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# A new phoretic deuteronymph of *Halodarcia* KARG (Acari: Mesostigmata: Halolaelapidae) associated with carabid beetles in Belgium with a review of the genus.

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**Abstract**

The deuteronymph of *Halodarcia carabidophila* sp.nov. occurring under the elytra of four species of Carabidae (Insecta) in Belgium is described and compared morphologically with the same instar of the two previously described species of the genus, *Halodarcia incideta* KARG and *Halodarcia porolata* KARG. The deuteronymphs of *H. incideta* and *H. porolata* are shown to have been assigned originally to the wrong species resulting in the deuteronymph of *H. incideta* sensu KARG 1969 being transferred to *H. porolata* and that of *H. porolata* sensu KARG 1969 to *H. incideta*. A key is provided for the identification of the deuteronymphs. The relationship of the genus *Halodarcia* to other genera included in the Halolaelapidae is discussed and a division of the family into two subfamilies, Halodarciinae and Halolaelapinae, is proposed.

**Key words**: Mites (Acari: Halolaelapidae). Sub-elytral phoretics of Carabidae (Coleoptera). Belgium.

## Introduction

The mites forming the subject of this work were found under the elytra of four species of beetles of the family Carabidae in Belgium. All are deuteronymphs and members of the genus *Halodarcia* KARG (Halolaelapidae). They were collected by Dr. M. DUFRÉNE and Mr M.I. NOTI, Department of Ecology and Biogeography, Catholic University of Louvain, Belgium in the course of ecological studies on the Carabidae of Belgium. A list of mites collected from carabid beetles in Belgium, including a redescription of the deuteronymph of *Halodarcia incideta* KARG 1969, has been published by FAIN et al. (1995). They referred to the new species described in that work as *Halodarcia* sp.
The terminologies for the dorsal idiosomatic chaetotaxy and the leg chaetotaxy follow the systems of LINDQUIST & EVANS (1965) and EVANS (1963), respectively. The system of nomenclature for the cuticular glands and "poroids" is that of Athias-Henriot (1971, 1975).

## Description of species

Order **Mesostigmata**
Family **Halolaelapidae KARG**
Genus *Halodarcia* KARG 1969

Deuteronymphs with podonotal and opisthonotal shields, adults with holodorsal shield; podonotal shield of deuteronymph with 15 or 16 pairs of setae, *z1* on unsclerotized cuticle, opisthonotal shield with 10-13 pairs; podonotal region of holodorsal shield of female with 16 or 17 pairs of setae (*z1* on shield, *s4* on shield or on unsclerotized cuticle), opisthonotal region with setae *J3* absent, *J5* in advance of *Z5* and with 4 pairs of *S* setae (*S5* off shield). Podonotal and opisthonotal regions each with 4 pairs of primary gland pores (*gd7* present), large in adults, supernumerary gland pores on podonotum present or absent; gland pores *gd3* and 10 associated with peritrematic shield. Posterior region of idiosoma of adults with aciculate areas resembling cribrum of ventrianal shield.
Sternal pores *iv3* lacking; *gv3* duplex, solenostomes on platelet. Presternal shields strongly developed in the female; sternal shield fused with endopodal elements of coxae 1-II and II-III in adults but not in deuteronymph; genital shield of female with hyaline flap produced into slender pointed process; adults with ventrianal shield, deuteronymphs with anal shield; peritrematic shield enlarged in the adult and free or fused with the exopodal shield of coxa IV. Spermatodactyl directed anteriorly and hook-like at extremity. Seven transverse rows of denticles on subcapitulum (*Q2-Q8*), *Qx* row weakly developed; rows not confined to capitular groove in adults. Pedipalp apotele three-tined, chaetotaxy of palptrochanter to genu (2-5-6). Genu and tibia of leg I each with 6 dorsal setae (2-3/2-3/1-2), femur I with 13 setae, genu III with 9 setae. Leg II of male without spurs. Sensory field of tarsus I in nymphs and adults with conspicuous goose-neck sensillus; acuminate paradactyli and setae *ad1-pd1* of tarsi II-IV of protonymphs and adults extending well beyond the ambulacrum. Adults free-living in litter and humus in damp or wet situations; deuteronymphs, of at least some species, sub-elytral phoretics of carabid beetles.
Type species: *Halodarcia incideta* KARG 1969.

*Halodarcia carabidophila* sp. nov.

Deuteronymph: Dorsum of idiosoma with two shields, podonotal shield 250-275 μm in median length and 190-240 μm in width at the level of setae *s3*, opisthonotal shield 200-220 μm in median length and 208-225 μm at anterior margin (Fig. 1). Podonotal shield with fifteen pairs of setae comprising *j1-j6,z2-z6* and *s2,s3,s5,s6*. Setae *z1* short (12-15 μm), subspinose and situated on unsclerotized cuticle anterior to the shield. Setae of the podonotal shield smooth and subequal: *j1* (19-23 μm), *j5* (24-25 μm), *z5* (26-28 μm). Surface of shield reticulate, with four pairs of gland pores (*gl1,2,4,5* - open circles in Fig. 1) and five pairs of poroids (represented in solid black). Sigilla indicated by dotted areas. Seven pairs of setae on lateral unsclerotized cuticle.

