Persian J. Acarol., 2020, Vol. 9, No. 2, pp. 95–128.
http://dx.doi.org/10.22073/pja.v9i2.58676
Journal homepage: http://www.biotaxa.org/pja

Article

Redescription of females of *Otopheidomenis zalelestes* Treat, 1955 (Acari: Otopheidomenidae) including details of the leg chaetotaxy, sigilla, and spermatheca

Vikram Prasad

7247 Village Square Drive, West Bloomfield, MI 48322, USA; E-mail: vikramprasad551@gmail.com

ABSTRACT
The adult female of *Otopheidomenis zalelestes* is redescribed and illustrated with many photographs based on three non-paratype females collected by Treat in 1955 and in 1966 on museum-preserved specimens of a female and male of the noctuid moth *Zale lunata* Drury that were donated to the author's collection by Treat decades ago. The chaetotaxy of genua and tibiae I-IV and several other details, including the sigilla and distance measurements between the paired dorsal idiosomal setae never discussed before, are included. These are compared with several paratype females of this species borrowed from the Ohio State University Acarology Laboratory (OSAL), Columbus, OH. This included a female showing the tubular laelapid type insemination system (spermatheca) and a male showing the spermatodactyl and basifemur of leg II showing a hump-like projection having a tiny seta on it which are described and illustrated.

KEY WORDS: Chaetotaxy; Noctuidae; *O. zalelestes*; redescription; spermatodactyl; *Zale*.

PAPER INFO.: Received: 15 December 2019, Accepted: 22 January 2020, Published: 15 April 2020

INTRODUCTION

Treat (1955) examined 500 dead and dried specimens of *Zale* species (Lepidoptera: Noctuidae) that were pinned and preserved in The American Museum of Natural History (AMNH), New York City, NY, USA. Among these, 11 moths collected in six states (Alabama, Florida, Georgia, Mississippi, New Jersey and New York) were infested with a new ectoparasitic gamasine mite which he named "*Otopheidomenis zalelestes*" in a new genus "*Otopheidomenis*" and new family "Otopheidomenidae" in the superfamily Parasitoidea Banks that he erected. He called this an "ear sparing mite" in comparison to another new ectoparasitic species he had described in 1954 as "*Myrmonyssus phalaenodectes* (now *Dicrocheles phalaenodectes* in family Laelapidae and superfamily Dermanyssoidea Kolenati) which he called an "ear invading mite". Both species infest noctuid moths but belong to two different families of mites in two different superfamilies which have significant morphological differences but both have laelapid-type sperm induction system.

The type specimens of *O. zalelestes* include the female holotype, male called at this time "allotype" (= presently a paratype male), two female paratypes, two male paratypes, and some representatives of early stages were deposited by Treat in the AMNH. Additional paratypes, without giving the number, were deposited in the United States National Museum (USNM), Beltsville,

How to cite: Prasad, V. (2020) Redescription of females of *Otopheidomenis zalelestes* Treat, 1955 (Acari: Otopheidomenidae) including details of the leg chaetotaxy sigilla and spermatheca. *Persian Journal of Acarology*, 9(2): 95–128.

Maryland; Dr. G.W. Wharton's collection at the University of Maryland; and Treat's personal collection. Thus, the exact total number of type specimens, and if any were stored in alcohol collection, is not known. In his classic book, "Mites of moths and butterflies", Treat (1975) provided additional information on *O. zalelestes* collected from different species of *Zale* that were collected in different states of USA (Florida, Georgia, Iowa, Mississippi, New Jersey, New York, North Carolina, South Carolina, and Texas) and some other locations in the U.S. Virgin Islands (US Territory in the Caribbean) and Panama Canal Zone, but did not state the number of mites he collected from different locations.

Chant (1965) redescribed *O. zalelestes* and placed it in the Otopheidomeninae which he considered as a subfamily of Phytoseiidae. This concept was not accepted and Otopheidomenidae became the accepted family infesting not only Noctuidae but also different other insect groups (Prasad 1975, 1987; Krantz and Khot 1962; Evans 1963; Chant and Lindquist 1965; Wainstein 1972; Fain and Lukoschus 1983; Syed and Goff 1983; Ghai and Gupta 1984; Zhang 1995). By the end of 2018, about 30 species were described in three subfamilies (Katydiseiinae Fain and Lukoschus, Otopheidomeninae Treat, and Treatiinae Wainstein) as ectoparasites of different insect orders [Blattaria, Hemiptera, Lepidoptera, and Orthoptera] and other hosts (thrips, malformed mango inflorescence, and *Tamarix* sp.). Historically, *O. zalelestes* is very important mite as it is the type species of the family Otopheidomenidae the problems of which have been discussed and new concept proposed by Prasad (2019).

In 1970's, in an exchange of moth mites, Treat provided three females of *O. zalelestes* on two glass slides to the author of this paper for his collection. After almost 45 years, these were examined in 2018 and found to be in excellent condition. Realizing the historical significance of this species still showing many features clearly, the present study was conducted the result of which is presented in this paper. For the first time, voucher photos of this mite are given along with details of the sigilla of the dorsal shield and chaetotaxy of the genua and tibiae I-IV. These are compared with those of *Prasadoseius achlora* (Prasad, 1972), another otopheidomenid mite which infests sphingid moths, for which similar studies have been reported.

It should be noted that after death of Treat, his collection of mites were deposited in The Museum of Biodiversity, The Ohio State University, Columbus, OH. Thus, in 2019, his slides of *O. zalelestes* (types and non-types) are present in different collections as: AMNH, OSU, USNM, and V. Prasad's personal collection. It is possible that some other type and non-type specimens may be present in other collections.

When the present study was completed based on three non-type females in the author's collection which did not show the spermatheca, six slides with many paratype females were borrowed from the Acarology Laboratory, Museum of Biological Diversity, The Ohio State University, 1315 Kinnear Road, Columbus, OH 43212-1192 and studied. Of these, one female showed the female insemination system which is photographed for the first time and presented in this study. Different measurements of three females in collection of this author (Table 1) have been compared with two paratype females (OSAL-19 and OSAL-21) and one paratype male (OSAL-24) (Table 6) and are discussed.

MATERIAL AND METHODS

(A) Two slides with 3 ♀♀ from the author's collection - (1) Slide # 1 with 1 ♀ (Not paratype): (a) Identification label on left stating - *Otopheidomenis zalelestes* ♀ (number 26 is given with pencil in a circle, possibly by Treat, and in ink written by this author as slide # 1, "Not paratype", VP, 7-2-18) and (b) Collection data label on right stating - Ex. *Zale lunata* Drury, ♀, AMNH-Sperry Collection "Oct. 14, 1939, Brownsville, Tex.", In Hoyer's 28 Sept., 1955, A.E. Treat (on the back of slide a label is placed by this author stating: ♀ 1, photos taken 12-31-2018 by VP and measured, on front written by VP). (2) Slide # 2 with 2 ♀♀ (Not paratypes): (a) Identification label on left stating - *Otopheidomenis zalelestes* 2 ♀♀ (number 95 is given with pencil in a circle, possibly by Treat, and

in ink written by this author as slide # 2, "Not paratype", VP, July 2, 18) and (b) Collection data label on right stating - Ex. *Zale lunata* Drury, ♂, AMNH: "Jackson, Hinds Co., Mississippi, "4 Aug. 62, Collection of Bryant Mather", In Hoyer's 6 Mar 1966, A.E. Treat (on the left front label of this slide is written by this author stating "Not paratype, VP, July 2, 18, slide # 2"). Thus, 3 ♀♀ were seen on 2 slides.

(B) Six slides with many ♀♀ and ♂♂ from the OSU collection - Collection and identification data are given on each slide as: (1) Slide # 1 (OSAL0104318 - with 1 paratype ♀); (2) Slide # 2 (OSAL0104319 - with 1 paratype ♀); (3) Slide # 3 (OSAL0104321 - with 1 paratype ♀); (4) Slide # 4 (OSAL0104323 - with 1 paratype ♂); (5) Slide # 5 (OSAL0104324 - with 1 paratype ♂); (6) Slide # 6 (OSAL0104331 - with 6 paratype ♀♀, 1 paratype ♂ and several eggs, larvae and protonymphs). All specimens of slides # 1–5 were collected from ♀ and ♂ *Zale lunata* Drury but specimens of slide # 6 were collected from ♂ *Zale fictilis* (Guenée). Thus, 9 ♀♀, 3 ♂♂, several eggs, larvae and protonymphs were seen on 6 slides.

The specimens were examined using an Accu-Scope 3000 phase-contrast microscope (Acc-Scope ™, New York, USA) under 100–400×. These were photographed and different structures studied and measured (Tables 1–8). Measurements were taken in micrometers (μm) directly from the slide mounted specimen in 200–400× using the Micrometrics system. Photographs of the mite were taken using a Canon™ EOS 550D camera after mounting on the microscope and saved in Photoshop CS5™. The photographs were placed in InDesign™ (Adobe Inc.) program to label the structures. The original magnification of the photos was 100–400× as mentioned in the explanation of the figures. As these were enlarged further in different magnifications to show the structures clearly and fit the page, exact magnifications are not given on the figures.

The line drawings of the right genua and tibiae I-IV were drawn at 400×, first in pencil on a transparent paper from the monitor. Each leg was oriented in the lateral position so that the coxa was located proximally, tarsus distally, anterior setae anteriorly, and posterior setae posteriorly. The anterodorsal (ad) and posterodorsal (pd) setae were drawn first, followed by the anteroventral (av), posteroventral (pv), anterolateral (al), and posterolateral (pl) setae. To identify the setae correctly, it was necessary to make sure that the segment was in proper position and anterior or posterior rotation or flattening of the segment was clearly evident. Once the leg setae were drawn, a white sheet was placed on top of each transparent paper and leg segments with setae inked directly on this sheet. These were scanned in Photoshop and setae with segments labeled in Adobe InDesign ™.

Different abbreviations used in the description and on the figures include: APO = apotele, AS = anal shield, BTA = basitarsus (of leg IV), CAP = capitular seta, CLE = cleavage, D = dorsal, D-DTA or DDTA = distal distitarsus, DEN = denticle, DS = dorsal shield, FE = femur, FOL = fold, GE = genu, GN = gnathosoma, GS = genital shield, GOS = ghost seta (on genu of leg IV), HY = hypostomal seta, ID = idiosoma, INT = integument, L = left, LYRF = lyrifissure, MD = movable digit, MS = macroseta (on tarsus of leg IV: ad2 and pd2 on proximal distitarsus and ad3 and pd3 on basitarsus), OPS = opisthonotal shield, PAA = paraanal setae, PAL = palp, P-DTA or PDTA = proximal distitarsus, PER = peritreme, POA = postanal seta, POS = podonotal shield, R = right, SS = sternal shield, TA = tarsus, TI = tibia, TR = trochanter, TRB = tritosternal base, and V = ventral.

Both slides with three females on which this study is based have been deposited in the College of Literature, Science, and the Arts Museum of Zoology, University of Michigan, Research Museum Center, 3600 Varsity Drive, Ann Arbor, MI 48108-2228 where all other mite collections of the author of the present paper (slides and mites in alcohol vials and jars) have been donated under the curation of Dr. Barry M. OConnor (bmoc@umich.edu). Slides of the OSU were returned to the Museum of Biological Diversity, in Columbus, Ohio during August 2019.

RESULTS

Otopheidomenis zalelestes Treat, 1955 (Figs. 1–42, Tables 1–8)

Female

Idiosoma – *Dorsum* (Figs. 1–5, 25–27, Tables 1, 2) – Dorsal shield oval, concave laterally in middle, almost totally covered with scale-like patterns, partially cleaved (CLE) bilaterally anterior to sigilla 'sg' partially dividing it into podonotal shield (POS) having a few lateral folds (FOL) and opisthonotal shield (OPS) with several folds. Podonotal shield longer (260–281) than opisthonotal shield (203–212) but width of former (POS) less (264–287) than the latter (299–302). Dorsal idiosoma with 16 pairs of setae of which podonotal shield with 9 pairs of setae (j1, j3, j5, j6, z2, z4, z5, s4, s6); opisthonotal shield with 5 pairs of setae (J2, J5, Z3, Z4, Z5); and 2 pairs of setae (r3 and r5) on lateral integument. Setae s6 and Z5 located on margin of shield. All setae short (11–27) except minute J5 (4–6) and long Z5 (52–60). None of setae with any serrations. Transverse distance between s6-s6 largest (256–260) followed by s4-s4 (243–258) and least between j5-j5 (16–21) indicating that pair of setae j5 are located closest to each other than any other pair of setae on the dorsal shield. Vertical distance between z5-Z3 largest (232–254) followed by J2-J5 (139–149). Different sigilla barely seen in low magnification except for sg medial to the lateral cleavage (Fig. 1) in female # 1 but many like saIII, saIV, saV, saVI, sg on the podonotal shield (Figs. 25, 27) and saIX, saX, saXI, saXII, saXIII and saXIV on the opisthonotal shield (Fig. 26) seen clearly in high magnifications in females # 1 and 2. Thus, examination of different specimens in high magnifications is necessary if to study and identify the sigilla. Anterior ends of peritremes extending between j3 and z2. Different measurements as given in Tables 1 and 2.

Venter (Figs. 6–8, 28–30, Table 3) – Paired tritosternal lacinae absent and only single, half-moon shaped tritosternal base (TRB) present. Sternal shield (SS) smooth, flying bat-wing shaped, much wider than long, both anterior ends narrowly pointed and extending on anteromedial borders of coxae II, flat or slightly concave anteromedially, concave posterolateral to ST1, irregularly strait or slightly concave posteromedially in between setae ST2, concave laterally between coxae II, smooth, and with 2 pairs of setae (ST1 and ST2) located on margin of shield appearing as they are off the sternal shield. Seta ST3 on integument or on tiny plate. Seta ST4 absent. Transverse distance between setal pair ST1-ST1 much less (49–53 = 51) than ST2-ST2 (81–92 = 87) and ST3-ST3 (110–129 = 119) and vertical distance between ST1-ST2 (46–56 = 52) much more than ST2-ST3 (32–42 = 39). Tip of seta ST1 almost touching base of ST2 and this touching or passing base of seta ST3. Genital shield round around both corners and posteriorly, concave laterally near seta ST5 which is located on integument. Transverse distance between ST5-ST5 97–106 = 101. Anal shield smooth, preanal setae absent, with pair of paraanal and single postanal seta surrounding anus, cribrum lightly present. Opisthosomal setae ZV1 and ZV2 on integument anterior to and JV5 lateral to anal shield. All ventral setae, similar to dorsal setae, smooth and without serrations. Different measurements given in Table 3.

Gnathosoma (Figs. 9–12, Table 4) – Dorsal gnathosoma with tectum being round and smooth anteriorly, not greatly elongate but shallow, length (in middle) 16 and width 44. Movable digit of chelicera wide posteriorly, narrow anteriorly, with 5 tiny teeth in distal half and no teeth in posterior half of segment; fixed digit atrophied and very much reduced to a stubby growth. Corniculi elongate, not harpoon-shaped seen in Phytoseiidae. Ventral gnathosoma with pair of capitular setae, 3 pairs of hypostomal setae and capitular gutter with 10–12 denticular rows, each having a few to several tiny anteriorly projected membranous growth giving serrate appearance. Palp tarsus with bifurcate apotele. Number of setae (dorsal, ventral and lateral) on palp segments as: Trochanter = 0, Femur = 6, Genu = 6 and Tibia = 12+ (setae on tarsus not studied, having a round thumb-like structure with several tiny setae on it).

Legs (Figs. 13–24, 34–42, Table 5) – Details of legs I-IV, including chaetotaxy of genua I-IV and tibiae I-IV, are given in Figs. 14–24, 33, 34 and Table 5. If the leg segments are rotated anteriorly (or posteriorly), commonly seen in Hoyer's mounted specimens, less vertical distance is seen anteriorly and more distance is seen posteriorly if measured from midline of the bases of setae ad1-ad2 and pd1-pd2 (Fig. 13, genu I). In this case of genu, setae ad1 and ad2 appear closer to the anterior border (shown with short dark arrow) and setae pd1 and pd2 appear way anterior to the posterior

margin of the segment (shown with long dark arrow). In case of genu IV which has 7 setae on it, similar to genu III and pv1 is absent (al1, ad1, ad2, av1; pd1, pd2 and pl1 = 7), a 'ghost seta' is present in one specimen (Fig. 20) giving total count of setae as '8' in place of '7' setae. Tarsus I has numerous setae and not studied as difficult to count. Similar to tarsus IV, each tarsus II and III (Table 5) has 18 short and simple setae (al1, al2, al3, pl1, pl2, pl3, ad1, ad2, ad3, pd1, pd2, pd3, av1, av2, pv1, pv2, **md** and **mv**). However, 4 of these setae (ad2, ad3, pd2 and pd3) on tarsus IV are large, greatly thickened and modified as macrosetae (**MS**). It should be noted that each tarsus II-IV has well defined three regions having fixed number of setae: (a) Basitarsus (BTA) proximal to lyrifissure of basitarsus having 4 setae (al3, pl3, ad3, pd3); (b) Proximal distitarsus (PDTA), proximal to lyrifissure of PDTA having five setae (al2, pl2, ad2, pd2 and **mv**); and (c) Distal distitarsus (DDTA), distal to PDTA and proximal to pretarsus having 9 setae (al1, pl1, ad1, pd1, av1, av2, pv1, pv2 and **md**). While lyrifissure of basitarsus is present all around the segment, the lyrifissure of proximal distitarsus is not present all around the segment.

DISCUSSION

Preference of female versus male moths as hosts – Based on collection data of Treat infesting Noctuidae, it is evident that *O. zalelestes* does not have a preference for either sex of its host. Similar observations were reported by Prasad (2013) for *Prasadiseius* species.

Comparison of paratype females to a paratype male – Table 6 shows the measurements of different dorsal characters of two paratype females and one male, all from OSAL collection. It is evident from these that females have larger features, including the length of setae on idiosoma, than those of the male. Also, most transverse and vertical distances between different characters indicate a similar pattern between two sexes of the mite (Table 7).

