine-like seta; spermatodactyl ribbon shaped, long and curled; hypostoma with long hyaline expansions; trochanter, femur, genua and tibia of leg II with apophysis; femur II with a large digitiform apophysis, two conical small tubercles and a spatulate seta; femur IV with apical and basal tubercles; eight pairs of setae on holovenal shields in addition to the three circumanal setae; 7 pairs of setae on the soft cuticle (setae $S4$ included); measurements $550 \times 337 \mu\text{m}$.
..... *P. glandularis*
- 6 (5). Tarsus II without chitinous tubercle opposite the distal spine-like seta
- 7 (8). Spermatodactyl short (FIG. 55 a, b); chelicera with curved movable digit and a conical projection; seven pairs of setae on the soft cuticle; measurements $618 \times 379 \mu\text{m}$.
..... *P. canariensis*
- 8 (7). Spermatodactyl ribbon shaped; more than seven setae on the soft cuticle
- 9 (10). Peritrematal shield with strong lateral protrusions, visible from above; shields with heavy, granulated reticulation; eight pairs of setae on holovenal shield in addition to the three circumanal setae; nine pairs of idiosomal setae on the soft cuticle; spermatodactyl more than twice as long as movable digit; femur II with a large spur, two conical tubercles and a spatulate seta; genua and tibia II with small tubercles; measurements $737 \times 579 \mu\text{m}$.
..... *P. auricularis*
- 10 (11). Nine pairs of idiosomal setae on the soft cuticle; peritrematal shield with light lateral protrusions; spermatodactyl long and ribbon shaped, three times longer

than movable digit; femur II with a distal spur and two small medial tubercles; tibia II with conical distal apophysis and medial small apophysis; measurements 669-723 x 384-430 μm *P. species incerta* n° 2

11 (9). Peritrematal shields without lateral protrusions; eight pairs of idiosomal setae on the soft cuticle; spermatodactyl three times longer than movable digit; femur, genua and tibia II with apophysis; measurements 446 x 277 μm *P. minutus*

GENERAL DISCUSSION

Regarding dorsal idiosomal chaetotaxy of *Pachylaelaps*, Costa (1966) described the juvenile instars of *P. hispani*. Following this author's observations, the larva bears a total number of 19 pairs of dorsal setae — "i1-i5, z1, z2, s2, s5-s7, J2-J5, Z2, S3-S5" ; eight pairs are added in the protonymph — "s1, z3, r4, r5, r7, J1, Z1 and Z3" and three in the deutonymph — "r1, r2 and S2" -, plus seven pairs on the soft cuticle referred to as "R". The homology of these dorsal setae following the system developed by LINDQUIST & EVANS (1965) is shown in TABLE II.

Three possible errors are detected in COSTA's ontogeny: protonymphal seta denotated as "Z3" is the larval "S4", which has been displaced toward a more central position. In the protonymphal instar, he does not indicate the existence of R1 and he may have assumed that the seta closer to "s6" continues to be "s7" when actually "s7" has been displaced to a posterior position lateral to "Z1". In the deutonymph, setae indicated as protonymphal "z3" (s5 for LINDQUIST & EVANS, 1965) is deutonymphal seta z6.

From a phylogenetic point of view, differences regarding ventral caudal setae Zv4 and Zv5 (LINDQUIST, 1994) may support the idea of the existence of two genera or at least two different subgenera.

Species belonging to morphological Type I have derivative characteristics of phylogenetic importance such as type of spermatheca and sexual dimorphism in the palp-tibia. Hypertrophic seta pl2 on tarsus II is a characteristic shared with *Pachyseius* and is considered as a plesiomorphic state. The presence of nine opisthogastric setae (Zv4-5 present) is also considered as a plesiomorphic characteristic, based on the comparison of this attribute in the related family Parholaspididae (PETROVA, 1977). Reduction of

opisthogastric setae (and even dorsal r6) and unmodified shape of seta pl2 on tarsus II are the characteristics considered derivative for species of the second morphological type.

TABLE II

Costa, 1966	Lindquist & Evans, 1965
i1(lv)	j1
i2-i5 (lv)	j3-j6
s2 (lv)	z2
z1(lv)	z4
z2(lv)	z5
s5(lv)	s4
s6(lv)	s6
s1(pn)	j2
r4(pn)	r2
r5(pn)	r3
r7(pn)	r5
z3(pn)	s5
r1(dn)	z1
R(dn)	r6
s7(lv)	S3
J2-J5 (lv)	J2-J5
Z2 (lv)	Z2
S3 (lv)	S4
S4 (lv)	Z3
S5(lv)	S5
J1 (pn)	J1
Z1(pn)	Z1
Z3 pn=S4Lv	Z3
S2(dn)	S1
6 R (dn)	R1(pn), R2-R5, Jv5(lv)

Given that an extensive comparative study of this genus is necessary, it is not possible to support or reject these proposed ideas. A deeper understanding of this and related families may allow us to arrive at a definitive conclusion at some point in the future.

ACKNOWLEDGMENT

Special thanks to the Cabildo of Tenerife and to the organization of The Teide National Park for allowing M.A. PEÑA-ESTEVEZ to collect the samples.