Opisthonotal shield normally with ten pairs of setae (10-10) comprising *J1,2,4,5*; *z1-5* and *S2* (Fig. 1), variants with 9 setae on one side due to the absence of *Z3* or *Z4*, or with 11 setae on one side of the body resulting from the addition of *S3* (Fig. 2), *S4* or *J3* (Fig. 3). Setae simple or sparsely barbed, subequal in length, *J2* (22-25 μm), *Z2* and *Z5* (26-27μm). Four pairs of gland pores (*gd6-9*) and one pair of supernumerary gland pores internal to *gd8* (overlying dark tissue mass in lactic acid macerated specimens). Normally 8 pairs of poroids present, *idm1* associated with *gd6* conspicuously absent (cf Figs. 1 & 14). Surface of shield reticulate; five paired groups of sigilla indicating the dorsal attachment sites of five pairs of dorso-ventral opisthosomatic muscles. Lateral unsclerotized cuticle bearing setae *S1* and *S3-5* and two rows of marginal setae.

Ventrally, tritosternum biramous with laciniae distinctly pilose, apical pilae long and extending well beyond tip of laciniae (Fig. 4). Sternal shield, 210-231 μm in length and 81-92 μm in maximum width, weakly ornamented and with the normal four pairs of setae (*st1-4*) but only two pairs of lyrifissures (*iv1-2*). Lyrifissure *iv2* typically oblique and removed from margin of shield. Sternal shield not fused with the endopodalia between coxae I-II, II-III and III-IV. Opisthogaster with six longitudinal rows of setae forming three paired series, inner series each with 5 setae, medial series normally each with five setae but anterior seta (*Zv1* sensu LINDQUIST & EVANS, 1965) sometimes absent, and outer series very variable with 0-3 setae (Fig. 4). Four platelets posterior to genital setae (*st5* of some authors) and one pair posterior to first pair of postgenital setae. One of the pair of *iv5* "poroids" rarely with a microseta (Fig. 4). Inguinal gland platelet with two pores (*gv2*). One pair of metapodal shields. Anal shield (78-90 μm long and 60-72μm wide at the level of the adanal setae) reticulate except for cribrum, paranal gland pores (*gv3*) conspicuous. Podalia of acetabulum IV strongly developed. Peritreme short, about 75-95μm in length and extending to the level of the posterior third of coxa II, of characteristic form with peritreme floor divided by sclerotized ridges, micropapillae not dense (Fig. 5). Peritrematic shield free and extending to the level of podonotal seta *z3*; *gd10* large, associated with a group of three sigilla and on an antero-ventral projection (Fig. 6). All dorsal and ventral shields micropunctate.

Cheliceral digits relatively shorter and stouter than in *Halodarcia porolata* and *H. incideta* (Fig. 16), fixed digit with five teeth, the three proximal teeth considerably stronger than the two distal; pilus dentilis as in Fig. 7. Movable digit (46 μm in length) with four or five small teeth; antiaxial and dorsal slit organs present, dorsal seta well developed.

Gnathotectum subtriangular in shape with toothed lateral margins and tapering bifurcate median process (Fig. 8). Subcapitular groove with seven transverse lines (*Q2-Q8*) with few or several denticles, line *Qx* inconspicuous and without distinct denticles; hypostomatic and palpcoxal setae subequal in length (Fig. 9). Palpomeres with normal complement of setae; seta *v2* on trochanter pilose, *al* on femur and *al1* and *al2* on genu pilose and spatulate in distal half; palpal claw (apotele) with three prongs, posterior prong slender.

All legs with ambulacra comprising lobed pulvilli and paired claws.

Pulvillus with lobed dorsal component and larger ventral caruncle as shown in the partially retracted puvillus and claws of tarsus IV in Fig. 10. Telotarsal setae *ad1/pd1* not extending beyond the anterior margin of the ambulacral stalk. Chaetotaxy of femora, genua and tibiae as follows:

Femora (I-IV) (2-5/4-2); (2-5/3-1); (1-3/1-1); (1-3/1-1).