Comparison of paratype and non-paratype females – Table 8 shows that most dorsal characters of two paratype females from OSAL collection and three non-paratype females from VP collection, including length of setae, are very close to each other showing some variation in each. These kind of variations are common in series of specimens of the same species of mites.

Sigilla on dorsal shield – These have been described and illustrated nicely for Phytoseiidae by Athias-Henriot (1975), Swirski *et al.* (1998) and Prasad (2017). Prasad (2019) described these in several species of female and male of *Prasadiseius* species (Otopheidomenidae Treat, 1955) and *Hemipteroseius indicus* (Hemipteroseiidae Prasad, 2019) indicating their similarity to those described by above authors for phytoseiid species and indicating that those sigilla present on the opisthonotal shield may be different in different species. He indicated also the significance of sigilla "sg" consisting of several muscle bundles which are always present medial to the lateral cleavage of the dorsal shield where this cleavage stops. However, this sigilla may extend posteriorly on the opisthonotal shield in species which have a partially incised dorsal shield or may be present on opisthosomal integument when dorsal shield is divided into two separate shields - a podonotal shield and a opisthonotal shield as seen in male of *Prasadiseius pholusis* which is a dimorphic species (dorsal shield is single in the female and has sigilla "sg" present medial to the lateral cleavage).

Sperm insemination system – Treat (1955, 1975) did not describe or illustrate the sperm insemination system *of O. zalelestes*. Chant (1965) did not illustrate it either but stated that the spermatheca of the female is reduced to a long, thread-like duct. Prasad (1970a, b, 1972, 1973, 1987) and Prasad *et al.* (2011) illustrated and discussed spermatodactyl of male and spermatheca of female of most *Prasadiseius* species. Prasad (2019) in study of these mites using scanning electron microscopy gave details of spermatodactyl and stated that it is laelapid type. The spermatheca of *O. zalelestes* as illustrated in the present work is clearly tubular, similar to that of *Prasadiseius* species. The sperm induction system of *Noctuiseius treati* Prasad, 1968 and *Otopheidomenis ascalaphae* Syed and Goff, 1983, which both infest noctuid moths, is similar to that of *O. zalelestes*. In this system, the central vesicle (sacculus foemineus in which spermatozoa are stored until the ova mature one at

a time, fertilized and released from the opening of the genital shield), is laelapid type, is never seen in any female. Also, a small, enlarged, oval to tubular, cup-like region is seen at the distal end (Fig. 4, *N. treati*, Prasad 1968b; Fig. 1B, *O. ascalaphae*, Syed and Goff, 1983). This kind of insemination system is also seen and illustrated in *Proctolaelaps lobatus* De Leon, 1963 (Ascidae) collected from a noctuid moth in Oahu Island, state of Hawaii, USA (Prasad 1968a). This morphology may be a subtype or variant of the typical laelapid type sperm induction system.

Chaetotaxy of genua and tibiae I-IV – Treat (1955, 1975) did not provide chaetotaxy of legs I-IV. Chant (1965) did not illustrate but stated legs I-III without macrosetae, leg IV with macrosetae on basitarsus (number not given), two macrosetae on tarsus and number of setae on genua II-IV as: 6-7-7. Neither he nor any other researcher published the exact chaetotaxy of genua and tibiae I-IV done in the present study and shown in Table 5. In this paper, it is indicated that four setae, ad3 and pd3 on basitarsus and ad2 and pd2 on proximal distitarsus IV, are greatly thickened, elongate and modified as macrosetae. No such macrosetae are present on tarsi I-III.

None of the species of *Prasadiseius* have macrosetae on legs I-IV. Of all the species of this genus, the chaetotaxy of genua and tibiae I-IV has been studied only for *Prasadiseius achlora* (Prasad, 1972) by Prasad (2019) [genu I = 2-2/1+2/1-1 = 9 setae; genu II = 2-2/1+2/1-1 = 9 setae; genu III = 1-2/1+2/1-1 = 8 setae; genu IV = 1-2/1+2/1-1 = 8 setae; tibia I = 1-2/1+2/1-1 = 8 setae; tibia II = 1-1/1+2/1-1 = 7 setae; tibia III = 1-1/1+2/1-1 = 7 setae; and tibia IV = 1-1/1+2/1-1 = 7 setae]. This chaetotaxy is different than above in *O. zalelestes* [genu I = 1-2/1+2/1-1 = 8 setae; genu II = 1-2/0+2/0-1 = 6 setae; genu III = 1-2/1+2/0-1 = 7 setae; genu IV = 1-2/1+2/0-1 = 7 setae; tibia I = 1-2/1+2/1-1 = 8 setae; tibia II = 1-1/1+2/1-1 = 7 setae; tibia III = 1-1/1+2/1-1 = 7 setae; and tibia IV = 1-1/1+2/1-1 = 7 setae]. Thus, both species representing two genera are different from each other on the basis of chaetotaxy of genua and tibiae I-IV and macrosetae (present on tarsus IV in *O. zalelestes* but absent in *P. achlora*).

Male of *O. zalelestes* – The male chelicera with spermatodactyl and dorsal and ventral views of idiosoma have been described and illustrated by Treat (1955) but not femur II which has setae or spur specific to each otopheidomenid species. The study of a male *O. zalelestes* from OSAL collection (#0104331) indicated that basifemur II has an enlarged and bulged projection on the ventral side having short spinose setae similar to as in *P. kayosiekeri* (Prasad, 1970b) and some other *Prasadiseius* species but not large leaf-like spurs seen in *P. donahuei* (Prasad, 1970a) and *P. incanus* Prasad and Guanilo, 2011. This feature is species or group specific and significant for the identification of otopheidomenid species especially when females of two species are very similar to each other.

Current status of Otopheidomenidae – Prasad (2019) presented his concept of 12 species of **OTOPHEIDOMENIDAE** belonging to two subfamilies [Otopheidomeninae Treat, 1955: *Noctuiseius batoridgi* Prasad, 1987; *N. treati* Prasad, 1968; *Otopheidomenis ascalaphae* Syed and Goff, 1983; *O. zalelestes* Treat, 1955 and Prasadiseiinae (*sic* as Prasadoseiinae) Prasad, 2019: *Prasadiseius aporodes* Prasad, 1972; *P. achlora,* Prasad, 1972; *P. cocytes* Prasad, 1970b, *P. donahuei* Prasad, 1970a; *P. indicus* Prasad, 1973; *P. kayosiekeri* Prasad, 1970b; *P. incanus* Prasad and Guanilo *in* Prasad *et al.*, 2011 and *P. pholusis* Prasad, 1970b]. He assigned the remaining 18 species previously described in Otopheidomenidae to different families and subfamilies [(1) Family **BLATTISOCIIDAE** Garman, 1948 (2 species) – *Eickwortius termes* Zhang, 1995 and *Orthopteroseius sinicus* Mo, 1996. (2) Family **HEMIPTEROSEIIDAE** Prasad, 2019 (7 species) – *Hemipteroseius adleri* Costa, 1968; *H. agenius* Treat, 1965; *H. antilleus* Treat, 1965; *H. indicus* Krantz and Khot, 1962 (syn.: *H. vikrami* Menon *in* Menon *et al.*, 2011); *H. parvulus* Treat, 1965; *H. subbaticus* Treat, 1965 and *H. womersleyi* Evans, 1963. (3) Family **KATYDISEIIDAE** Fain and Lukoschus, 1983, Subfamily Katydiseiinae Fain and Lukoschus, 1983 (1 species) – *Katydiseius nadchatrami* Fain and Lukoschus, 1983 and (4) Family **TREATIIDAE** Wainstein, 1972 (8 species) – *Nabiseius arabicus* Negm and Alatawi, 2013; *N. duplicisetus* Chant and Lindquist, 1965; *N. melinae* Halliday, 1994 and *N. rivnayae* Amitai and Swirski, 1980; *Treatia dieuches* Ramsay, 1973; *T.*

dysderci Evans, 1963; *T. ghaiguptaorum* Zhang, 1995 and *T. phytoseioides* (Baker and Johnston, 1959)].

ACKNOWLEDGEMENTS

I am thankful to the followings: Dr. Hans Klompen, The Acarology Laboratory, Museum of Biological Diversity, The Ohio State University, 1315 Kinnear Road, Columbus, OH 43212-1192 who provided the type specimens from Treat Collection; Dr. Barry M. OConnor, LSA Museum of Zoology, University of Michigan, 3600 Varsity Drive, Ann Arbor, MI 48108 for help in various ways, and Dr. Gregory A. Evans, USDA, Building 005, Room #137, Barc-West, 10300 Baltimore Avenue, Beltsville, MD 20705-2350 who reviewed the draft of this paper improving the presentation.

REFERENCES

Amitai, S. & Swirski, E. (1980) Two new species of phytoseiid mites (Mesostigmata: Phytoseiidae) from Israel. *Israel Journal of Entomology,* 14: 1–7.

Athias-Henriot, C. (1975) Nouvelles notes sur les Amblyseiini. II - Le relevé organotaxique de la face dorsale adulte (Gamasides Protoadéniques, Phytoseiidae). *Acarologia*, 17: 20–29.

Baker, E.W. & Johnston, D.E. (1959) *Laelaptonyssus phytoseioides*, a new species of laelaptonyssid mite from Hemiptera (Acarina, Mesostigmata). *Proceedings of the Entomological Society of Washington*, 61: 275–277.

Chant, D.A. (1965) Generic concepts in the family Phytoseiidae (Acarina: Mesostigmata). *Canadian Entomologist*, 97: 351–374.

Chant, D.A. & Lindquist, E.E. (1965) *Nabiseius duplicisetus,* a new genus and species of Otopheidomeninae (Acarina: Phytoseiidae) from nabid bugs. *Canadian Entomologist*, 97: 515–521.

Costa, M. (1968) Notes on the genus *Hemipteroseius* Evans (Acari: Mesostigmata) with the description of a new species from Israel. *Journal of Natural History*, 2: 1–15.

De Leon, D. (1963) A new genus and twelve new species of mites from Mexico and southeast United States (Acarina: Blattisociidae). *The Florida Entomologist*, 46: 197–207.

Evans, G.O. (1963) Observations on the classification of the family Otopheidomenidae (Acari: Mesostigmata) with descriptions of two new species. *Annals and Magazine of Natural History*, 5: 609–620.

Fain, A. & Lukoschus, F.S. (1983) *Katydiseius nadchatrami* n. g., n. sp. (Acari: Otopheidomenidae) from the tracheae of a Malaysian katydid *Chloracis brullei* Pictet & Saussure, 1892 (Orthoptera, Pseudophyllidae). *International Journal of Acarology*, 9: 173–178.

Garman, P. (1948) Mite species from apple trees in Connecticut. *Connecticut Agricultural Experiment Station, New Haven, Bulletin*, 520: 1–27.

Ghai, S. & Gupta, S.K. (1984) A new species of *Treatia* Krantz and Khot (Acari: Otopheidomenidae) with a new record of *Amblyseius* Berlese (Acari: Phytoseiidae) from India. *Bulletin of Zoological Survey of India*, 6: 171–175.

Halliday, R.B. (1994) First record of the family Otopheidomenidae (Acarina: Mesostigmata) in Australia, with description of *Nabiseius melinae* sp. n. *Australian Journal of Entomology*, 33: 347–350.

Krantz, G.W. & Khot, N.S. (1962) A review of the family Otopheidomenidae Treat, 1955 (Acari: Mesostigmata). *Acarologia*, 4: 532–542.

Menon, P., Joshi, S., Hussain, M. & Ramamurthy, V.V. (2011) A new species of *Hemipteroseius* (Acarina: Otopheidomenidae) parasitic on *Dysdercus* (Hemiptera: Pyrrhocoridae) in India. *Zootaxa*, 2800: 53–63.

Mo, C.F. (1996) A new genus and new species of the Otopheidomenidae (Acari: Mesostigmata) from longhorned grasshoppers. *Systematic and Applied Acarology*, 1: 199–204.

Negm, M. & Alatawi, F.J. (2013) First record of Otopheidomenidae Treat, 1955 (Acari: Mesostigmata) in Saudi Arabia, with description of *Nabiseius arabicus* sp. nov. *Turkish Journal of Zoology*, 37: 184–197.

Prasad, V. (1968a) Three moth mites (Acarina: Mesostigmata) from Hawaii, with description of a new species. *Annals of the Entomological Society of America*, 61: 129–132.

Prasad, V. (1968b) *Noctuiseius treati*, a new genus and species of moth mite from Hawaii and Easter Island. *Annals of the Entomological Society of America*, 61: 411–413.

Prasad, V. (1970a) Two new species of *Otopheidomenis* mites from South America (Acarina: Phytoseiidae). *Acarologia*, 12: 28–33.

Prasad, V. (1970b) Two new species of *Otopheidomenis* (Acarina: Phytoseiidae) ectoparasitic on sphingid moths with a note on *Noctuiseius. Canadian Entomologist*, 102: 1209–1215.

Prasad, V. (1972) New species of *Otopheidomenis* (Acarina: Phytoseiidae) ectoparasitic on sphingid moths from Uganda. *Acarologia*, 14: 345–249.

Prasad, V. (1973) A new species of *Otopheidomenis* (Acarina: Otopheidomenidae) from India. *Acarologia*, 15: 193–196.

Prasad, V. (1975) ["1976"] Ectoparasitic mites (Acarina: Otopheidomenidae) on sphingid moths. *Acarologia*, 17: 375–383.

Prasad, V. (1987) A new species of otopheidomenid mite from the Philippines with comments on *Noctuiseius* Prasad and *Prasadiseius* Wainstein (Acari: Otopheidomenidae). *International Journal of Acarology*, 13: 245–250.

Prasad, V. (2013) Infestation of Sphingidae (Lepidoptera) by otopheidomenid mites in intertropical continental zones and observation of a case of heavy infestation by *Prasadiseius kayosiekeri* (Acari: Otopheidomenidae). *Acarologia*, 53: 323–345.

Prasad, V. (2017) *Hemipteroseius vikrami* Menon: a junior synonym of *H. indicus* (Krantz and Khot) (Acari: Otopheidomenidae) with comments on the sigilla of the dorsal shield. *Persian Journal of Acarology*, 6(3): 143–160.
DOI: 10.22073/pja.v6i3.31947

Prasad, V. (2019) *Scanning electron microscopic studies on several otopheidomenid mites (Acari: Otopheidomenidae)*. Indira Publishing House, West Bloomfield, MI, USA, 772 pp.

Prasad, V., Guanilo, A.D., Grados, J. & Prasad, I. (2011) A new species of *Prasadiseius* Wainstein, 1970 (Acari: Otopheidomenidae) from hawk moths (Lepidoptera: Sphingidae) in Peru. *Acarologia*, 51: 99–125
DOI: 10.1051/acarologia/20111999.

Ramsay, G.W. (1973) A new species of *Treatia* (Acari: Phytoseiidae) from East Africa. *Acarologia*, 15: 1–9.

Swirski, E., Di Chiara, S.R. & Tsolakis, H. (1998) Keys to the phytoseiid mites (Parasitiformes, Phytoseiidae) of Israel. *Phytophaga*, 8: 85–154.

Syed, A.R. & Goff, M.L. (1983) A new species of *Otopheidomenis* (Acari: Otopheidomenidae) ectoparasitic on *Ascalapha odorata* (Lepidoptera: Noctuidae) in the Hawaiian Islands, with a key to the species in the genus. *International Journal of Entomology*, 25: 316–320.

Treat, A.E. (1954) A new gamasid inhabiting the tympanic organs of phalaenid moths. *Journal of Parasitology*, 40: 619–631.

Treat, A. E. (1955) An ectoparasite (Acarina: Mesostigmata) from moths of the genus *Zale*. *Journal of Parasitology*, 41: 555–561.

Treat, A.E. (1965) Otopheidomenids from the Antilles and elsewhere. *Acarologia*, 7: 1–16.

Treat, A.E. (1970) The genus *Dicrocheles:* Three new species and a reappraisal. *Acarologia*, 11(4): 630–656.

Treat, A.E. (1975) *Mites of moths and butterflies*. Comstock Publishing Associates, Cornell University Press, Ithaca and London, 362 pp.

Wainstein, B.A. (1972) On the system of entomoparasitic mites of the family Otopheidomenidae Treat, 1955 (Parasitiformes). *Parazitologiya*, 6: 451–456.

Zhang, Z.-Q. (1995) Review of the systematics and biology of the Otopheidomenidae (Acari: Mesostigmata) with a description of *Eickwortius* gen. n. from a termite (Isoptera: Termitidae). *Systematic Entomology*, 20: 239–246.

Table 1. Measurements of different dorsal idiosomal characters (µm) in three females of *Otopheidomenis zalelestes* Treat, 1955 from collection of the author (VP) [DS = dorsal shield, ID = idiosoma, NR = not recorded as difficult to measure, OPS = opisthonotal shield, POS = podonotal shield].

Particulars	Slide # 1 Female 1	Slide # 2 Female 1	Slide # 2 Female 2	Total	Average	Range
Dorsum						
Length of DS	463	480	493	1436	479	463–493
Length of POS	260	268	281	809	270	260–281
Length of OPS	203	212	212	627	209	203–212
Width of POS	NR	264	287	551	276	264–287
Width of OPS	NR	302	299	601	301	299–302
Pair of setae on POS	9	9	9	27	9	9
Pair of setae on OPS	5	5	5	15	5	5
Pair of setae on DS	14	14	14	42	14	14
Pair of setae on integument	2 (r3, r5)	2 (r3, r5)	2 (r3, r5)	6	2	2
Pair of setae on dorsal ID	16	16	16	48	16	16
Length of setae						
j1	15	21	20	56	19	15–21
j3	11	16	16	43	14	11–16
j5	12	17	14	43	14	12–17
j6	15	16	17	48	16	15–17
J2	16	15	16	47	16	15–16
J5	5	4	6	15	5	4–6
z2	14	20	19	53	18	14–20
z4	23	25	27	75	25	23–27
z5	15	18	16	49	16	15–18
Z3	11	11	12	34	11	11–12
Z4	13	15	12	40	13	12–15
Z5	60	55	52	167	56	52–60
s4	15	21	23	59	20	15–23
s6	26	25	23	74	25	23–26
r3	25	24	23	72	24	23–25
r5	25	24	21	70	23	21–25

Table 2. Measurements of distances between different setal pairs (µm) in 3 females of *Otopheidomenis zalelestes* Treat, 1955 from collection of the author (VP) [Av = average; vertical distances between left and right setae].

