A new species of Histostomatidae (Acari: Astigmata) extracted from garlic cultivated in Shandaweel, Sohag governorate

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ABSTRACT

A histiostomatid hypopi, *Histiostoma shandaweeli* **sp. nov.,** was collected from the garlic plants cultivated in the farm of Shandaweel Agricultural Research Station, Sohag governorate, Egypt. The alive hypopi were transferred into the laboratory to study the complete life cycle of this species under laboratory conditions on suitable food (this study will be published in a separate paper). The appropriate numbers of males and females, as well as deutonymphs, were obtained for the present taxonomical study. Adults (males and females) and the deutonymphal stage are described and illustrated hereunder.

Keywords: Taxonomy, description, *Histiostoma*, *Allium sativum*, Egypt.

INTRODUCTION

Histiostomatidae is one of the largest families of the suborder Astigmata (Acari), comprising 470 described species (Kurosa and Tagami 2006). The feeding stages of histiostomatid mites are generally common in niches that contain wet organic matter, such as decomposed vegetables, decaying mushrooms, and animal dung. Dispersal between habitat patches is affected by the phoretic association between their hypopial deutonymphs and the host, which may be either another arthropod or vertebrate (OC'onnor 1982; Houck and OC'onnor 1991). Due to the lack of information regarding the life cycles of the majority of histiostomatid species, scientists described the new taxa based on hypopial stages (deutonymphs) only. Despite Scheucher (1957) and Hughes and Jackson (1958). The morphology of the hypopial stages on the taxonomy of the histiostomatid species is very important; however, more data on the ontogeny, habitat, and ecology of many histostomatid mites described only from hypopi are required to more understanding of the genus *Histiostoma*. In Upper Egypt, the study on the Acaridida mites (Acaridae and Histiostomatidae) has received the attention of several authors, such as Eraky 1997, 1999, 2000; Eraky et al. 2010, 2017; Fawzy and Metwally 2007; Fakeer et al. 2014), but in many of their studies, the new species were discovered based on hypopial stages only (most abundant in many environments). Therefore, the current study focused on the morphology of adult males and females, as well as the hypopial stages.

MATERIALS AND METHODS

The specimens of eight well-preserved individuals of each stage (male, female, and deutonymph) were taken from the stock culture used to study the complete life cycle of this species under laboratory conditions. Mites were cleared up in lactic acid, mounted in Hoyer's medium on a clean glass slide, dried on a hot plate, ringed with nail polish, and then examined under a phase contrast research microscope (Optika-Vision-Lite ENG-rev 01, Italy). Measurements are given in micrometers (μm); each measurement shows the average for the number of individuals, followed (in parentheses) by the respective ranges; a drawing tube was also used when necessary. The adult male and female

and the deutonymph were described and illustrated. Nomenclature by Griffiths et al. 1990 followed for idiosomal setae, and Grandjean, 1939 for leg setae.

RESULTS AND DISCUSSION

Genus *Histiostoma* Kramer, 1876

Histiostoma shandaweeli sp. nov.

Descriptions of the new species:

Female (n=6), (Figs. 1–7 & Photo. 1a,b): Body oval, relatively elongated. Idiosoma: length 296 (283–310 μm), width 173 (166–180 μm).

Gnathosoma (Figure 3): Gnathosoma: Length 144 (142–147 μm), width 89 (87–90). Chelicerae with a fixed digit **showing a** membranous fingerlike distal portion with a tiny apical tooth, a medium region bearing well-developed large teeth pointing upward, and a movable digit with four apical teeth. The anterior portion of the movable digit is broadly flattened with a curved apex and internally with four well-developed sub-apical teeth.

Dorsum (Figure 1): Cuticle-smooth anterior propodosoma ornamented with finely punctate extended posteriorly above legs I, in addition to oval and rectangular shapes resembling beads located in the middle of the propodosoma. The punctate areas also extended to the idiosoma around the dorsal setae. All dorsal setae are simple and filiform. Setae *vi* 13 (12–15), *ve* 12 (11–13), *sci* 18 (17–19), *sce* 19b (18–20), *c1* 13 (13–14), *c2* 15 (14–15), *c3* 15 (13–16), *d1* 18 (16–19), *d*2 21 (18–24), *e1* 14 (12–15), *e2* 20 (19–21), *f2* 26 (25–27), *h1* 22 (21–23), *h2* 13 (13–14), *h3* 19 (18–20). Oil gland (*gla*) well–developed, located between *e1* and *e2*, the cupule (*ia*) well visible, located between *c2* and *d2*, cupules (*im, ip*) invisible.