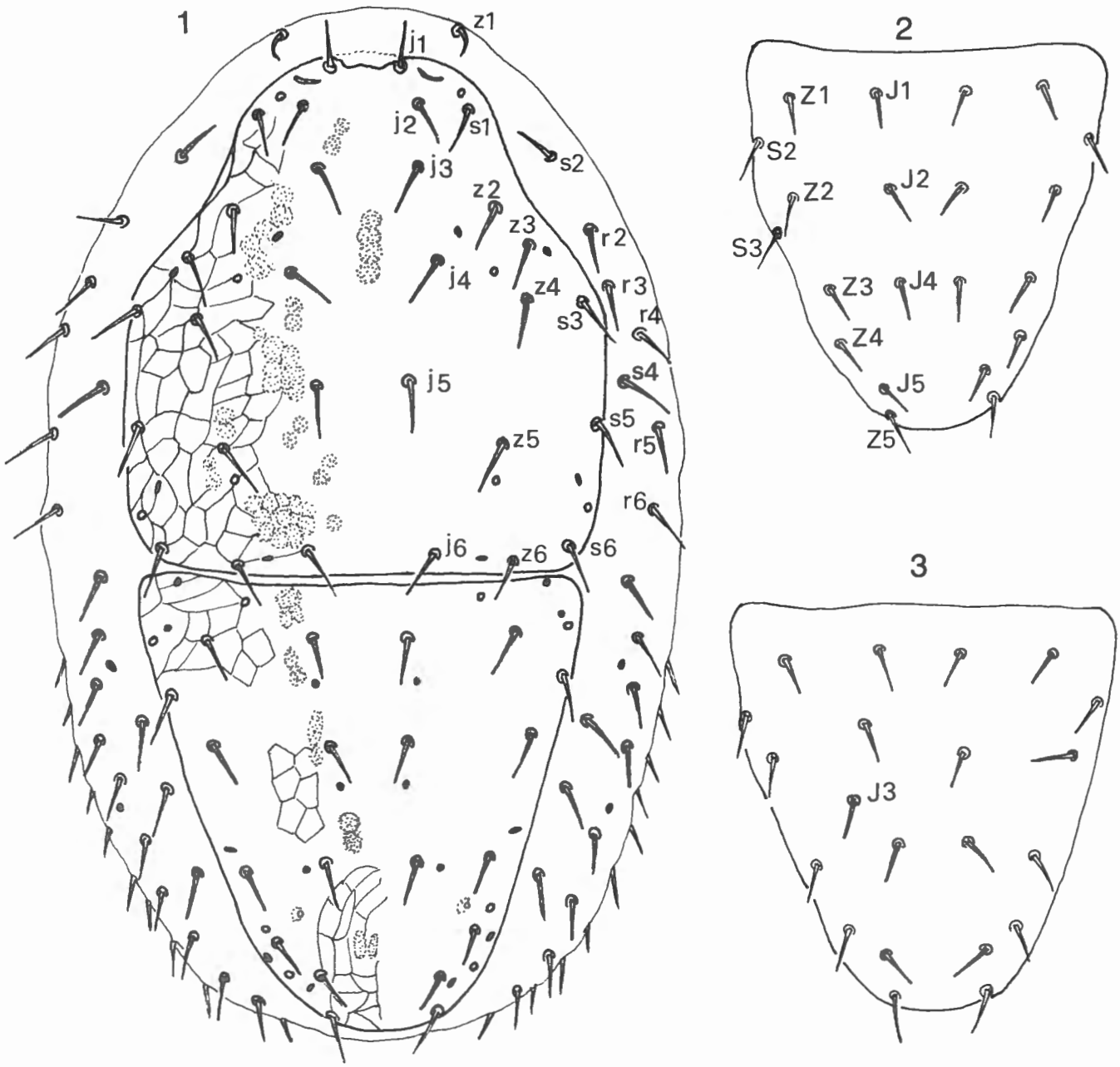
Genua (I-IV) (2-3/2,3/1-2); (2-3/1,2/1-2); (2-2/1,2/1-1); (2-2/1,3/1-1).

Tibiae (I-IV) (2-3/2,3/1-2): (2-2/1,2/1-2); (2-1/1,2/1-1); (2-1/1,3/1-2).

Coxae II with weak anterior spine. Tarsus I with distal sensory field comprising 12 blunt-ended chemoreceptors, a characteristic goose-neck sensillus, inflated distally and ending in a fine process, and a number of mechanoreceptors with pointed tips (Fig. 11). Tarsi II-IV with four basitarsal and 12 telotarsal setae, majority of setae with one to three barbules.

Locality: known only from deuteronymphs found under the elytra of the following species of Carabidae in Belgium: *Agonum versutum* (GYLLENHAL), *Pterostichus diligens* (STURM) and *Pterostichus minor* (GYLLENHAL) collected in traps at the borders of a pond, "Les Eplattis", Ardenne; *A. versutum* from borders of a pond (Étang de Luchy), Ardenne; *Pterostichus versicolor* (STURM) from a sandy moor, Vallée du Zijpbeek, Campine. Holotype from *A. versutum*, collecting station "Les Eplattis", Ardenne (locality: 5° 18' 36", 49° 45' 43") and deposited with paratypes in the Institut Royal des Sciences Naturelles de Belgique, Brussels; paratypes also in the collections of The Natural History Museum, London.

Deuteronymphs of *H. carabidophila* have been found, each on a single occasion, with those of *Halodarcia incideta* (= *H. porolata* sensu KARG (1969) under the elytra of *Agonum versutum*, *Pterostichus diligens*, *P. minor* and *P. versicolor* (FAIN et al., 1995).




*Halodarcia carabidophila* sp. nov., deuteronymph. Fig. 1. Dorsum of idiosoma showing chaetotaxy, adenotaxy (open circles), poroidotaxy (black circles and ellipses) and sigilla (dotted areas). Figs. 2 & 3. Variations in the setal complement of the opisthonotal shield.