Particulars	Slide # 1 Female 1	Slide # 2 Female 1	Slide # 2 Female 2	Total	Average	Range
Transverse						
j1-j1	40	27	27	94	37	27-40
j3-j3	61	80	72	213	71	61-80
j5-j5	18	16	21	55	18	16-21
j6-j6	66	60	64	190	63	60-66
J2-J2	65	61	87	213	71	61-87
J5-J5	43	43	32	118	39	32-43
z2-z2	117	128	124	369	123	117-128

Table 2. Continued.

Particulars	Slide # 1 Female 1	Slide # 2 Female 1	Slide # 2 Female 2	Total	Average	Range
z4-z4	170	181	178	529	176	170–181
z5-z5	82	76	85	243	81	76–85
Z3-Z3	166	160	167	493	164	160–167
Z4-Z4	124	113	147	384	128	113–147
Z5-Z5	59	62	63	184	61	59–63
s4-s4	250	243	258	751	250	243–258
s6-s6	256	258	260	774	258	256–260
r3-r3	317	300	288	905	302	288–317
r5-r5	310	326	334	970	323	310–334
Vertical						
j1-j3	28	33	46	107	36	28–46
j3-j5	72	76	75	223	74	72–76
j5-j6	116	126	124	366	122	116–126
j6-J2	99	100	98	297	99	98–100
J2-J5	139	140	149	428	143	139–149
z2-z4	41	51	55	147	49	41–55
z4-z5	85	84	81	250	83	81–85
z5-Z3	232	254	239	725	242	232–254
Z3-Z4	44	37	39	120	40	37–44
Z4-Z5	55	42	64	161	54	42–64
s4-s6	85	87	81	253	84	81–87
r3-r5	97	102	96	295	98	96–102

Table 3. Measurements of different ventral idiosomal characters (µm) in three females of *Otopheidomenis zalelestes* Treat, 1955 from collection of the author (VP) [slide # 1, female # 1; slide # 2, female # 1; slide # 2, female # 2].

Particulars
Ventral structures, range (average)
Tritosternal laciniae – Absent
Tritosternal base (TRB), tiny, half moon-shaped - Length = 12–16 (13), width = 5–9 (7)
Sternal shield (SS), wing-shaped with anterior corners narrowly extending over anterior margin of coxa II - Length in middle between ST1-ST1 and ST2-ST2 = 56–58 (57), width anterior to ST1-ST1 = 153–173 (163) and width posterior to ST2-ST2 = 93–109 (101)
Metasternal shield (MSS), right - Length = 14, width = 15
Genital shield (GS) - Width posterior to ST5 at the widest point = 106–111 (109), width anterior to ST5 in the concavity at the narrowest point = 96
Anal shield (AS) - Length in middle = 96–104 (100), width of the widest point = 69–85 (77)
Peritreme - Extending anteriorly from anterior coxa or trochanter IV to in between coxae I-II or in between setae j3-z2
Spermatheca = Not seen.
Length of setae, range (average)
ST1 (on integument adjacent to anterior border of SS) = 38–48 (43)
ST2 (on integument adjacent to posterolateral border of SS or on SS close to margin) = 30–40 (35)
ST3 (on integument or on tiny platelet) = 33–43 (39)
ST4 = Absent
ST5 (on integument adjacent to lateral border of GS) = 29–41 (35)
ZV1 (on opisthosomal integument) = 21–37 (28)
ZV2 (on opisthosomal integument) = 22–28 (24)

Table 3. Continued.

Particulars
JV5 (on opisthosomal integument, may be on dorsum in well flattened females) = 32–36 (34)
PAA (pair of paraanal setae) = 25, POA (single postanal seta) = broken or distorted, not recorded
Transverse distance, range (average):
ST1-ST1 = 49–55 (51)
ST2-ST2 = 83–92 (87)
ST3-ST3 = 110–129 (119)
ST5-ST5 = 97–106 (101)
Vertical distance, range (average):
ST1-ST2 (in same row) = 46–56 (52)
ST2-ST3 (in same row) = 32–42 (39)
ST1-ST2 (across) = 83–90 (86)
ST1-ST3 (across) = 112–119 (116)

Table 4. Comments on dorsal and ventral gnathosomal characters in 3 females of *Otopheidomenis zalelestes* Treat, 1955 from collection of the author (VP) [slide # 1, female # 1; slide # 2, female # 1; slide # 2, female # 2].

Particulars
Dorsal
Tectum - Anterior margin round and smooth; length (in middle) = 16 µm, width (posterior) = 44 µm
Fixed digit - Atrophied
Movable digit - 5 teeth
Ventral
Pair of capitular setae - Present
Three pairs of hypostomal setae - Present
Capitular gutter - With 10-12 denticular rows
Bifurcate apotele on palp tarsus - Present
Setae on palp segments:
Trochanter: 0
Femur: 5
Genu: 6
Tibia: 12+
Tarsus: Not studied

Table 5. Chaetotaxy of genua and tibiae I-IV in 3 females of *Otopheidomenis zalelestes* Treat, 1955 from collection of the author (VP) [slide # 1, female # 1; slide # 2, female # 1; slide # 2, female # 2; MS = macroseta].

Particulars	**Chaetotaxy (same on left and right segments)**	
Genu I	1-2/1 + 2/1-1 (= 8)	or al1-ad1,ad2/av1 + pd1,pd2/pv1-pl1 (= 8)
Genu II	1-2/0 + 2/0-1 (= 6)	or al1-ad1,ad2/0 + pd1,pd2/0-pl1 (= 6) [av1 and pv1 = absent]
Genu III	1-2/1 + 2/0-1 (= 7)	or al1-ad1,ad2/av1 + pd1,pd2/0-pl1 (= 7) [pv1 = absent]
Genu IV	1-2/1 + 2/0-1 (= 7)	or al1-ad1,ad2/av1 + pd1,pd2/0-pl1 (= 7) [pv1 = absent]
Tibia I	1-2/1 + 2/1-1 (= 8)	or al1-ad1,ad2/av1 + pd1,pd2/pv1-pl1 (= 8)
Tibia II	1-1/1 + 2/1-1 (= 7)	or al1-ad1/av1 + pd1,pd2/pv1-pl1 (= 7) [ad2 = absent]
Tibia III	1-1/1 + 2/1-1 (= 7)	or al1-ad1/av1 + pd1,pd2/pv1-pl1 (= 7) [ad2 = absent]
Tibia IV	1-1/1 + 2/1-1 (= 7)	or al1-ad1/av1 + pd1,pd2/pv1-pl1 (= 7) [ad2 = absent]
Tarsi II-III	3-3/2 + 3/2-3, **md**, **mv** (= 18 setae)	or al1,al2,al3-ad1,ad2,ad3/av1,av2 + pd1,pd2,pd3/pv1,pv2-pl1,pl2,pl3, **md, mv** (= 18 setae)
Tarsus IV	3-3/2 + 3/2-3, **md**, **mv** (= 18 setae)	or al1,al2,al3-ad1,**MS-ad2**,**MS-ad3**/av1,av2 + pd1,**MS-pd2**, **MS-pd3**/pv1,pv2- pl1,pl2,pl3, **md**, **mv** (= 18 setae)

Note - (1) Setae ad2 and ad3 are macrosetae (**MS**) on anterodorsal side and pd1 and pd2 are macrosetae on posterodorsal side of tarsus IV. All these are paired setae. (2) On the other hand, seta **md** located on mediodorsal side of distal distitarsus and **mv** located on medioventral side of proximal distitarsus are unpaired and single setae. (3) Thus: (a) Each basitarsus (BTA) II-IV has 4 setae (ad3, pd3, al3, and pl3) proximal to its dorsally and ventrally present lyrifissure (LYRF-BTA) of which **ad3 and pd3 are modified as macrosetae on basitarsus IV** and (b) Setae **ad2**

and pd2 are modified as macrosetae on proximal distitarsus IV (P-DTA) which has 7 setae (ad2, pd2, av2, pv2, al2, pl2, and **mv**) around its partially present lyrifissure of proximal distitarsus (LYRF-PDTA). (c) The most distal segment, distal distitarsus (D-DTA), has 7 setae without macrosetae (ad1, pd1, av1, pv1, al1, pl1, and **md**). Therefore, each tarsus II-IV has 18 setae but 4 macrosetae are absent on tarsi II-III (al1,al2,al3-ad1,ad2,ad3/av1,av2 + pd1,pd2,pd3/pv1,pv2-pl1,pl2,pl3, **md**, **mv** (= 18) but 4 macrosetae are present on tarsus IV (al1,al2,al3-ad1,**MS-ad2**,**MS-ad3**/av1,av2 + pd1,**MS-pd2**,**MS-pd3**/pv1,pv2-pl1,pl2,pl3, **md**, **mv** (= 18 setae) [see Figs. 23 and 24 given in this paper and Evans, 1963:284]. (4) Measurements of 4 macrosetae on tarsus IV range from 57 to 84 µm. Of these, MS-ad3 and MS-pd2 are longest and MS-ad2 and MS-pd3 are shortest.

Table 6. Measurements of different dorsal idiosomal characters (µm) in 2 paratype females and 1 paratype male of *Otopheidomenis zalelestes* Treat, 1955 obtained from the Ohio State University Acarology Laboratory (OSAL) [AB = absent or not clear to see, DS = dorsal shield, F = female, ID = idiosoma, NR = not recorded as difficult to measure, OPS = opisthonotal shield, POS = podonotal shield].

Particulars	**OSAL-19 Female 1**	**OSAL-21 Female 2**	**Total 2F**	**Average 2F**	**Range 2F**	**OSAL-24 1 Male**
Dorsum						
Length of DS	484	NR	484	484	484	**431**
Length of POS	276	NR	276	276	276	**252**
Length of OPS	196	NR	196	196	196	**179**
Width of POS	309	NR	309	309	309	**274**
Width of OPS	306	NR	306	306	306	**250**
Pair of setae on POS	9	9	18	9	9	**9**
Pair of setae on OPS	5	5	10	5	5	**5**
Pair of setae on DS	14	14	28	14	14	**14**
Pair of setae on integument	2 (r3, r5)	2 (r3, r5)	4	2	2	**2**
Pair of setae on dorsal ID	16	16	32	16	16	**16**
Length of setae						
j1	17	18	35	18	17–18	**11**
j3	17	14	31	16	14–17	**10**
j5	15	16	31	16	15–16	**11**
j6	18	16	34	17	16–18	**11**
J2	16	14	30	15	14–16	**12**
J5	4	5	9	5	4–6	**6**
z2	21	17	38	19	17–21	**10**
z4	34	28	62	31	28–34	**16**
z5	20	17	37	19	17–20	**11**
Z3	13	AB	13	13	13	**10**
Z4	14	13	27	14	13–14	**9**
Z5	54	54	108	54	54	**40**
s4	15	20	35	18	15–20	**14**
s6	25	19	44	22	19–25	**16**
r3	21	26	47	24	21–26	**14**
r5	27	21	48	24	21–27	**17**

Table 7. Measurements of distances between different setal pairs (µm) in 2 paratype females and 1 paratype male of *Otopheidomenis zalelestes* Treat, 1955 obtained from the Ohio State University Acarology Laboratory (OSAL) [AB = absent or not clear to see, Av = average; vertical distances between left and right setae, F = female, NR = not recorded as difficult to measure].

Particulars	OSAL-19 Female 1	OSAL-21 Female 2	Total 2F	Average 2F	Range 2F	OSAL-24 1 Male
Transverse						
j1-j1	16	15	31	16	15–16	**9**
j3-j3	73	69	142	71	69–73	**51**
j5-j5	20	25	45	23	20–25	**31**
j6-j6	70	68	138	69	68–70	**78**
J2-J2	77	83	160	80	77–83	**92**
J5-J5	43	50	93	47	43–50	**42**
z2-z2	120	122	242	121	120–122	**108**
z4-z4	193	177	370	185	177–193	**182**
z5-z5	94	84	178	89	84–94	**97**
Z3-Z3	194	NR-AB	194	194	194	**NR**
Z4-Z4	116	163	279	140	116–163	**126**
Z5-Z5	63	57	120	60	57–63	**60**
s4-s4	240	248	488	244	240–248	**NR**
s6-s6	250	242	492	246	242–250	**260**
r3-r3	261	292	553	277	261–292	**168**
r5-r5	309	296	605	303	296–309	**280**
Vertical						
j1-j3	47	48	95	48	47–48	**24**
j3-j5	82	78	160	80	78–82	**88**
j5-j6	122	119	241	121	119–122	**117**
j6-J2	104	97	201	101	97–104	**88**
J2-J5	130	137	267	134	130–137	**125**
z2-z4	65	47	112	56	47–65	**81**
z4-z5	90	87	177	89	87–90	**80**
z5-Z3	233	NR	233	233	233	**210**
Z3-Z4	49	NR	49	49	49	**40**
Z4-Z5	51	NR	51	51	51	**51**
s4-s6	85	86	171	86	85–86	**NR**
r3-r5	97	88	185	93	88–97	**NR**

Table 8. Comparison of average measurements of different dorsal idiosomal characters (µm) in 3 non-paratype females of *Otopheidomenis zalelestes* Treat, 1955 from author's collection (VP) and 3 paratype females from the Ohio State University Museum (OSAL) [AB = absent or not clear to see, DS = dorsal shield, ID = idiosoma, NR = not recorded as difficult to measure, OPS = opisthonotal shield, POS = podonotal shield, x = not possible to state as VP data not available].

Particulars	VP	OSAL	Total	Average	Range
Dorsum					
Length of DS	479	484	963	482	479-484 (463-493)
Length of POS	NR	276	x	x	x
Width of POS	276	309	585	293	276-309 (276-464)
Length of OPS	NR	196	x	x	x

Table 8. Continued.

Particulars	VP	OSAL	Total	Average	Range
Width of OPS	301	306	607	304	301–306 (299–306)
Pair of setae on POS	9	9	18	9	9
Pair of setae on OPS	5	5	10	5	5
Pair of setae on DS	14	14	28	14	14
Pair of setae on integument	2 (r3, r5)	2 (r3, r5)	4	2	2
Pair of setae on dorsal ID	16	16	32	16	16
Length of setae					
j1	19	17	36	18	17–19 (11–21)
j3	14	17	31	16	14–17 (10–17)
j5	14	15	29	15	14–15 (11–17)
j6	16	18	34	17	16–18 (11–18)
J2	16	16	42	16	16–16 (12–16)
J5	5	4	9	5	4–5 (4–6)
z2	18	21	39	20	18–21 (10–21)
z4	25	34	59	30	25–34 (16–34)
z5	16	20	36	18	16–20 (11–20)
Z3	11	13	24	12	11–13 (10–13)
Z4	13	14	27	14	13–14 (9–15)
Z5	56	54	110	55	54–56 (40–60)
s4	20	15	35	18	15–20 (14–23)
s6	25	25	50	25	25–25 (16–26)
r3	24	21	45	23	21–24 (14–26)
r5	23	27	50	25	23–27 (17–27)