REFERENCES

- ALEXANDROVA (E.M.), 1980. — New species of the mites from the family Pachylaelapidae (Parasitiformes, Gamasina). — *Novye i Maloizvestnye Vidy Fauny Sibiri*, 14 : 34-39.
- COSTA (M.), 1966. — Description of the juvenile stages of *Pachylaelaps hispani* Berlese (Acari: Mesostigmata). *Acarologia*, 8 (1): 9-22.
- COSTA (M.), 1971. — Mites of the genus *Pachylaelaps* Berlese (Acari: Mesostigmata, Pachylaelapidae) from litter in Israel. — *Israel Journal of Zool.*, 20: 253-277.
- EVANS (G.O.), 1963. — Observations on the chaetotaxy of the legs in the free-living Gamasina (Acari: Mesostigmata). — *Bull. Brit. Mus. (Nat. Hist.)*, Zool., 13: 249-294
- GU (Y.) & HUANG (C.), 1991. — Four new species and one new record of the genus *Pachylaelaps* from China (Acari: Laelapidae). — *Acta Zootax. Sinica*, 16(4) : 436-443.
- HALLIDAY (R.B.), 1997. — Revision of the genus *Zygoseius* Berlese (Acarina: Pachylaelapidae). *Acarologia*, 8 (1): 3-20
- HIRSCHMANN (W.) & KRAUSS (W.), 1965. — Bestimmungstafeln von 55 *Pachylaelaps* Arten. — *Acarologia*, 38 : 1-5.
- HYATT (K.H.), 1956. — British mites of the genus *Pachyseius* Berlese, 1910 (Gamasina-Neoparasitidae). — *Ann. Mag. Nat. Hist. Ser. 12*, 9 : 1-6.
- IAVORSCHI (V.), 1995. — Acariens-Gamasides (Anactinothrichida, Gamasida) d'Israël. Première note. In: *Soil Fauna of Israel*. Nitzu E. (Ed.), Editura Academiei Romane, 1: 53-62.
- JOHNSTON (D.E.) & MORAZA (M.L.), 1991. — The idiosomal adenotaxy and poroidotaxy of Zerconidae (Mesostigmata: Zerconina). In: *Modern Acarology*, Dusbábek and Bukva (Eds.), Academia Prague and SPB Academic Publishing bv. The Hague, vol. 2 : 349-356.
- KARG (G.W.), 1971. — Acari (Acarina), Milben Unterordnung Anactinochaeta (Parasitiformes). Die freilebenden Gamasina (Gamasides), Raubmilben. — *Die Tierwelt Dtl.*, 56, 475 pp.
- KOROLEVA (E.V.), 1977a — Family Pachylaelaptidae. In: M. S. Ghilarov y N. G. Bregetova. (Eds.). *Handbook for the identification of soil inhabiting mites. Mesostigmata*. Nauka, leningrad, pp. 411-483.
- KOROLEVA (E.V.), 1977b. — New species of mites of the genus *Pachylaelaps* Berlese, 1888 (Parasitiformes, Pachylaelaptidae). — *Parazitol. Sb. ZIN AN SSSR*, 27 : 119-148.
- LINDQUIST (E.E.), 1994. — Some observations on the chaetotaxy of the caudal body region of Gamasine mites (Acari: Mesostigmata), with a modified notation for some ventrocaudal body setae. — *Acarologia*, 35 (4) : 323-326.
- LINDQUIST (E.E.) & EVANS (G.O.), 1965. — Taxonomic Concepts in the Ascidae, with a Modified Setal Nomenclature for the Idiosoma of the Gamasina (Acarina: Mesostigmata). — *Mem. Entomol. Soc. of Canada*, 47 : 1-64.
- LINDQUIST (E.E.) & MORAZA (M.L.), 1999.- Observations on homologies of idiosomal setae in Zerconidae (Acari: Mesostigmata), with modified notation for some posterior body setae. — *Acarologia*, 39 (1998), 203-226.
- MA (L.), 1985. — Three new species of the genus *Pachylaelaps* from Qinghai and Gansu provinces, China. — *Entomotaxonomia*, 7(4): 337-340.
- MA (L.) & WANG (CH.), 1997. — A new species of the genus *Pachylaelaps* and a new species of the genus *Lasioseius* from Xizang, China (Acari: Pachylaelapidae, Acoesejidae). — *Acta Zootax. Sinica*, 22(1) : 29-32.
- MA (L.) & YIN (X.), 2000. — Two new species of the family Pachylaelapidae (Acari: Gamasina). — *Acta Entomol. Sinica*, 43(1) : 94-97.
- MAJEWSKI (T.), 1982. — Rare and new Laboulbeniales from Poland. 7. — *Acta Mycologica*, 17(1-2): 53-62
- MORAZA (M.L.) & JOHNSTON (D.E.), 1990. — *Pachyseius hispanicus* n. gen., n. sp., from Navarra (Northern Spain) (Acari: Mesostigmata: Pachylaelapidae). — *Inter. J. Acarol.*, 16(4) : 1-6.
- MORAZA (M.L.) & JOHNSTON (D.E.), 1993. — *Pseudopachyseius ignacii* n. gen., n. sp., from Navarra (Northern Spain) (Acari: Mesostigmata: Pachylaelapidae). — *Redia*, 76, n.2: 263-271.
- PETROVA (A.D.), 1977. — Family Parholaspididae in M.S. Ghilarov and N.G. Bregetova (Eds.) 1977. *Handbook for the identification of soil inhabiting mites. Mesostigmata*. Nauka, Leningrad, pp 315-346.
- SCHMÖLZER (V. K.), 1992. — Neue Höhlenmilben aus Kärnten (Acarina, Parasitiformes). *Carinthia II* : 611-620.
- VAN DRIEL (C.D.), LOOTS (G.C.) & MARAIS (J.F.), 1977. — La faune terrestre de l'île de Sainte-Helene. Quatrième partie. 3. Arachnida: 4. Acarina. 7. Freelifving Mesostigmata. — *Koninklijk. Museum voor Midden Afrika Tervuren Annalen Zoologische Wetenschappen*, 220 : 305-335.
- VISHNUPRIYA (R.) & MOHANASUNDARAM (M.), 1988. — Mites associated with insects in Tamil Nadu, India. — *Entomol.*, 13(3-4): 247-257.