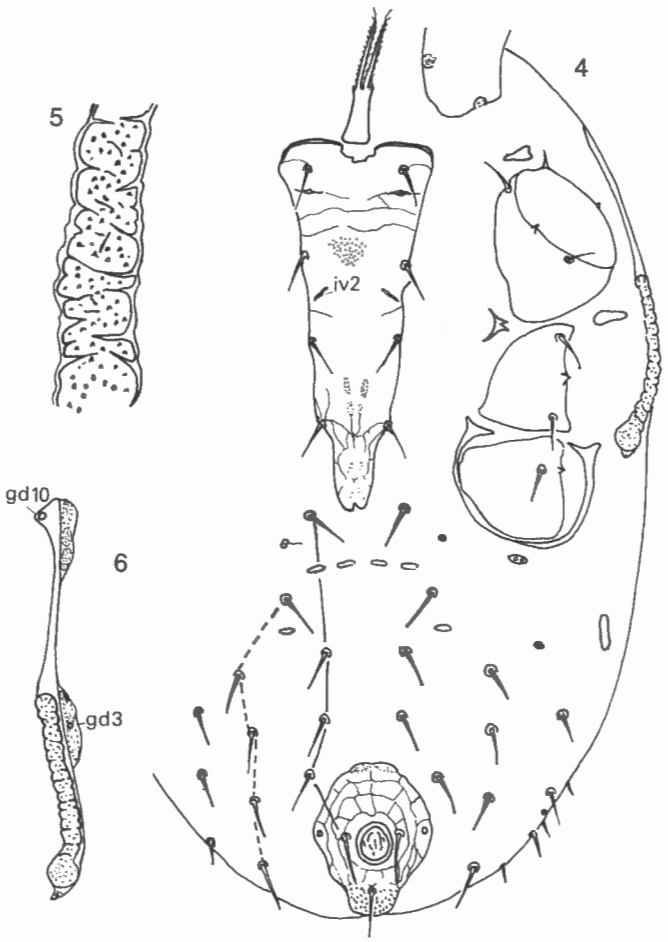
## Relationship to other species of *Halodarcia*

An examination of the type material of adults and nymphal instars of *H. porolata* and *H. incideta* indicated the probable incorrect assignment of the deuteronymphs to their adults. This conclusion is based on the following observations on the labelled type specimens:

(1) Setae *s4* are present on the podonotal shield of the deuteronymph of *H.incideta* (Fig. 12) and the female of *H. porolata* (male not seen) but lie off the shield in the deuteronymph of *H. porolata* (cf Fig. 1) and the female of *H.incideta*.

(2) Deuteronymph of *H. incideta* (Fig. 12) and female of *H. porolata* with additional "gland" pores lying between *gd2* and *gd5*; supernumerary "gland" pores absent in the deuteronymph of *H. porolata* and both sexes of *H. incideta*.

(3) Setae of dorsal shield(s) in the protonymph and female of *H. porolata* and the deuteronymph of *H. incideta* (series A) are consistently longer than in the protonymph and female of *H. incideta* and the deuteronymph of *H. porolata* (series B). For example, the lengths of *z5* and *J1* (*z5/J1*) in the protonymph, female and deuteronymph of series A are, respectively, 43/28, 36/29, 35/30μm and in series B. 25/21, 27/24, 26/24.




*Halodarcia carabidophila* sp. nov., deuteronymph. Fig. 4. Venter of idiosoma. Fig. 5. Floor of peritreme. Fig. 6. Peritreme and peritrematic shield in lateral view.

Data on the slide labels suggest that nymphs and adults of both species were recovered from the same sample (confirmed by Dr KARG). On the basis of the above morphological criteria, we consider that the deuteronymph of *H. porolata* sensu KARG (1969) is that of *Halodarcia incideta* KARG 1969 and that the deuteronymph of *H. incideta* sensu KARG 1969 is that of *Halodarcia porolata* KARG 1969. The following citations of the two species of deuteronymphs refer to their emended taxonomic status.