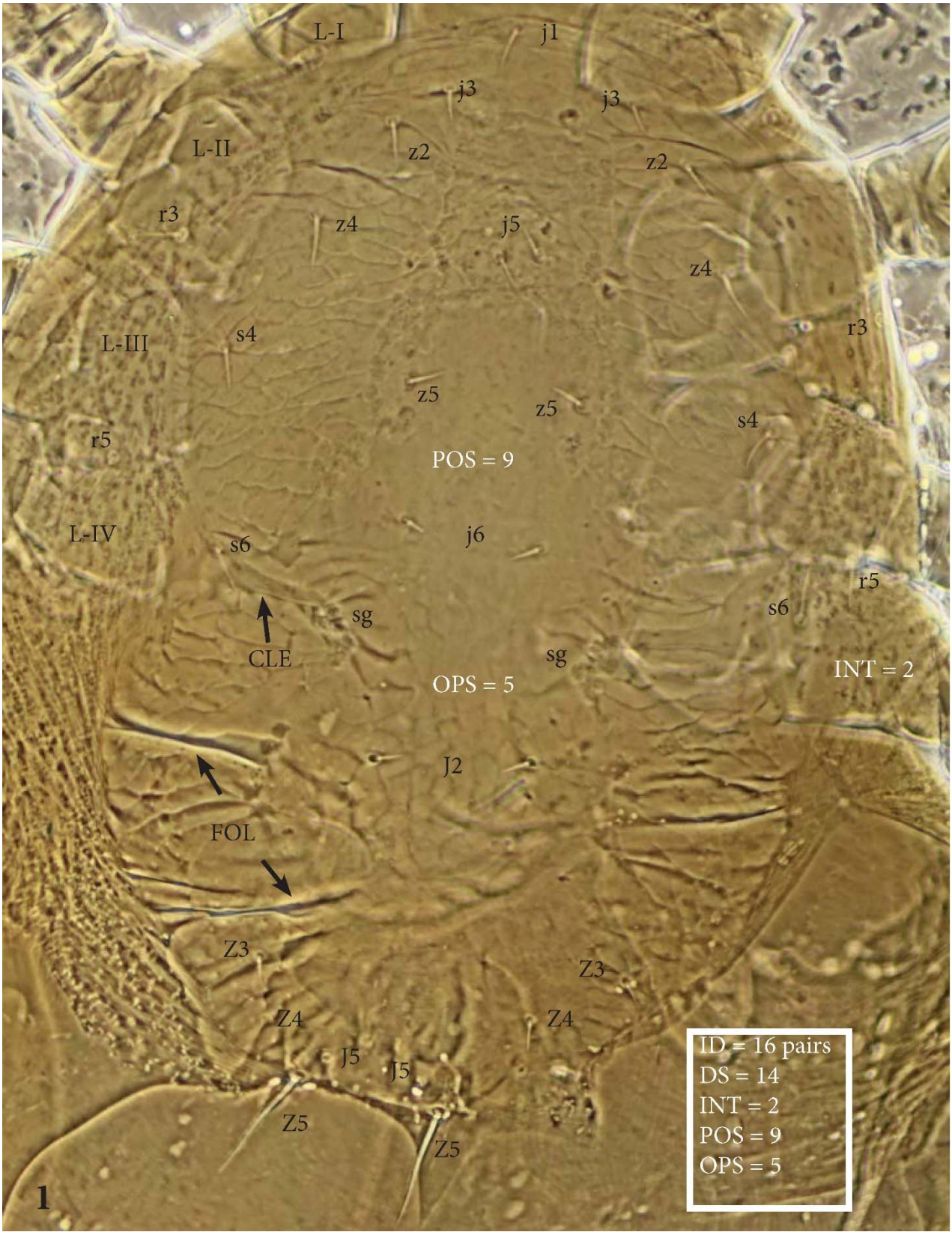
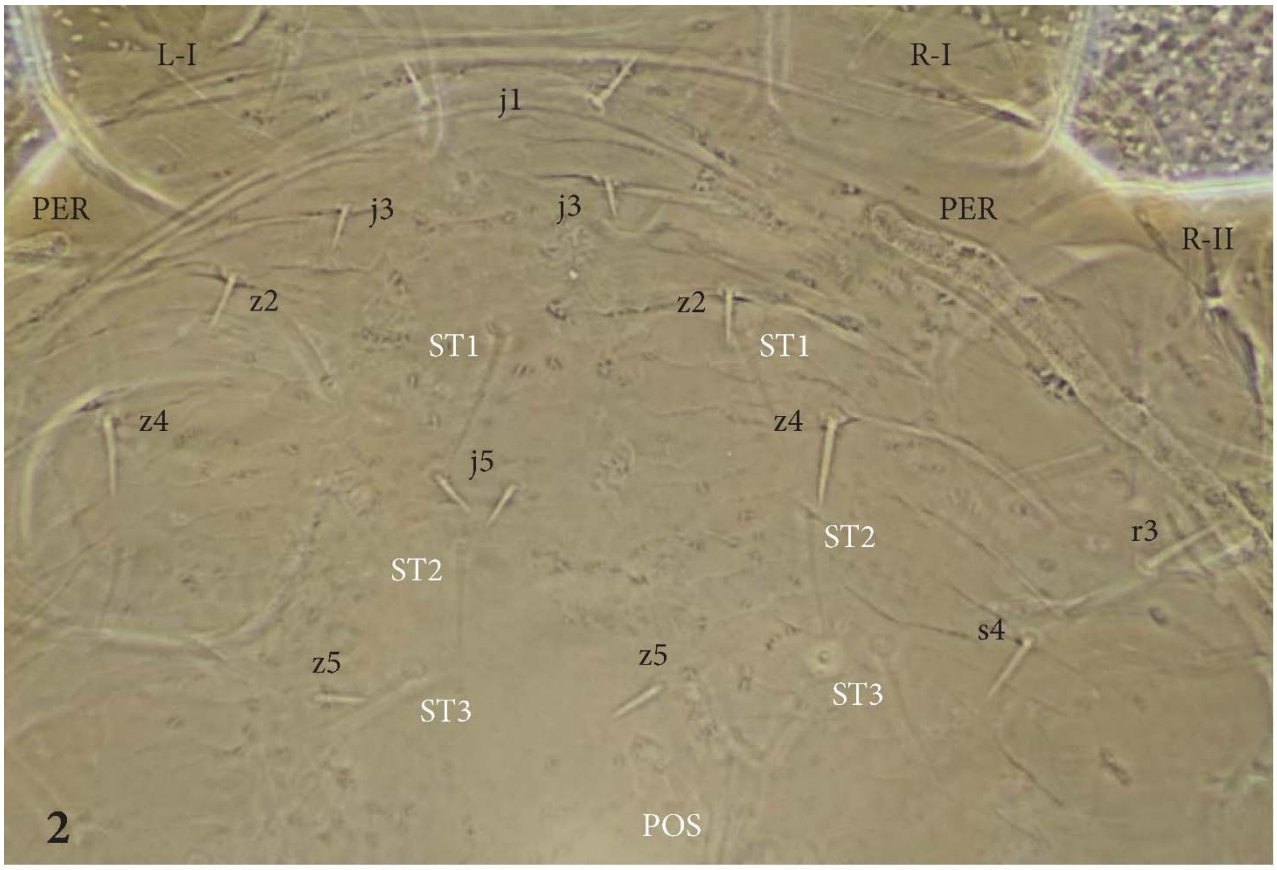
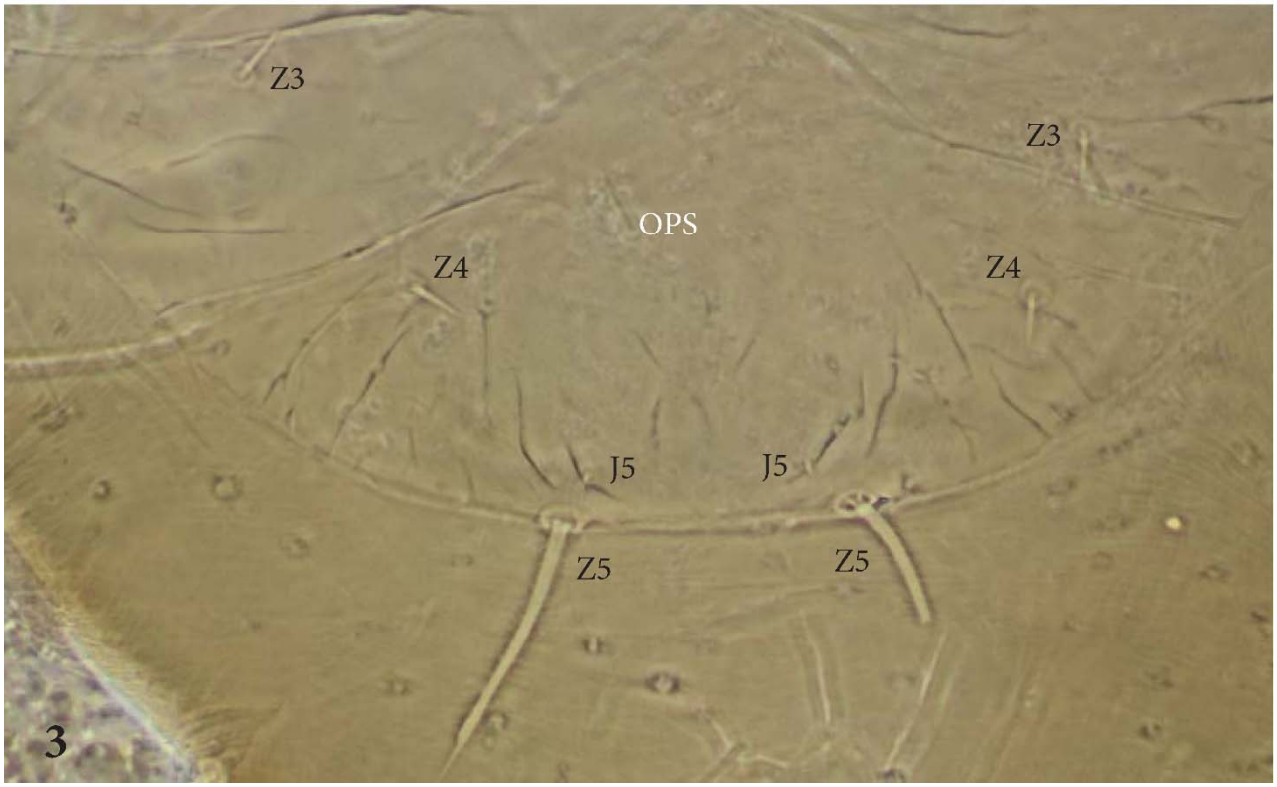
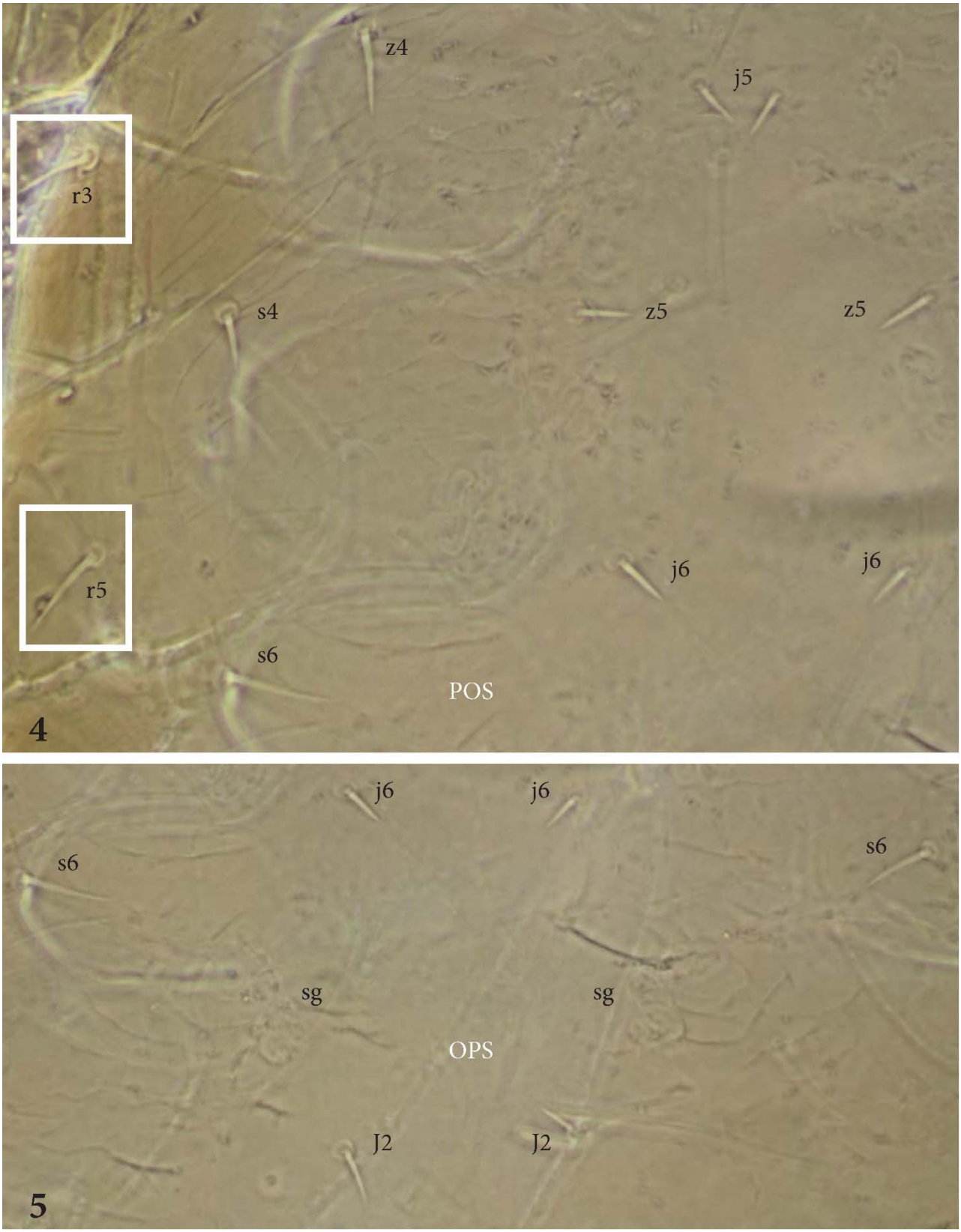


Figure 1. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Idiosoma (ID) in low magnification with 16 pairs of setae of which 14 pairs (j1, j3, j5, j6, J2, J5, z2, z4, z5, Z3, Z4, Z5, s4, s6) on dorsal shield (DS) and 2 pairs (r3 and r5) on integument. A lateral cleavage (CLE) partially dividing podonotal shield (POS) with 9 pairs of setae from opisthonotal shield (OPS) with 5 pairs of setae where seta s6 present laterally and sigilla sg present medially. Several folds (FOL) also seen (Treat slide # 2, female # 1, photo # 5 - Fig. 1, 200×).



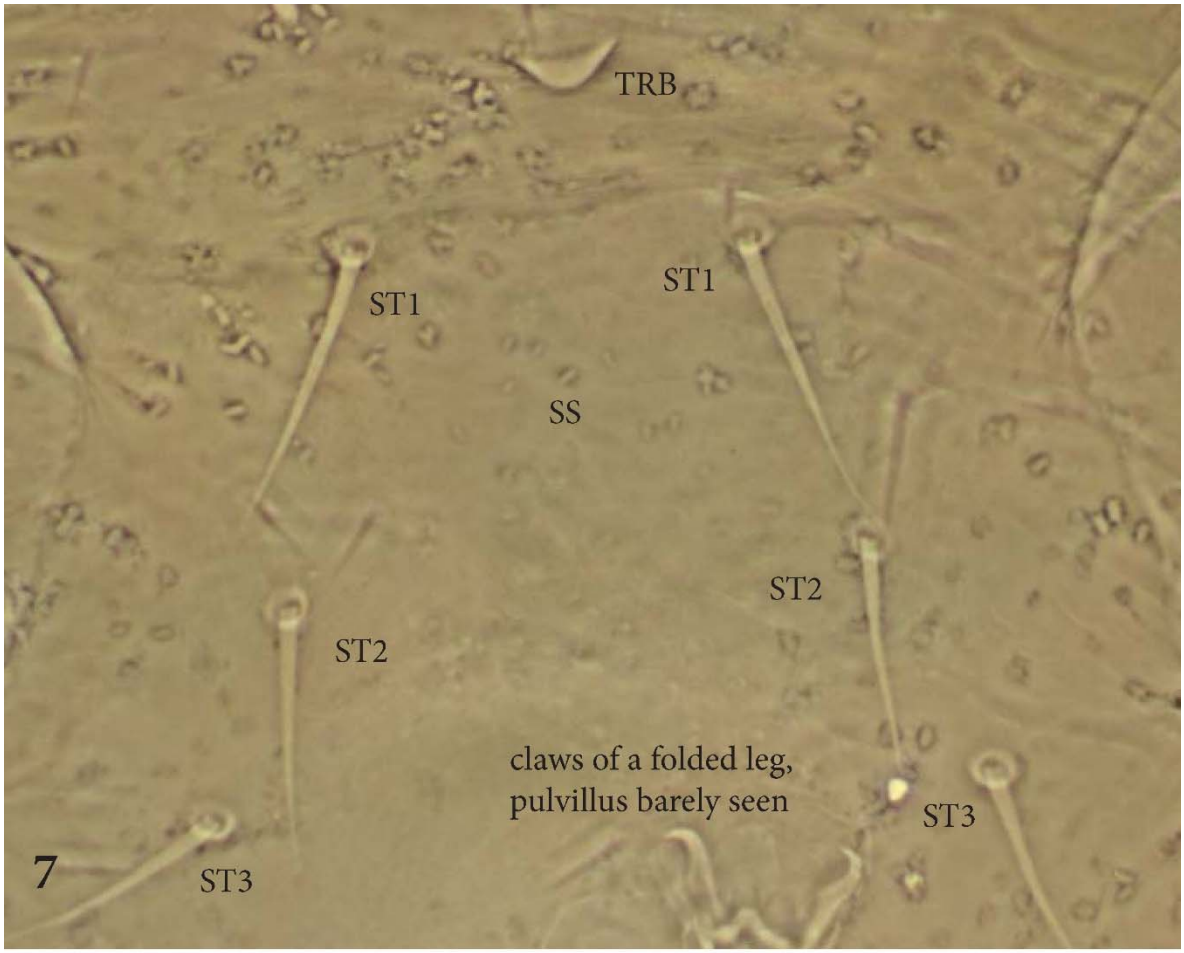


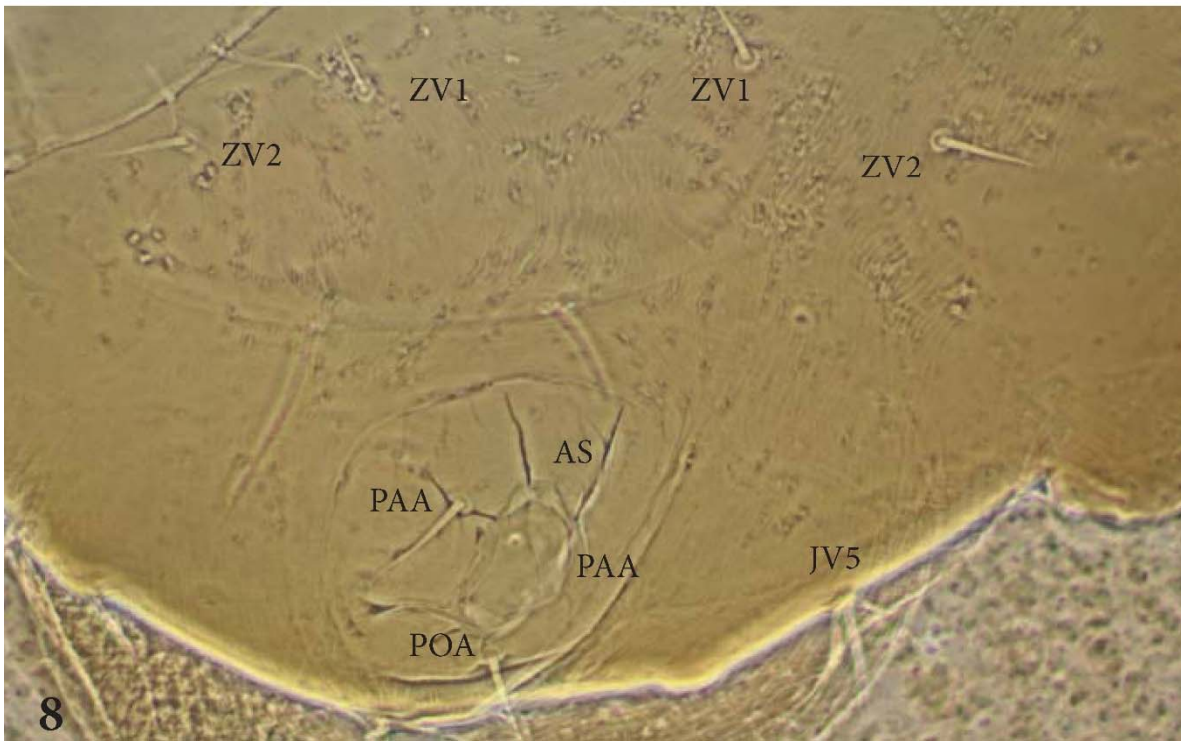
Figures 2–3. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) in high magnification – 1. Idiosoma setae j1, j3, j5, z2, z4, z5, and s4 on podonotal shield and r3 on integument; 2. Opisthonotal shield with setae J5, Z3, Z4 and Z5. Setae j6, J2, s6 and r5 are not photographed. Anterior end of peritreme (PER) extends between setae j3 and z2 (Treat slide # 1, female # 1, photo # 10 - Fig. 2 and photo # 11 - Fig. 3, 400×).