Venter (Figure 2): Apodemes I fused medially to form a Y-shaped with very short extension posteriorly; all other apodemes were very short, free medially. Setae (*1a*) short 13 (11–14 μm), filiform, positioned on coxal areas 1. Coxal setae (*3a*) minute 7 (6–7 μm), filiform, positioned posteromedial to anterior genital papillae. . Coxal setae (*3b*) are short 8 (7–8 μm) located anterolateral to posterior papillae. Coxal setae (*4a*) very short 9 (9–10 μm), located posterolateral to posterior papillae. The anterior and posterior genital papillae are circular and well sclerotized. Two pairs of anal setae (*ps3* and *ps2),* minute, filiform, located laterally to the anal opening, A pair of anal setae (*ps1*), also minute, is positioned posterior to the anal opening. Setae *ps3* 6 (6–7), *ps2* 5 (5–6), and *ps1* 5 (5–6).

Legs. (Figs. 4–7): Legs slender, with all segments free. Measurements of legs I–IV: Legs I 158 (155–160), legs II 144 (140–145), legs III 140 (138–142), legs IV 159 (155–162). Chaetotaxy: trochanters 1–1–1–0; femora 1–1–0–1; genua 2–2–0–0; tibiae 2–2–1–1; tarsi 10–12–8–8. Famulus (*ε*) absent. Solenidiotaxy: Genua 2–1–0–0; tibiae 1–1–1–1; tarsi 3–1–0–0. Terminal tarsal setae (*d*) legs I and II, elongated, filiform, longer on legs I. Measurements of setae and solenidia on legs I–IV: Legs I: *pR* 6 (5–7), *vF* 9 (8–10), *mG* 10 (9–10), *cG* 10 (9–10), *δ1* 10 (9–10), *δ2* 10 (9–10), *hT* 11 (10–11), *gT* 7 (6–7), *α* 11 (10–11), *ω1* 11 (10–11), *ω2* 7 (6–8), *a*a 7 (6–7), *ba* 6 (5–6), *ra* 11 (10–12), *la* 11 (10–11), *p* 6 (5–6), *s* 5 (4–5), *q* 8 (7–8), *f* 6 (5–6), *e* 13 (12–13), *d* 40 (38–42), *ω3* 6 (5–6); Legs II: *pR* 7 (6–7), *vF* 8 (7–8), *mG* 9 (8–9), *cG* 12 (11–12), *δ* 11 (10–12), *hT* 13 (12–14), *gT* 16 (15–17), *α* 11 (10–11), *ω* 14 (13–15), *ba* 9 (8–9), *ra* 11 (10–11), *la* 9 (8–9), *p* 8 (7–8), *s* 8 (7–8), *q* 7 (6–7), *f* 8 (7–8), *e* 8 (7–8), *d* 38 (35–40), *wa* 10 (9– 10); Legs. III: *sR* 6 (5–6), *kT* 16 (15–17), *α* 10 (9–10), *r* 11 (10–11), *w* 11 (10–11), *d* 10 (9–10), *p* 11 (10–12), *f* 10 (9–10), *q* 10 (9–10), *u* 9 (8–9), *s* 9 (8–9); Legs. IV: *wF* 8 (7–8), *kT* 8 (7–8), *α* 6 (5–6), *r* 7 (6–7), *w* 7 (6–7), *p* 5 (4–5), *d* 5 (4–5), *u* 7 (6–7), *s* 7 (6–7), *f* 8 (7–8), *e* 8 (7–8). Terminal tarsal setae (*d*) on legs. I–IV filiform, long and thin on legs. I and II, but thick and short on legs. III and IV.

Male (n=6), (Figs. 8–14 & Photo. 1c,d): Body approximately oval in its shape. Idiosoma: length 200 (195–205 μm), width 118 (115–120 μm).

Gnathosoma (Fig. 10): Gnathosoma: Length 41 (40–42 μm), width 40 (39–41). Gnathosoma similar to that of female.

Dorsum (Fig. 8): Dorsal side ornamented with strongly punctate. All dorsal setae simple, filiform. Setae *vi* 8 (7–9), *ve* 13 (11–14), *sci* 12 (11–13), *sce* 9 (8–10), *c1* 15 (14–16), *c2* 15 (14–

15), *c3* 16 (15–16), *d1* 11 (11–12), *d2* 12 (11–13), *e1* 13 (12–14), *e2* 20 (19–21), *f2* 16 (15–17), *h2* 16 (15–17), *h3* 15 (14–15). Oil gland (*gla*) well–developed, located posterior to *d2*, the cupules (*ia*, *im*, *ip*) invisible.