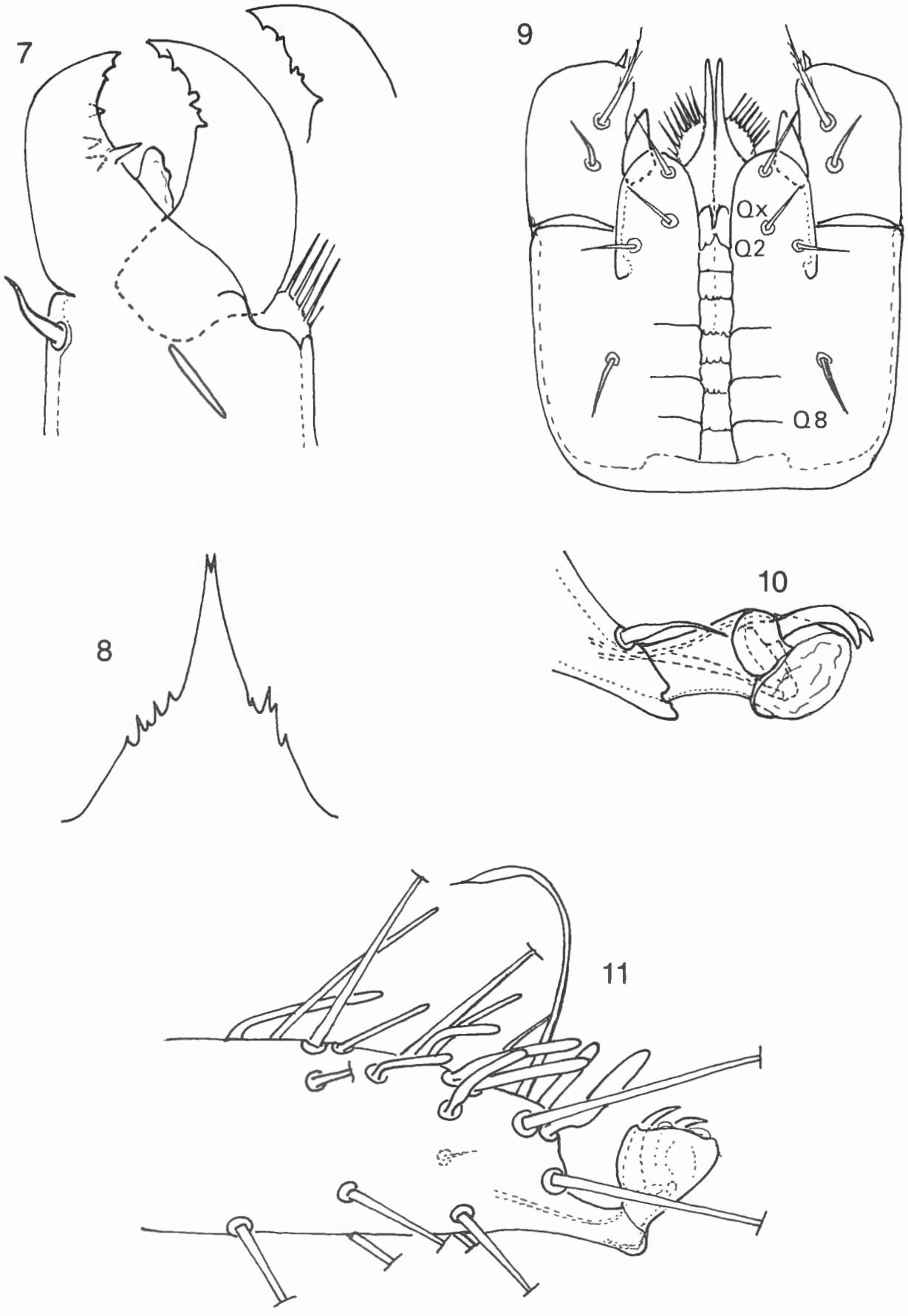
The deuteronymph of *Halodarcia carabidophila* sp. nov. can be distinguished from the same instar of the other two species of the genus by a number of morphological characters. The most obvious relates to the chaetotaxy of the opisthonotal shield which in *H. incideta* and *H. porolata* normally bears 13 pairs of setae (Fig. 13) through the addition of *S1,S3* and *S4* to the normal complement occurring in *H. carabidophila*. Rarely, *S3* may be located on lateral unsclerotized cuticle on only one side of the body. The four pairs of opisthonotal gland pores and one pair of accessory gland pores are present in the three species but in *H. incideta* 11 pairs of poroids occur on the shield, including *idm1* (Fig. 13). Unfortunately, it was not possible to determine with certainty the number of poroids in *H. porolata*. The chaetotaxy, adenotaxy and poroidotaxy of the podonotal shield in *H.incideta* is the same as in *H. carabidophila* but, as stated above, in *H. porolata* setae *s4* occur on the shield and not on the lateral striated cuticle as in the other two species, there are additional "gland" pores lying between setae *gd2* and *gd5* (three on the right side and one on the left side in the paratype examined by us) and the setae of both dorsal shields are longer and stronger (thorn-like) in *H. porolata*, for example, *j1* (30$\mu$m), *z5* (36$\mu$m) and *Z5*(34$\mu$m). Setae *z1* lie off the podonotal shield in all three species.

The form of the dorsal idiosomatic setae in the adults of *H. porolata* and *H.incideta* differ from those of their immature instars. In *H.incideta*, all the setae are spinose with the marginal series distinctly pilose whereas the stout pilose spine-like setae (Fig. 14) in *H. porolata* are longer and more numerous than the setiform type (Fig. 15), for example, in the podonotal region of the holodorsal shield in the female only *j5,j6,z5,* and *z6* are setiform. In both adults, the gland pores (and supernumerary "gland" pores in *H. porolata*) are large and conspicuous. The holotype female of *H. incideta* has setae *S4* off the shield on the left side of the idiosoma and the surface of the lateral striated cuticle is produced into rounded tubercles reminiscent of the lobes on the cuticular ridges of some Tetranychidae (Fig. 22). They are not present in the deuteronymph or male.

Ventrally, differences are seen in the orientation of the second pair of deuteronymphal sternal lyrifissures (*iv2*) which are directed longitudinally along the lateral margins of the shield in both *H. incideta* and *porolata* as opposed to oblique and removed from the margin of the shield in *H. carabidophila*. The absence of gland pores *iv3* is a feature of the deuteronymphs and apparently also the adults of *Halodarcia*. *H. carabidophila* is exceptional in having a much reduced peritreme measuring less than 95$\mu$m in length compared with over 130$\mu$m in *H. incideta* and *porolata*. The floor of the peritrematic canal has a few lateral ridges in *H. porolata* whereas no distinct ridges occur in the peritreme of *H. incideta*. Gland pores *gd10* are present in all three species.

The teeth of the more slender cheliceral digits, especially of the fixed digit, of the deuteronymphs of *H. incideta* (Fig. 16) and *H. porolata* are larger and stronger than in *H. carabidophila*. The form of the gnathotecta is shown in Figs. 17 and 18. The subcapitular rows of denticles are broader and the denticles larger in *H. porolata* (Fig. 19) than in *H. incideta* which resembles the condition in *H. carabidophila*.