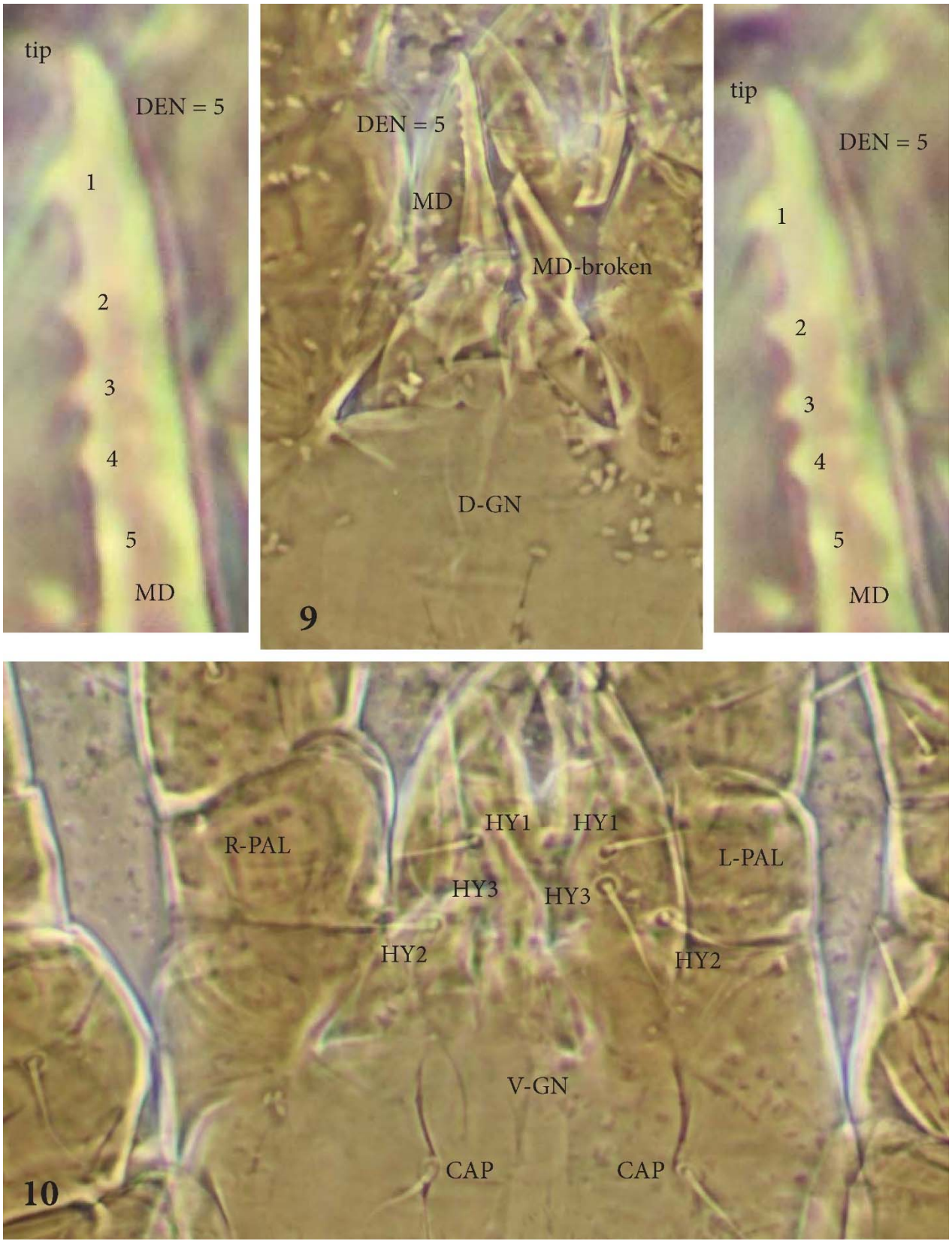
Figures 4–5. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) in high magnification – 4. Left anteromedial idiosoma with setae j5, j6, z4, z5, s4, s6 on podonotal shield and r3 and r5 on integument; 5. Posteromedial idiosoma with setae j6, J2, and s6. Elongate sigilla sg seen medial to lateral cleavage (Treat slide # 1, female # 1, photo # 14 - Fig. 5 and photo # 13 - Fig. 6, 400×).

Figure 6. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Ventral view of idiosoma in low magnification with tiny tritosternal base (TRB) without laciniae, wing-shaped sternal shield (SS), setae ST1-ST3, genital shield (GS) with seta ST5, metapodal shield (MPS) and opisthosomal setae ZV1 and ZV2. Anal shield and seta JV5 not photographed (Treat slide # 2, female # 1, photo # 7 - Fig. 6, 200×).

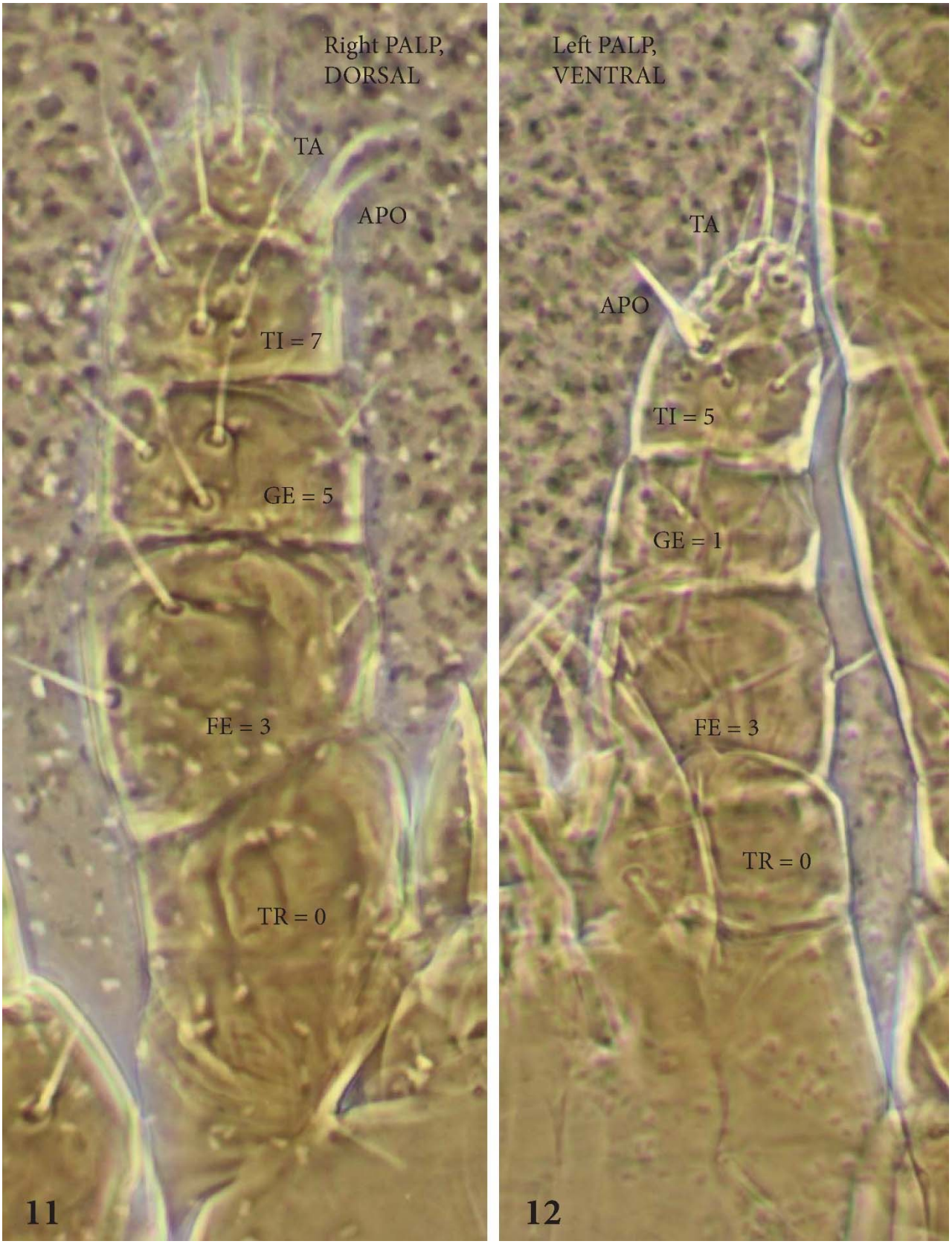




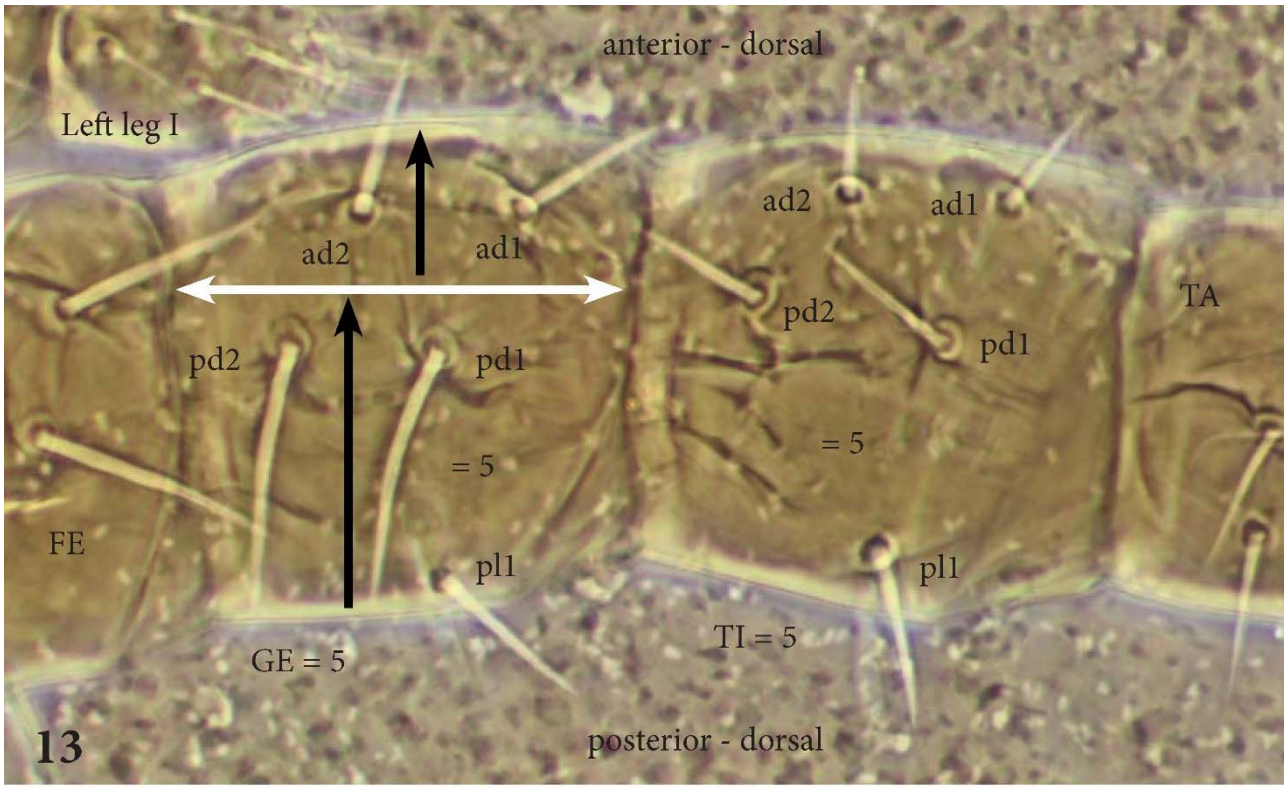
Figures 7–8. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Ventral idiosoma in high magnification with tiny moon-shaped tritosternal base (TRB) without laciniae is concave anteriorly and convex posteriorly. 7. Wing-shaped sternal shield (SS) with setae ST1 and ST2 on it and ST3 on integument; 8. Anal shield (AS), and opisthosomal setae ZV1 and ZV2 (Treat slide # 1, female # 1, photo # 15 - Fig. 7 and photo # 17 - Fig. 8, 400×).

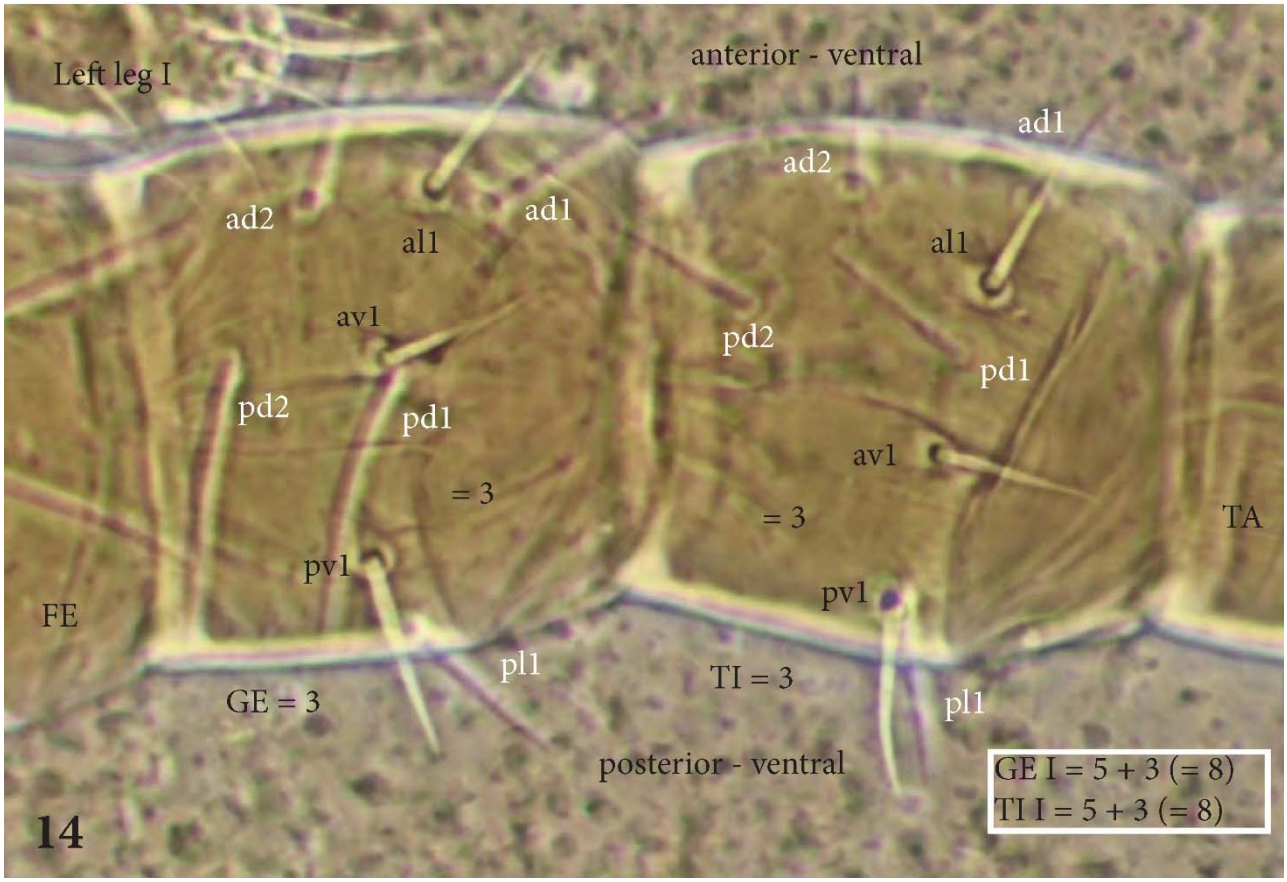


Figures 9–10. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Dorsal (Fig. 9) and ventral (Fig. 10) gnathosoma in high magnifications with movable digits (MD), pair of capitular setae (CAP), and 3 pairs of hypostomal setae (HY1-HY3). Top insets, left and right, enlarged movable digits (MD) with 5 denticles (DEN) on each (Treat slide # 1, female # 1, photo # 19 - Fig. 9 and photo # 20 - Fig. 10, 400×).