The podomeric chaetotaxy is constant in the genus as is the presence of the goose-neck sensillus of tarsus I in nymphs and adults. Long acuminate ventro-lateral processes of the ambulacral stalk, the paradactyli, are absent in all deuteronymphs but are present on legs II -IV in the protonymph and adult (Figs. 20, 21). The two processes retain their position when the pulvillus is retracted. The anterior acuminate process is usually longer than the




*Halodarcia carabidophila* sp. nov., deuteronymph. Fig. 7. Chelicera showing variation in dentition of movable digit. Fig. 8. Gnathotectum. Fig. 9. Venter of subcapitulum. Fig. 10. Ambulacrum of tarsus II. Fig. 11. Sensory field of tarsus I showing goose-neck sensillus.

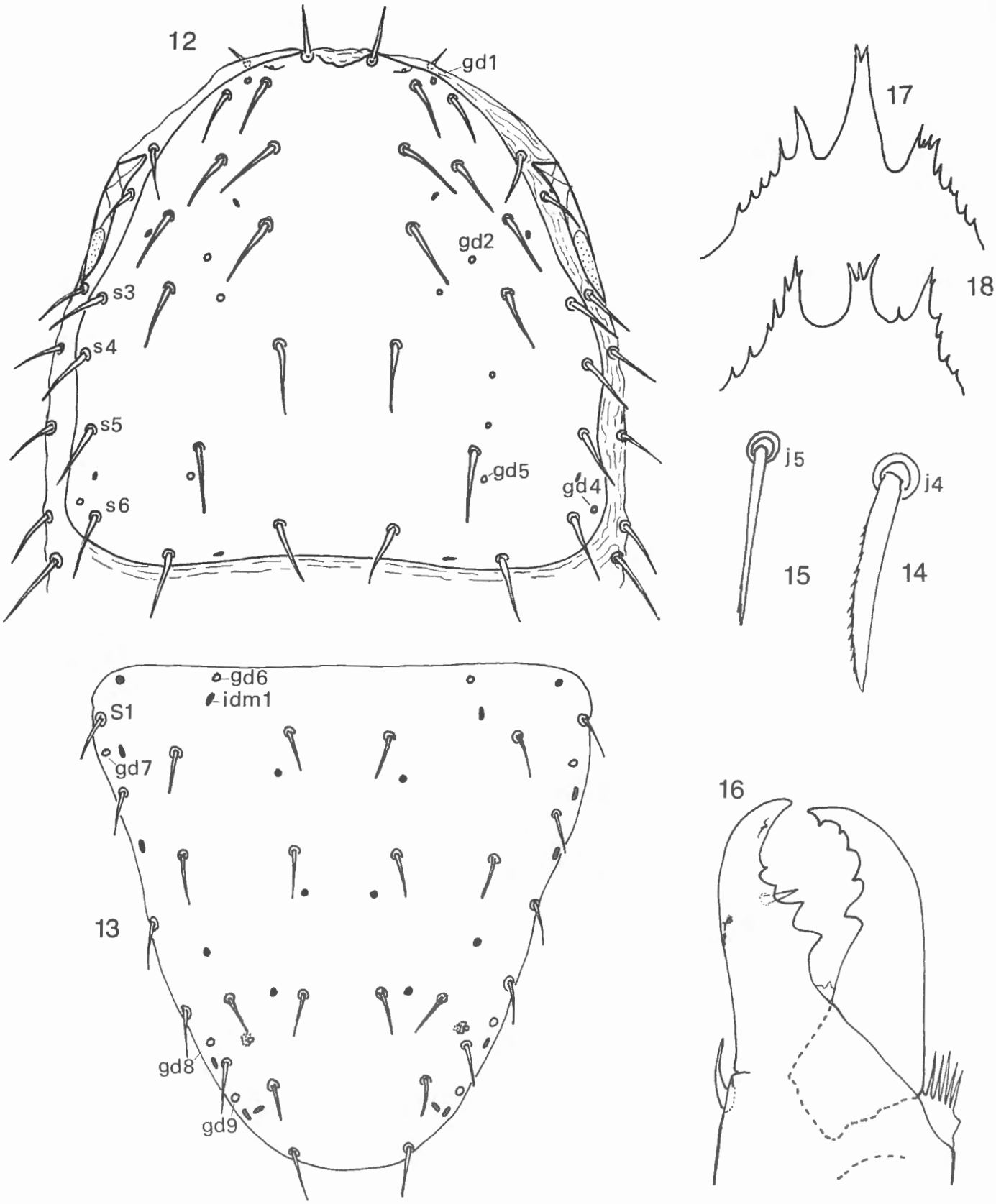



Fig. 12. Podonotal region of the deuteronymph of *Halodarcia porolata* KARG. Fig. 13. Opisthonotal shield of the deuteronymph of *Halodarcia incideta* KARG. Figs 14 & 15. Dorsal setae of the female of *H. porolata*. Fig. 16. Chelicera of the deuteronymph of *H. incideta*. Figs 17 & 18. Gnathotecta of the deuteronymphs of *H. incideta* KARG (17) and *H. porolata* KARG (18).

posterior one in the adults. This condition is very evident in the male of *H. incideta* (male of *H. porolata* not examined). Tarsal setae *ad1* and *pd1* are considerably longer in the protonymphs and adults than in the deuteronymphs and extend beyond the ambulacrum (Fig. 21).