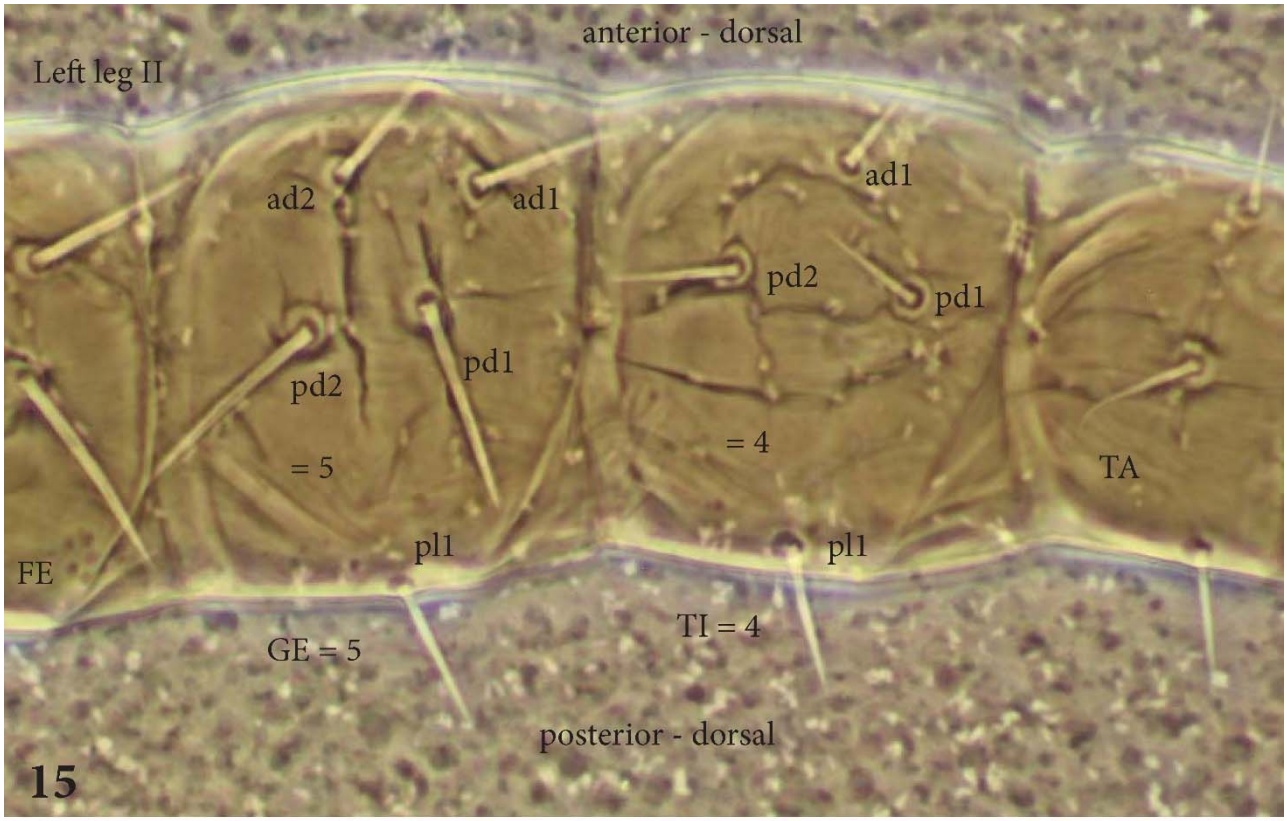


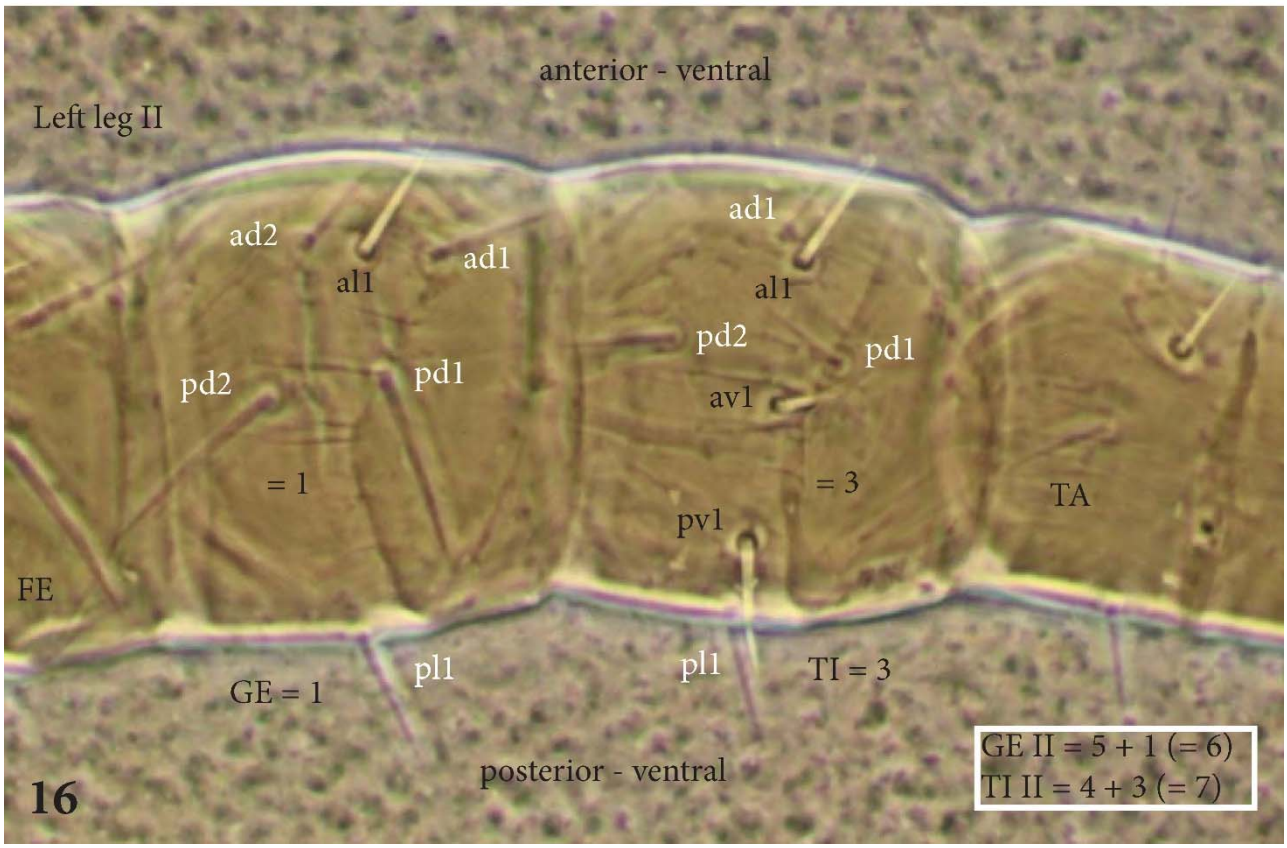
Figures 11–12. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Dorsal (Fig. 11) and ventral (Fig. 12) palps in high magnifications with associated setae on: TR (Trochanter) = without setae, FE (Femur) = with 6 setae, GE (Genu) = with 6 setae, TI (Tibia) = with 12 setae, and TA (Tarsus) = with many setae and bifurcate apotele, APO (Treat slide # 1, female # 1, photo # 21 - Fig. 11 and photo # 22 - Fig. 12, 400×).



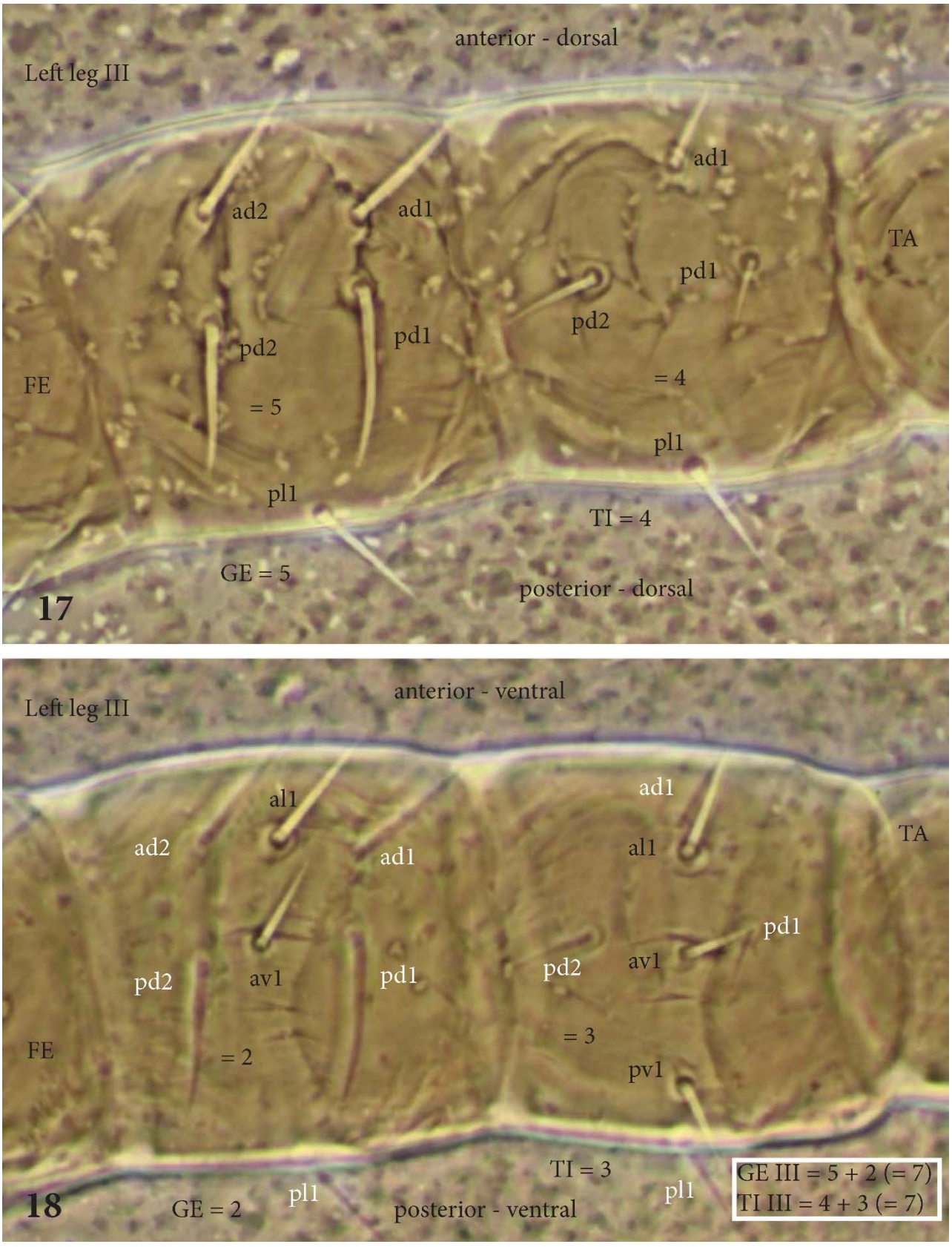


Figures 13–14. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Genu and tibia of left leg I in dorsal (Fig. 13) and ventral (Fig. 14) views with associated setae in high magnifications [GE: 5 + 3 = 8 setae; TI: 5 + 3 = 8 setae]. Note anterior rotation of genu and tibia due to which setae ad1 and ad2 have moved close to anterior margin (Treat slide # 1, female # 1, Fig. 13 - photo # 23 and Fig. 14 - photo # 24, 400×).

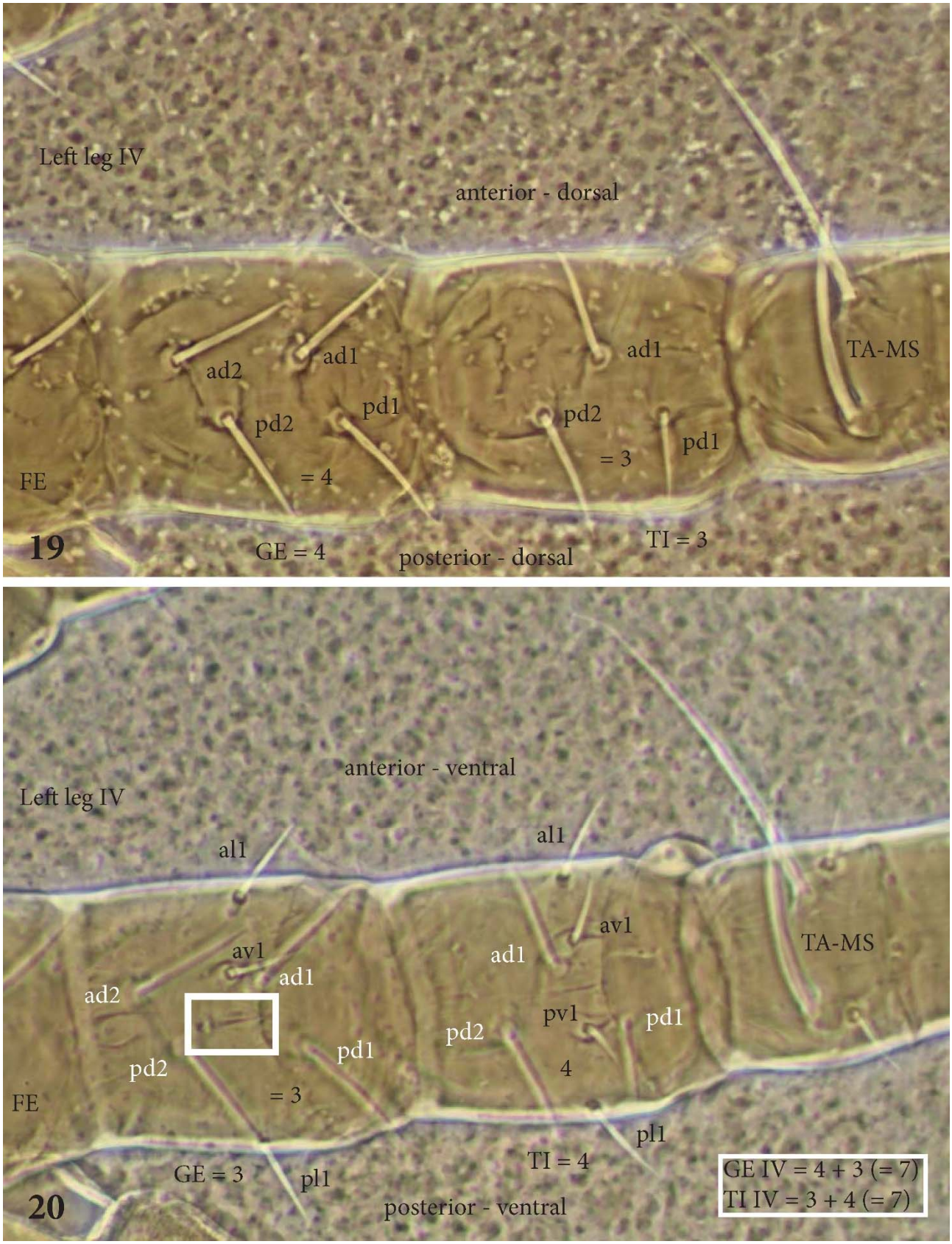




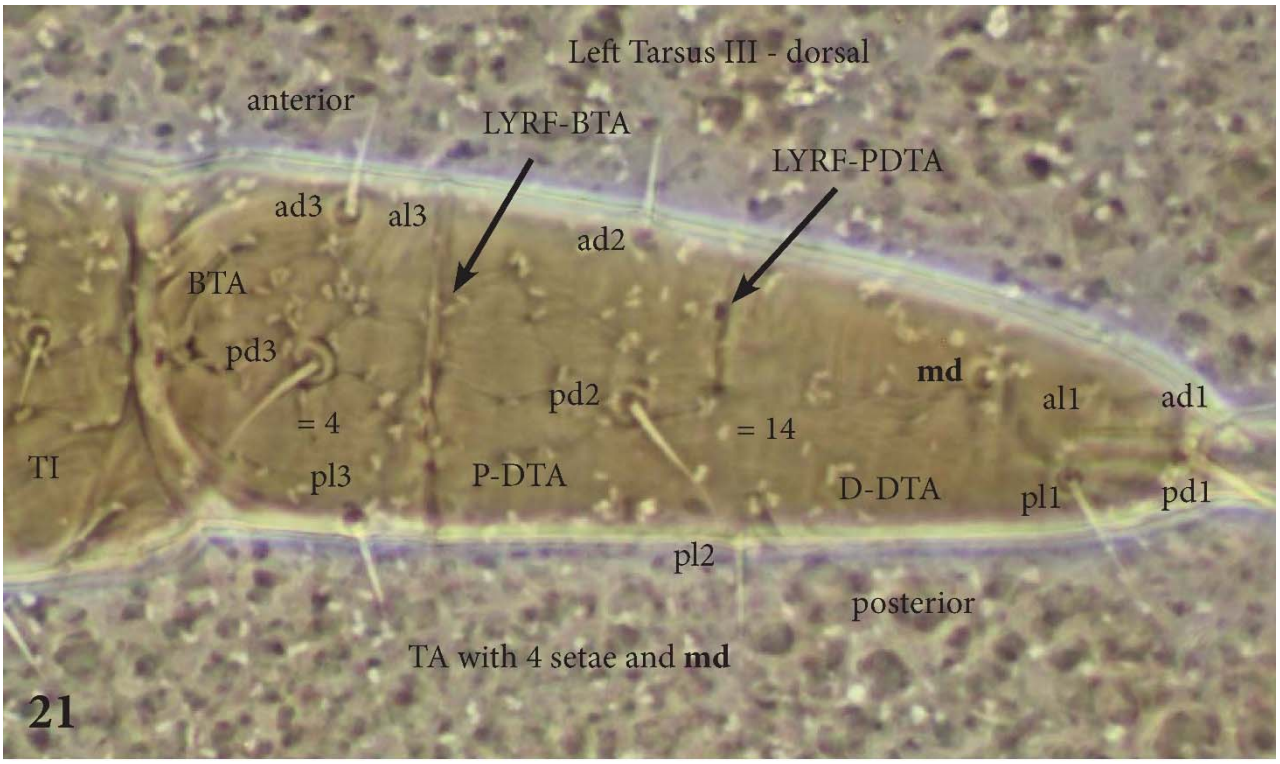
Figures 15–16. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Genu and tibia of left leg II in dorsal (Fig. 15) and ventral (Fig. 16) views with associated setae in high magnifications. Note absence of setae av1 and pv1 on genu II and absence of ad2 on tibia II. Thus, Ge II = 6 setae (5 + 1) and Ti II = 7 setae (4 + 3) (Treat slide # 1, female # 1, Fig. 15 - photo # 25 and Fig. 16 - photo # 26, 400×).

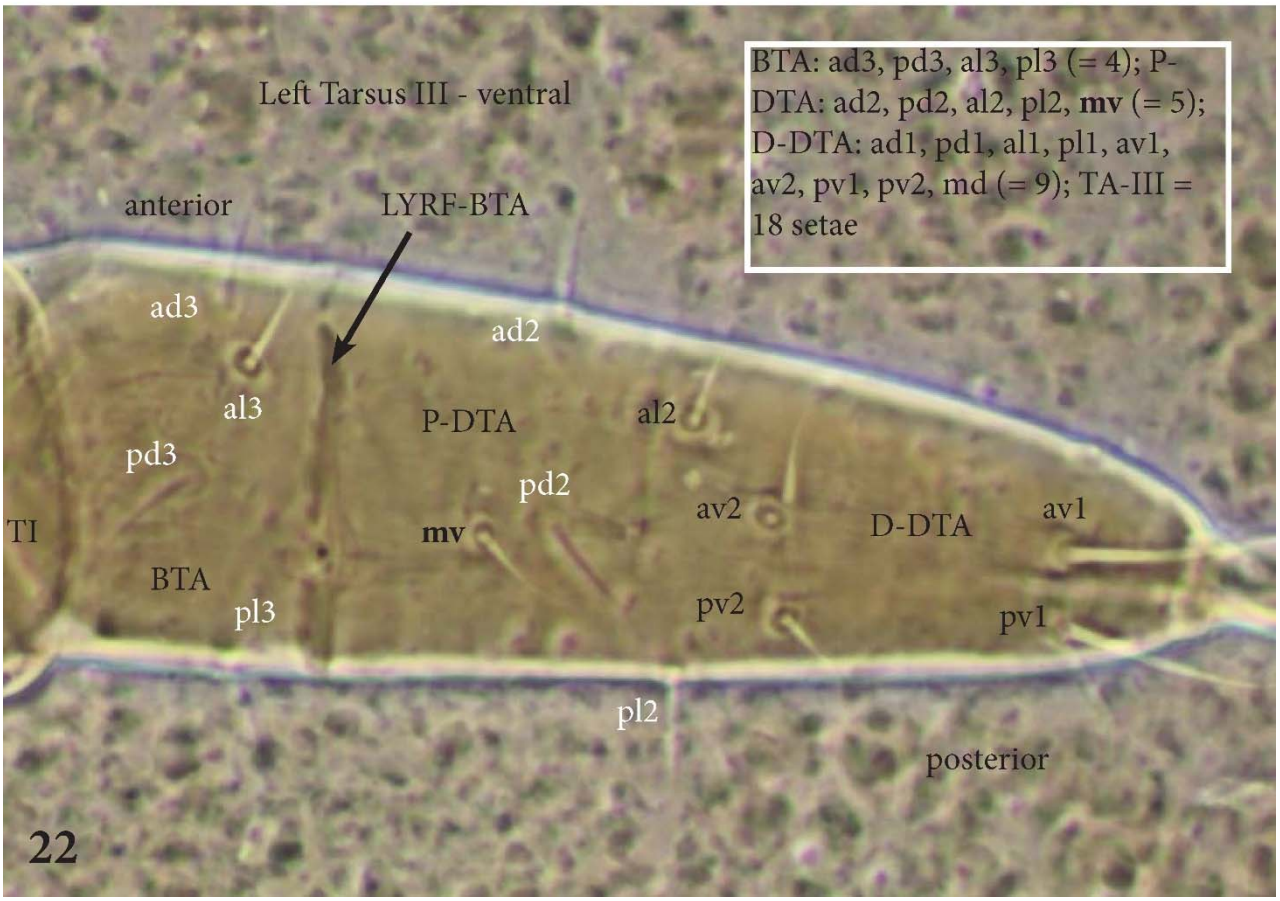


Figures 17–18. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Genu and tibia of left leg III in dorsal (Fig. 17) and ventral (Fig. 18) views with associated setae in high magnifications. Note absence of seta pv1 on genu III and absence of seta ad2 on tibia III. Thus, Ge III = 7 setae (5 + 2) and Ti III = 7 setae (4 + 3) (Treat slide # 1, female # 1, Fig. 17 - photo # 27 and Fig. 18 - photo # 28, 400×).

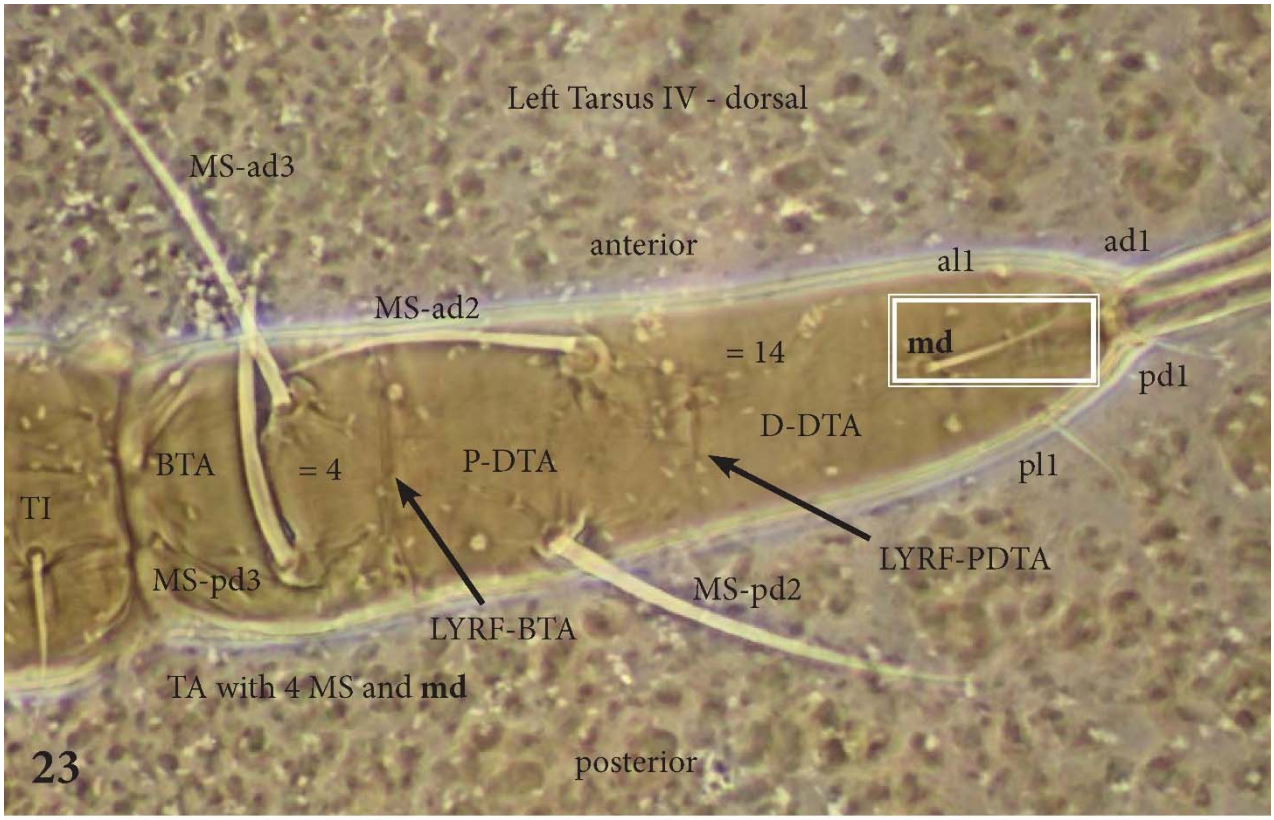


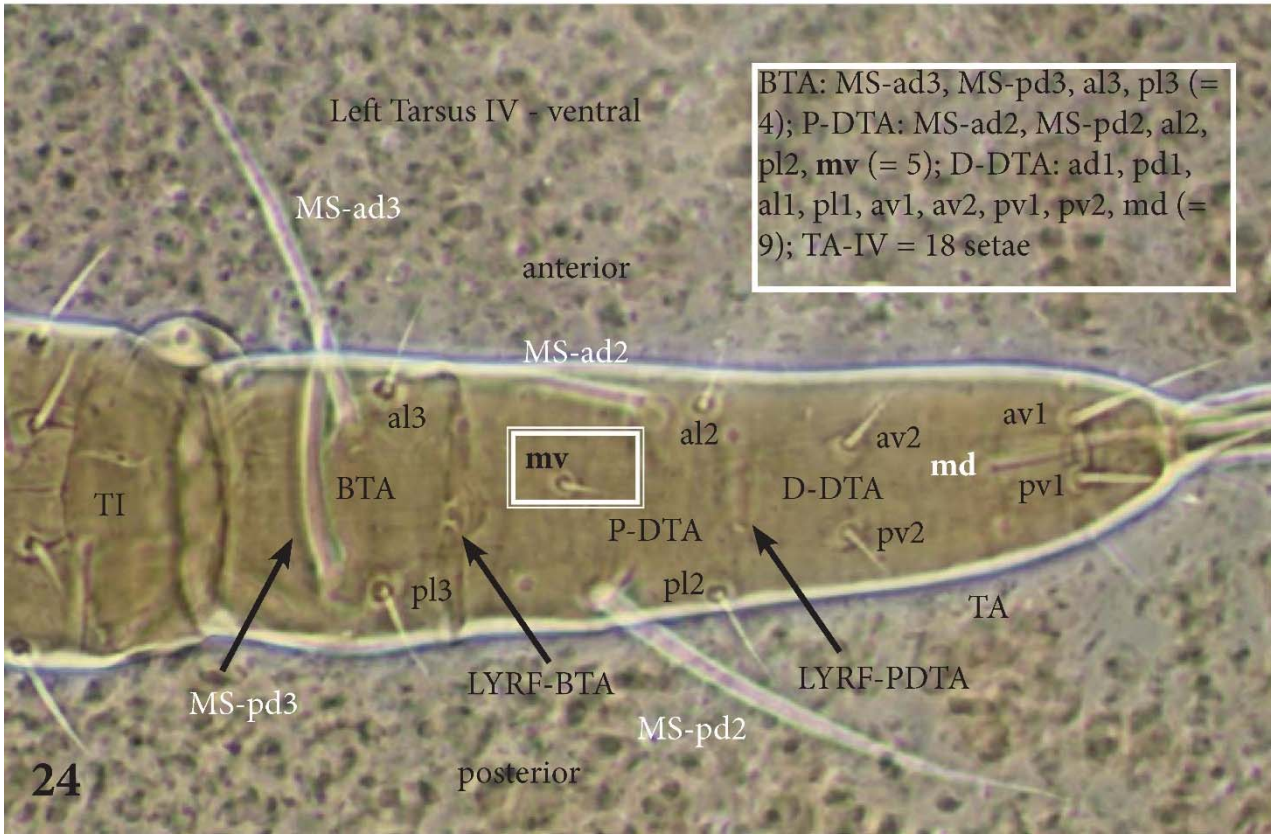
Figures 19–20. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Genu and tibia of left leg IV in dorsal (Fig. 19) and ventral (Fig. 20) views with associated setae in high magnifications [GE: 4 + 3 = 7 setae; TI: 3 + 4 = 7 setae]. Note a ghost seta (in rectangular box) on genu IV not included in this count (Treat slide # 1, female # 1, Fig. 19 - photo # 29 and Fig. 20 - photo # 30, 400×).





Figures 21–22. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Tarsus of left leg III in dorsal (Fig. 21) and ventral (Fig. 22) views with associated setae [BTA: 4 setae (ad3, pd3, al3, pl3, proximal to LYRF-BTA); P-DTA: 5 setae (ad2, pd2, al2, pl2, mv around LYRF-PDTA); and D-DTA: 9 setae (ad1, pd1, al1, pl1, av1, av2, pv1, pv2, md); Tarsus III = 18 setae] (Treat slide # 1, female # 1, Fig. 21 - photo # 39 and Fig. 22 - photo # 40, 400×).





Figures 23–24. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Tarsus of left leg IV in dorsal (Fig. 23) and ventral (Fig. 24) views with associated setae [BTA: 4 setae (MS-ad3, MS-pd3, al3, pl3, proximal to LYRF-BTA); P-DTA: 5 setae (MS-ad2, MS-pd2, al2, pl2, mv around LYRF-PDTA); and D-DTA: 9 setae (ad1, pd1, al1, pl1, av1, av2, pv1, pv2, md); Tarsus IV = 18 setae] (Treat slide # 1, female # 1, Fig. 23 - photo # 41 and Fig. 24 - photo # 42, 400×).

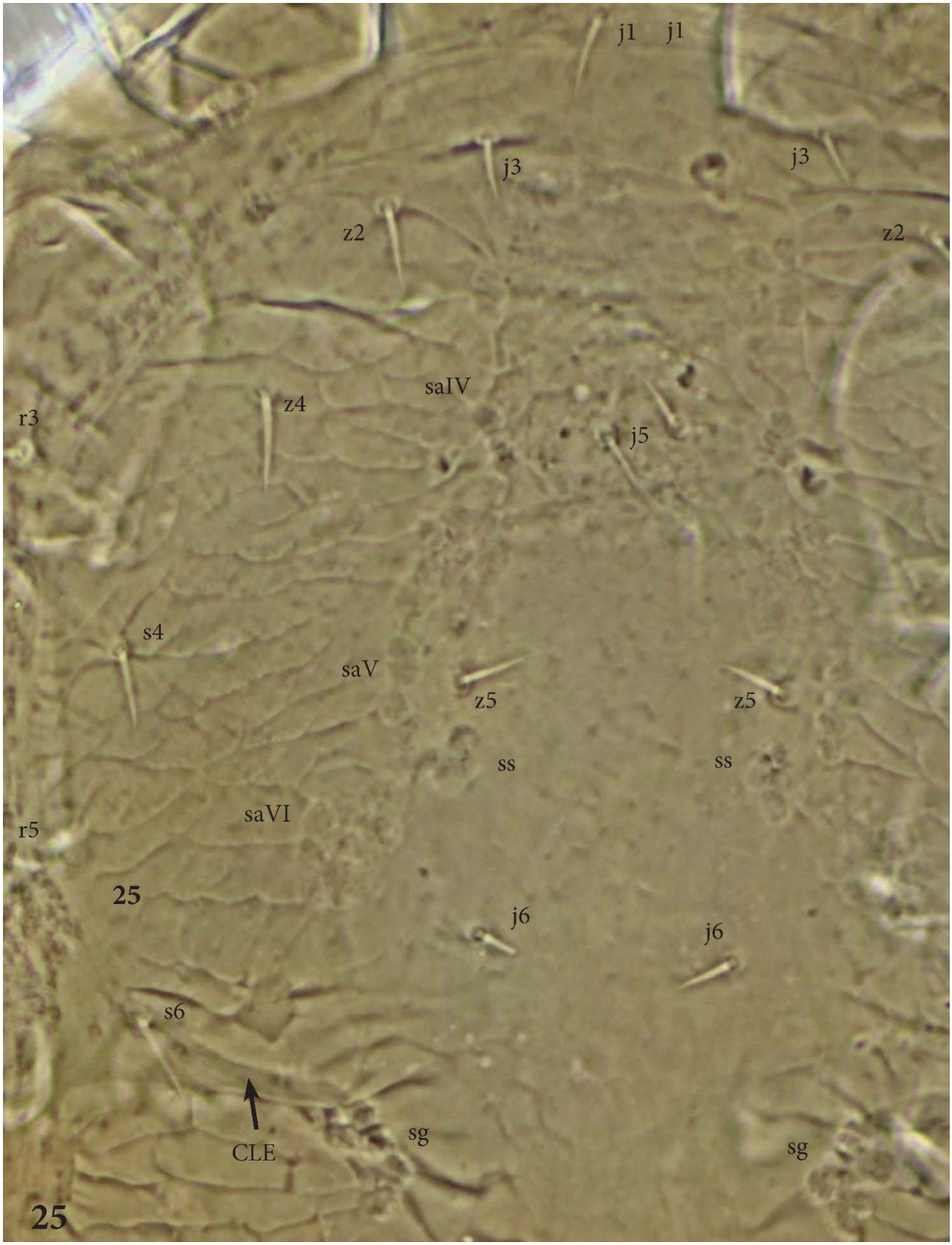


Figure 25. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Anterior dorsal shield showing different sigilla on the podonotal shield. Note left lateral cleavage (CLE) which ends anterior to sigilla sg anterior to which many sigilla are present but only some (saIV, saV, saVI, and ss) are clearly seen (Treat slide # 2, female # 1, photo # 3, 200×).