The following key summarises the major diagnostic characteristics of the deuteronymphs:

1. Opisthonotal shield with normally 10 pairs of setae, *S1* never present on the shield (Fig. 1); peritreme reduced, less than 95 $\mu$m in length; sternal lyrifissures *iv2* typically oblique and removed from lateral margin of shield (Fig. 4); cheliceral digits stout with teeth of movable digit weak (Fig. 7) ..... ..... *Halodarcia carabidophila* sp. nov.
   - Opisthonotal shield normally with 13 pairs of setae, *S1* present on the shield (Fig. 14); peritreme longer, at least 130$\mu$m in length; sternal lyrifissures *iv2* directed longitudinally along lateral margin of shield; cheliceral digits relatively slender with proximal teeth of movable digit strong (Fig. 16) ..... 2
2. Podonotal shield with 15 pairs of setae, *s4* on lateral unsclerotized cuticle, and without supernumerary gland pores; subcapitular transverse rows of denticles relatively narrow, restricted to groove and with denticles weak (cf. Fig. 9); median process of gnathotectum long, normally bifurcate distally and extending well beyond the level of the antero-lateral projections (Fig. 17) ..... *Halodarcia incideta* KARG
   - Podonotal shield with 16 pairs of setae, *s4* on shield, and with supernumerary gland pores; subcapitular transverse/oblique rows of denticles broader, not restricted by grove and with strong denticles (Fig. 19); median process of gnathotectum shorter, stouter and typically trifurcate distally (Fig. 18) ..... ..... *Halodarcia porolata* KARG

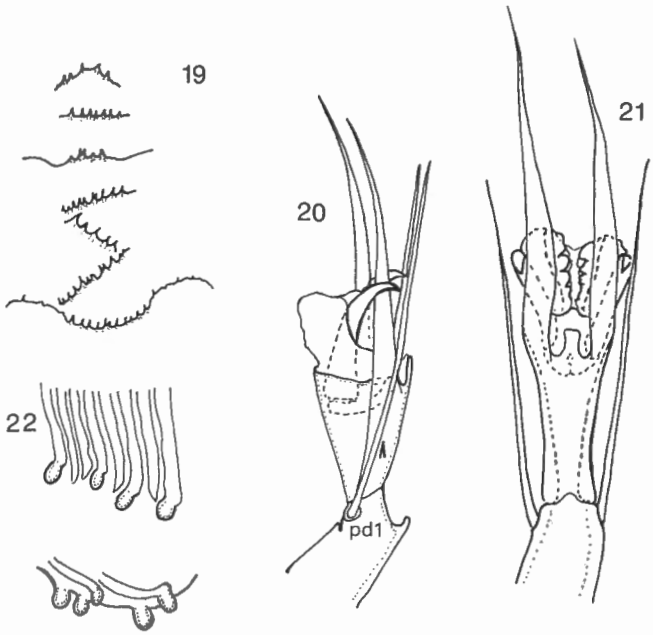



Fig. 19. Subcapitular rows of denticles in the deuteronymph of *Halodarcia porolata* KARG. Figs 20 & 21. Ambulacrum of tarsus II of the female of *Halodarcia incideta* KARG in lateral (20) and ventral (21) views. Fig. 22. Terminal lobes of the cuticular striae of the dorso-lateral region of the opisthosoma of the female of *H. incideta*.

**Relationship to other Halolaelapidae**

KARG (1969) placed the genus *Halodarcia* in the family Halolaelapidae together with the genera *Halolaelaps* and *Antennoseius*. The new genus shared with *Halolaelaps* certain morphological features, such as the location of *Z5* posterior to *J5* and the absence of *J3* on the opisthonotum and the presence of pointed "pulvilli" ("spitzen Haftlappen"), which figured prominently in his diagnosis of the family. The genus *Antennoseius* had previously been placed in the family Ascidae by LINDQUIST & EVANS (1965) and in the Antennoseiidae by KARG (1965). This broad concept of the family was retained by KARG (1971) who also included within it the genera *Leitneria* and *Saprosecans*. EVANS & TILL (1979) excluded *Antennoseius* from the Halolaelapidae but recognized *Saprolaelaps* and *Saintdidieria* (treated as synonyms of *Halolaelaps* by KARG) as valid genera. Certain of the morphological features of *Halodarcia*, such as, the dorsal sclerotization of the adults, the adenotaxy of the idiosoma, and the chaetotaxy of tibia I, appear to differ from other Halolaelapidae and are discussed below.

The fusion of the two dorsal shields in the deuteronymph of *Halodarcia* to form a holodorsal shield in the adult is atypical for other Halolaelapidae in which the podonotal shield is distinct from the opisthonotal shield(s) in the adult. In fact, this scutal developmental pattern, although common in the Parasitina, is relatively rare in free-living Dermanyssina with the notable exception of the family Ologamasidae. The complement and arrangement of the inner (*J*) series of setae on the opisthonotal shield in the Halolaelapidae, as seen in the absence of setae *J3* (a seta first appearing at the larval instar) and the position of *Z5* posterior to *J5* are evident in *Halodarcia*, *Halolaelaps*, *Leitneria*, *Saintdidieria* and *Saprolaelaps*. However, *J3* is considered to be present in *Saprosecans* and the location of *Z5* posterior to *J5* is common in the Laelapidae and also in the Eviphididae and Pachylaelapidae which lack *J3*.