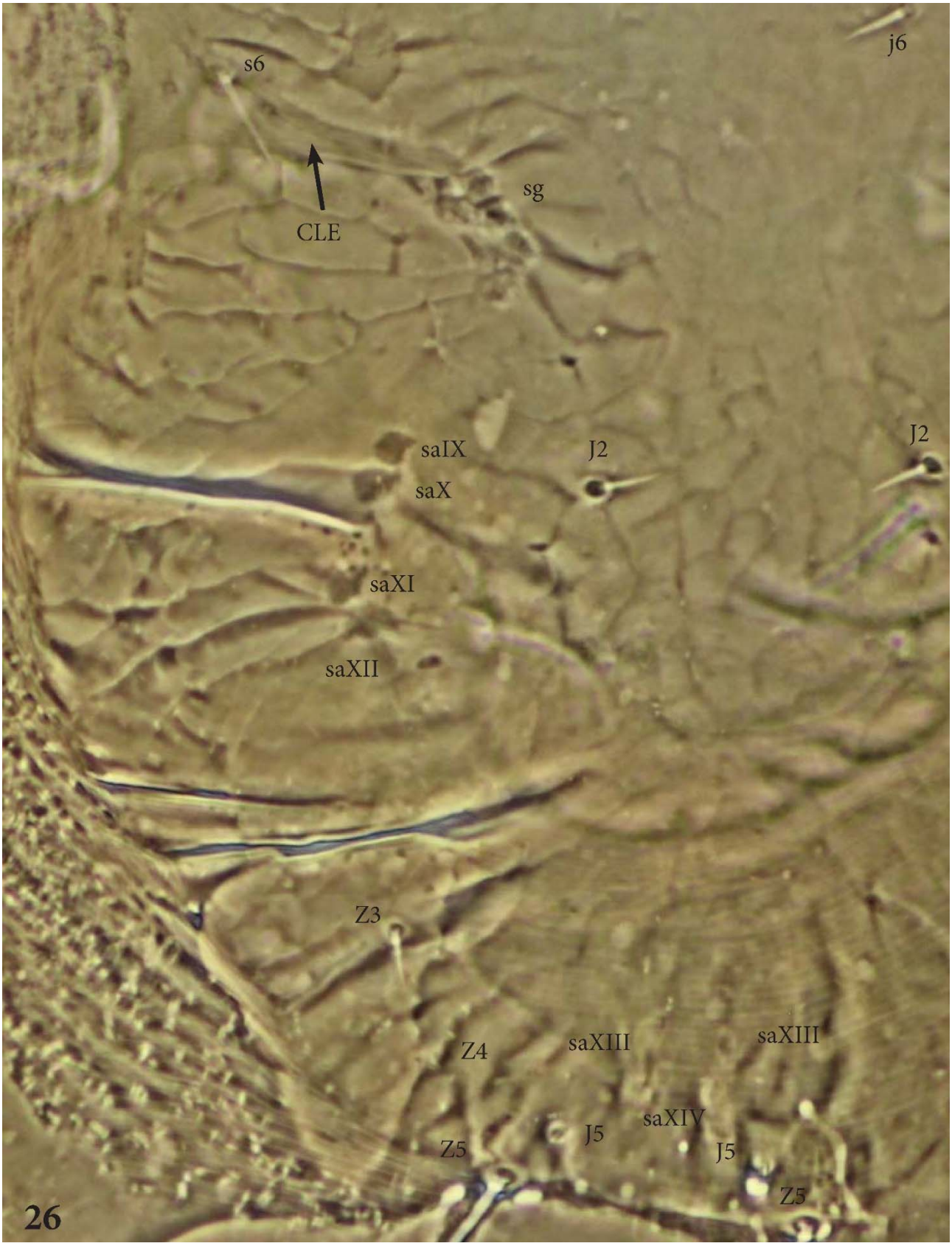
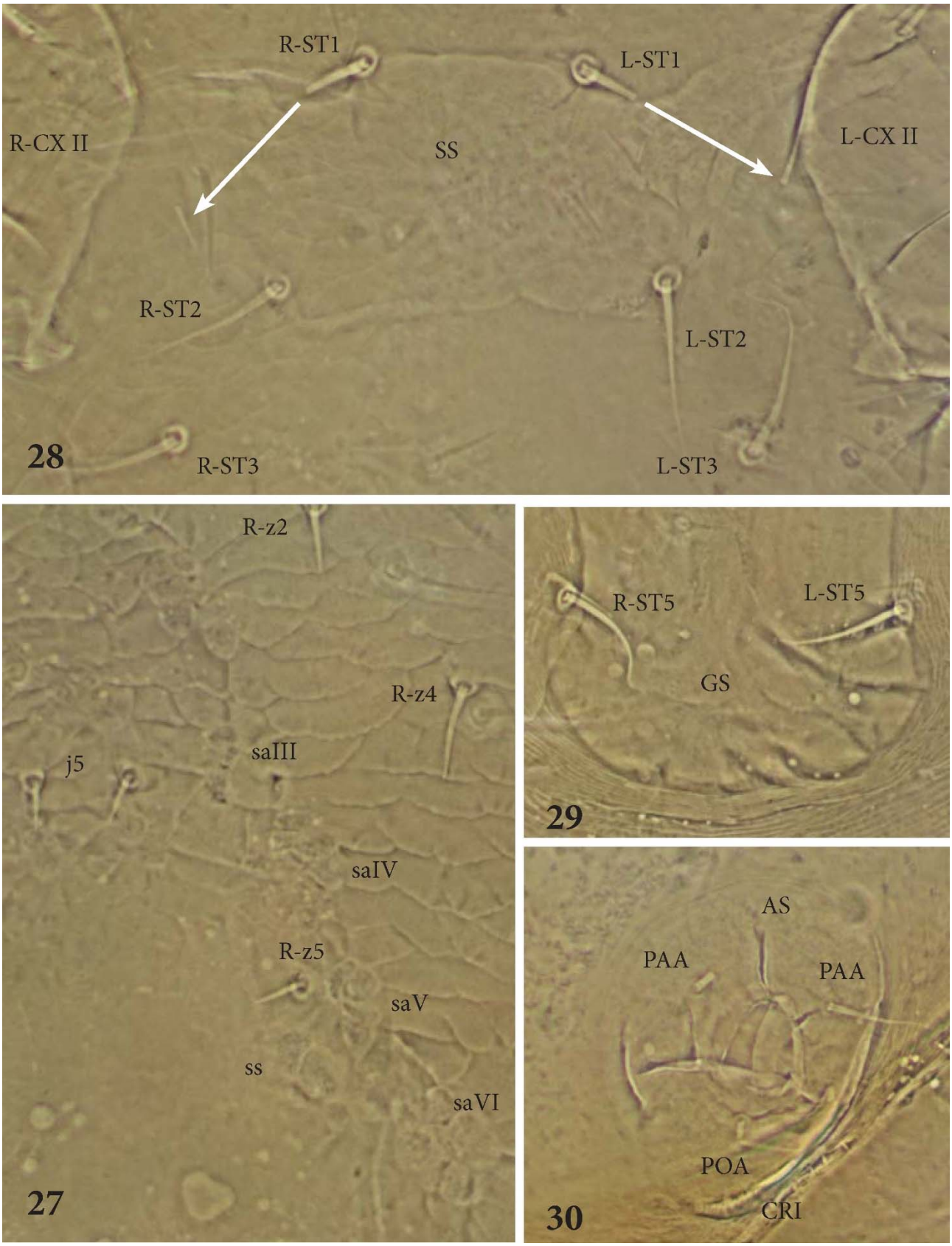
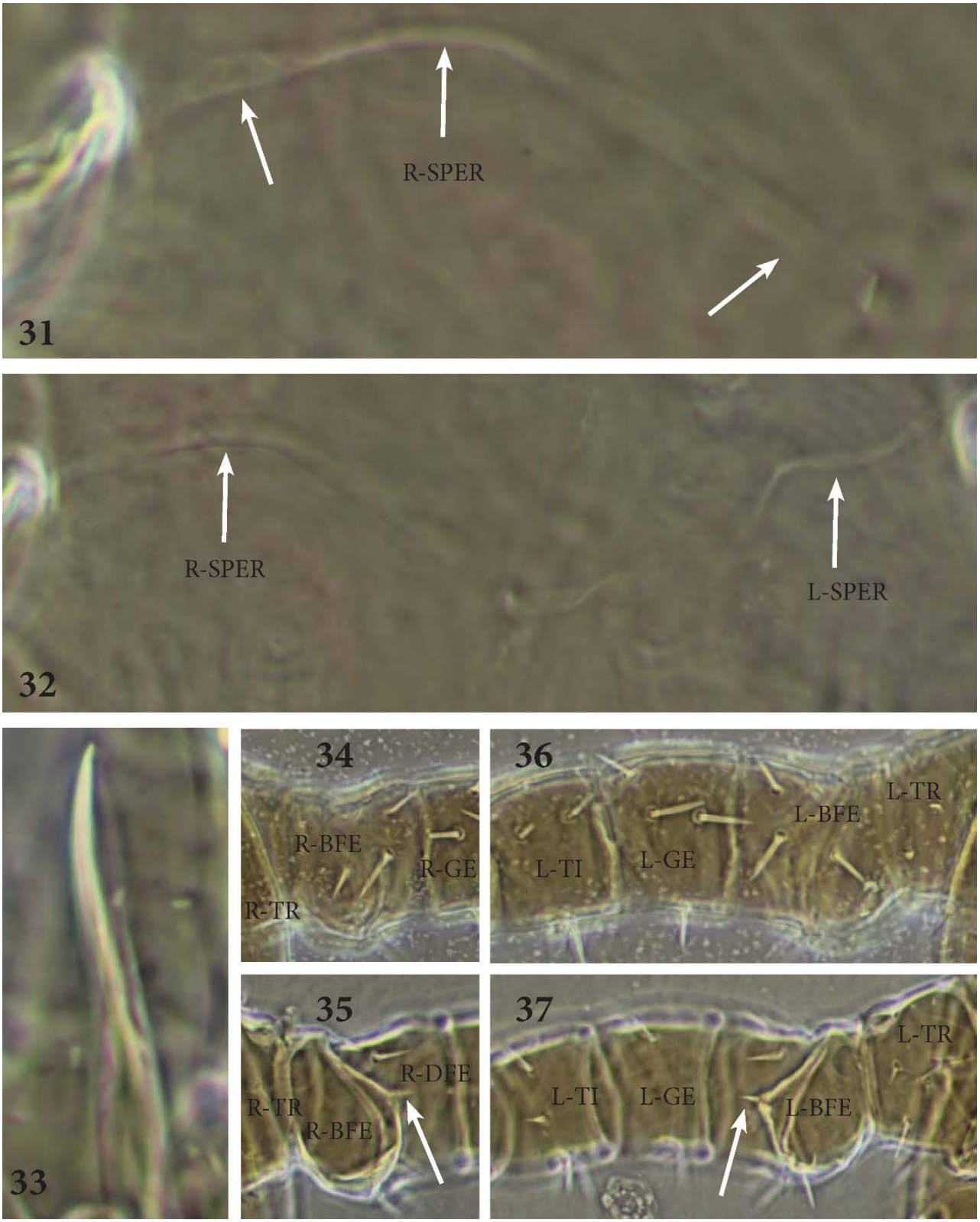


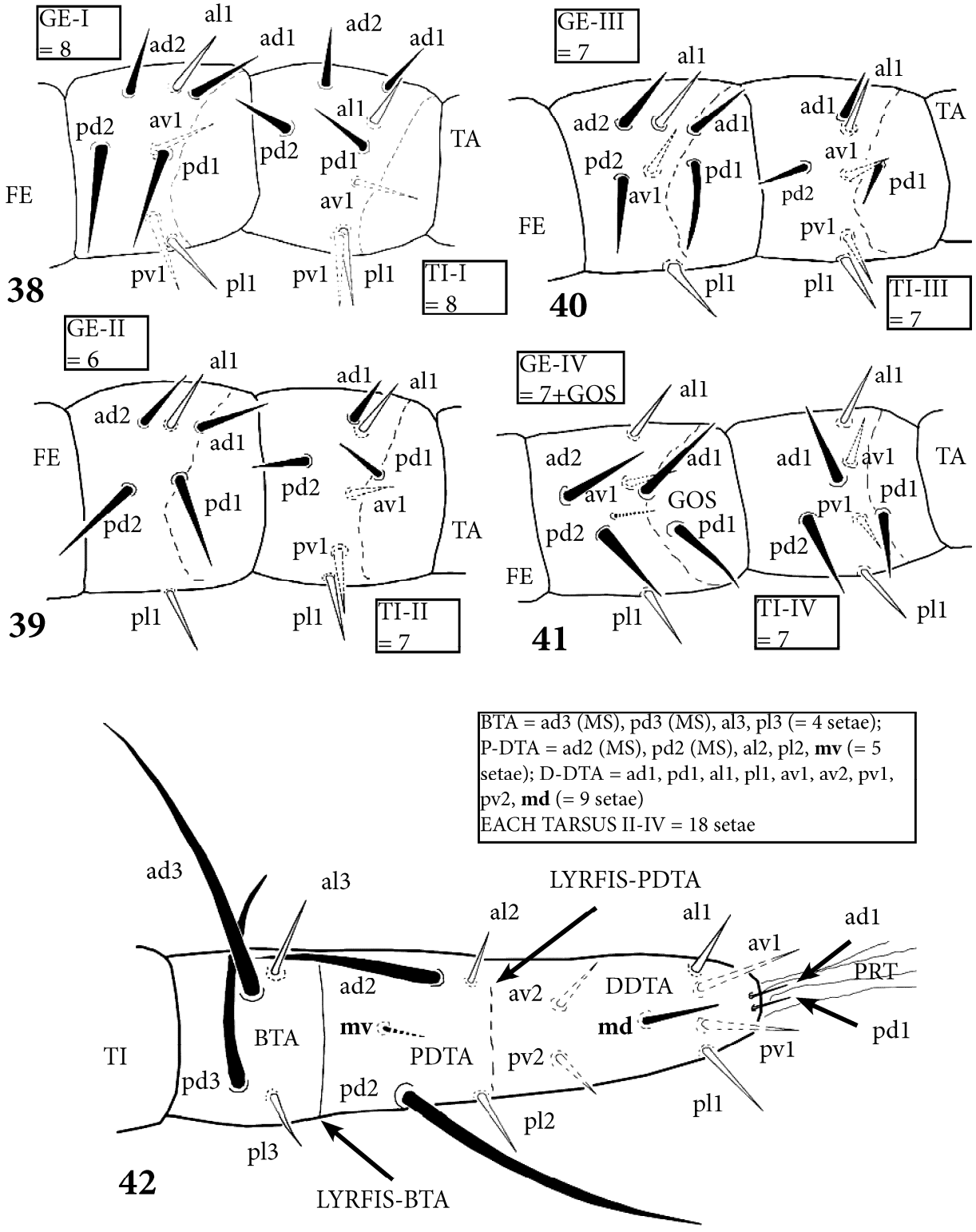
Figure 26. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – Posterior dorsal shield showing different sigilla on the opisthonotal shield. Note left lateral cleavage (CLE) which ends anterior to sigilla sg and posterior to which 4 sigilla (saIX, saX, saXI, and saXII) are present. Sigilla saXIII and saXIV between setae Z4 and Z5 are barely seen (Treat slide # 2, female # 1, photo # 3, 200×).



Figures 27–30. *Otopheidomenis zalelestes* Treat, 1955 (VP collection) – 27. Some sigilla of anterior dorsal shield right to setae j5 and z5 (Treat slide # 2, female # 2, photo # 13, 400×); 28–29. Sternal shield and genital shield (Treat slide # 2, female # 1, photos # 11 and 12, 400×); 30. Anal shield (Treat slide # 2, female # 2, photo # 18, 400×).



Figures 31–37. *Otopheidomenis zalelestes* Treat, 1955 (OSAL 0104319) – 31–32. Tubular insemination system in female (L-SPER = left spermatheca; R-SPER = right spermatheca) without showing central vesicular sacculus: Fig. 31 (top, photo # 22) - Right; Fig. 32 (bottom, photo # 24) (Left and right, both figures in 400×); 33–37. Chaetotaxy of left legs I-IV: 33. Genu and tibia I (photo # 24); 34. Genu and tibia II (photo # 26); 35. Genu and tibia III (photo # 28-1); 36. Genu and tibia IV (photo # 30); 37. Tarsus IV (photo # 42). Note setae ad2, ad3, pd2, and pd3 being the 4 macrosetae [BTA = basitarsus, GOS = ghost seta on genu IV, DDTA = distal distitarsus, LYRFIS-BTA = lyrifissure of BTA, LYRFIS-PDTA = lyrifissure of PDTA, MS = macroseta, PDTA = proximal distitarsus, PRT = pretarsus] (Treat slide # 1, female # 1, 400×).



Figures 38–42. *Otopheidomenis zalelestes* Treat, 1955 – Chaetotaxy of legs I-IV: 38. Genu and tibia I (photo # 24); 39. Genu and tibia II (photo # 26); 40. Genu and tibia III (photo # 28-1); 41. Genu and tibia IV (photo # 30); 42. Tarsus IV (photo # 42). Note setae ad2, ad3, pd2, and pd3 being the 4 macrosetae [BTA = basitarsus, GOS = ghost seta on genu IV, DDTA = distal distitarsus, LYRFIS-BTA = lyrifissure of BTA, LYRFIS-PDTA = lyrifissure of PDTA, MS = macroseta, PDTA = proximal distitarsus, PRT = pretarsus] (Treat slide # 1, female # 1, 400×).

بازتوصیف مادههای *Otopheidomenis zalelestes* Treat, 1955 (Acari: Otopheidomenidae) شامل کتوتاکسی پاها، سیجیلا و اسپرماتکا

ویکرام پراساد

۷۲۴۷ ویلیج اسکوآر درایو، وست بلومفیلد، ام‌آی ۴۸۳۲۲، ایالات متحدهٔ امریکا؛ رایانامه: vikramprasad551@gmail.com

چکیده تاریخ دریافت: 139،

مادههای بالغ *Otopheidomenis zalelestes* با تعداد زیادی عکس از مادههای غیرپاراتایپ جمع‌آوری شده توسط تریت در سال ۱۹۵۵ و ۱۹۶۶ نگهداری شده در موزه از یک ماده و یک نر شب‌پرهٔ *Zale lunata* Drury که تریت در دهه‌های گذشته از کلکسیون شخصی‌اش اهدا کرده بود، بازتوصیف و ترسیم شد. کتوتاکسی زانوها و ساق‌های یکم تا چهارم و چندین جزئیات دیگر مانند سیجیلا و اندازهٔ فاصله بین جفت موهای پشتی ایدیوزوما که پیش‌تر هرگز مورد بحث قرار نگرفته‌اند، آورده شده است. این نمونه‌ها با چند نمونهٔ پاراتیپ مادهٔ این گونه امانت گرفته شده از آزمایشگاه کنه‌شناسی دانشگاه ایالتی اوهایو، کلمبوس، اوهایو مقایسه شدند. در این مقاله ماده‌ای که سیستم تلقیح لوله‌ای (اسپرماتکا) للاپید مانند و نری که اسپرماداکتیل و بند نخست ران پای دوم آن برجستگی کوهان مانند داشته و موی ریزی روی آن قرار دارد، توصیف و ترسیم می‌شوند.

واژگان کلیدی: کتوتاکسی؛ خانوادهٔ Noctuidae ؛ *O. zalelestes* ؛ بازتوصیف؛ اسپرماداکتیل؛ *Zale*.

اطلاعات مقاله: تاریخ دریافت: ۱۳۹۸/۹/۲۴، تاریخ پذیرش: ۱۳۹۸/۱۱/۲، تاریخ چاپ: ۱۳۹۹/۱/۲۷