The dorsal and lateral adenotaxy in *Halodarcia* comprises ten pairs of gland pores (*gd1-10*). The adenotaxy of the other Halolaelapidae has not been studied in detail and, as in the Dermanyssina as a whole, the data are patchy and inadequate for comparative purposes. An unusual feature of *H. porolata* is the presence of supernumerary "gland" pores in the podonotal region of the deuteronymph and adult. All the dorsal gland pores in the adults

of *H. porolata* and *H. incideta* are enlarged and conspicuous in contrast to the relatively small gland pores, other than *gd8* in some species, in other Halolaelapidae. A full complement of poroids are present in the podonotal and pleural (stigma, peritreme, peritrematic shield) regions in *Halodarcia* and *Saintdidieria*. Details are not available for other Halolaelapidae. An interesting and unique feature of the poroidotaxy of the intercoxal region of the deuteronymph of *Halodarcia* is the absence of the third sternal pores (*iv3*). These pores normally first appear in the deuteronymphal instar. We were unable to find them in mounted type specimens of the adults which have suffered compression and distortion but their absence requires confirmation.

The major difference in podomeric chaetotaxy between *Halodarcia* and other Halolaelapidae is seen in the presence of six (2-3/2-3/2-2) instead of five (2-3/2-2/2-2) dorsal setae on genu and tibia I. No intrageneric variation was observed. The occurrence of 13 setae (four ventrals) on femur I also occurs in *Halolaelaps*, *Leitneria*, *Saprolaelaps* and *Saprosecans* but only 12 setae are present in *Saintdidieria* and *Saprogamasellus* (2-5/3-2). Differences in the chaetotaxy of other podomeres in comparision with the condition in *Halodarcia* are seen on genu III (2-2/1-2/0-1), genu IV (2-2/1-3/0-1) and tibia IV (2-1/1-2/1-1) of *Saprolaelaps* and *Saprosecans*, on genu IV (2-2/1-3/0-1) and tibia IV (2-1/1-2/1-2 or 2-1/1-3/1-1) of *Halolaelaps*, *Leitneria* and *Saprogamasellus*, and on genu II (2-3/0-2/1-2) of *Saintdidieria*.

The prominent goose-neck sensillus of tarsus I in *Halodarcia* which distally enlarges before being drawn out into a fine process, is not present in that form in *Halolaelaps* but does occur in *Leitneria*, *Saprolaelaps*, *Saprosecans* and *Saintdidieria*. This type of sensillus, however, appears widely in the Dermanyssina (and also the Parasitina), for example, within the families Macrochelidae, Pachylaelapidae, Laelapidae, Ascidae and Gamasellidae. The paradactyli, present only on each of legs II-IV, are particularly well-developed in the protonymphs and adults of *Halodarcia*, *Halolaelaps* and *Saprolaelaps* and in the female of *Saprosecans* (nymphs not examined) and form long acuminate processes extending a considerable distance beyond the ambulacrum. Members of these genera live in damp or wet habitats and this extreme development of the paradactyli and the distal pair of dorsal tarsal setae could be an adaptation for moving over wet substrates. Their absence in deuteronymphs suggests that the normal habitat of this instar is different from other stages in the life-cycle and the phoretic relationship established between two of the species of deuteronymphs and carabid beetles supports this. (Differences in the form of the pulvilli between aphoretic females and their phoretic deuteronymphs are also apparent in the Parasitinae in which the deuteronymphal pulvilli are disc-like and not lobate as in the adults.) Paradactyli in the Dermyssina vary considerably in shape. In the majority, they are in the form of short acuminate or lobular processes lying alongside the pulvillus in its extended state but in some taxa within the Macrochelidae and Haemogamasidae, for example, each ends in a flattened denticulate lobe. Unlike the ambulacrum, comprising claws and pulvillus, the paradactyli are not capable of being withdrawn into the ambulacral stalk. The denticulate lobes appear to close over the extremity of the ambulacral stalk when the ambulacrum is withdrawn and thereby provide a protective cover to the retracted ambulacrum. On the basis of their proposed function, EVANS & TILL (1965) named the lobes pretarsal opercula. Those species with elongate acuminate paradactyli usually have longer tarsal setae ad1 and pd1 than those with short paradactyli.

It is apparent from the above that the genus *Halodarcia* differs from other genera included in the Halolaelapidae in at least three well-defined morphological characters:

1) the presence of a holodorsal shield in the adults;
2) six dorsal setae on the tibia and tarsus of leg I in deuteronymphs and adults;
3) the absence of poroid *iv3* in deuteronymphs and probably also adults.

On this basis, we propose the division of the family into two subfamilies, the HALODARCIINAE to accommodate the genus *Halodarcia* and the HALOLAELAPINAE for the genera *Halolaelaps*, *Leitneria*, *Saintdidieria*, *Saprogamasellus*, *Saprolaelaps* and *Saprosecans*.

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