Venter (Fig.9): Apodemes I fused medially to form a Y-shaped, with long extension posteriorly. All other apodemes approximately long medially, but ending free. All ventral setae thin, short and filiform. Setae *1a* 13 (11–14), positioned on coxal areas 1. Coxal setae *3a* 11 (10–11), positioned on coxal areas 3. Coxal setae *3b* 9 (8–9) located posterolateral to anterior papillae. Coxal setae *4a* 7 (6–7), located lateral to posterior papillae. Anterior and posterior genital papillae oval in shape. Three pairs of anal setae (*ps3*, *ps2*, and *pa1*) minute, filiform, located lateral and posterior to anal slit.. Setae *ps3* 6 (5–6), *ps2* 7 (6– 7), *ps1* 5 (5–6).

Legs. (Figs. 11–14): Legs normal–developed, with all segments free. Measurements of legs I–IV: Legs I 160 (155–161), legs II 147 (144–150), legs III 124 (122–126), legs IV 158 (155–160). Chaetotaxy: trochanters 1–1–1–0; femora 1–1–0–1; genua 2–2–0–0; tibiae 2–2–1–1; tarsi 10–8–8–8. Famulus (*ε*) absent. Solenidiotaxy: Genua 2–1–0–0; tibiae 1–1–1–1; tarsi 3–1–0–0. Terminal tarsal setae (*d*) legs I and II, elongated, filiform, longer on legs I. Measurements of setae and solenidia on legs I–IV: Legs I: *pR* 5 (4–5), *vF* 10 (9–10), *mG* 7 (6–7), *cG* 8 (7–8), *δ1* 8 (7–8), *δ2* 8 (7–8), *hT* 6 (5–6), *gT* 7 (6–7), *α* 11 (10–11), *ω1* 11 (11–12), *ω2* 7 (6–7), *aa* 5 (4–5), *ba* 8 (7–8), *ra* 5 (5–5), *la* 6 (5–6), *p* 4 (3–4), *s* 4 (3–4), *q* 4 (3–4), *f* 4 (4–4), *wa 5 (4–5), d* 49 (47–51), *ω3* 5 (4–5); Legs II: *pR* 5 (4–5), *vF* 8 (7–8), *mG* 9 (8–9), *cG* 9 (8–9), *δ* 6 (5–6), *hT* 9 (8–9), *gT* 7 (6–7), *α* 13 (12–13), *ω* 9 (8–9), *ba* 15 14–16), *ra* 8 (7–8), *la* 9 (8–9), *p* 6 (5–6), *q* 6 (5–6), *f* 8 (7–8), *d* 27 (25–28), *wa* 10 (9– 11); Legs. III: *sR* 8 (7–8), *kT* 10 (9–10), *α* 11 (10–12), *r* 10 (9–10), *w* 9 (8–9), *d* 10 (9–10), *p* 7 (6–7), *f* 10 (9–10), *ra* 10 (9–10); Legs. IV: *wF* 8 (7–8), *kT* 12 (11–12), *α* 6 (5–6), *r* 8 (7–8), *w* 9 (8–9), *p* 8 (8–8), *d* 5 (4–5), *u* 8 (7–8), *s* 7 (6–7), *f* 7 (6–7), *e* 8 (7–8). Terminal tarsal setae (*d*) on legs. I–IV filiform, long and thin on legs. I and II, but thick and short on legs. III and IV.

Deutonymph (Figs. 15–22 & Photo. 2a,b,c): Body ovoid, widest in sejugal region. Idiosomal length: 185 (180–190 μm), width: 138 (127–148), (n=6). Gnathosoma (Fig. 17) normal developed, its infracapitulum oblong, gnathosomal length 15 (14–16), width 7 (6–7), palpal solenidia (ω) approximately long 17 (16–17), palpal setae minute 3 (2–3).

Dorsum (Figure 15): Propodosoma triangular with well discernible two definite lines decurrently approximately parallel with each other and with a body margin. All dorsal setae minute and filiform. Setae *vi* 3 (2–3); internal scapular setae *sci* 4 (3–4), positioned in front of external scapular setae *sce* 4 (3–4). Sejugal region well-developed, approximately wide, ornamented with transverse dense lines. Surfaces of propodosoma and hysterosoma smooth, without any sculpture. Cupule *ai* well–visible situated inward, at the same line of *c2*. Cupules *im* and *ip* invisible. Measurements of dorsal setae: *c1* 9 (8–9), *c2* 7 (6–7), *cp* 7 (6–7), *d1* 12 (11–12), *d2* 7 (6–8), *e1* 7 (6–7), *e2* 7 (6–7), *f2* 7 (6–7), *h1* 7 (6–7), *h2* 6 (5–6), *h3* 7 (6–7).

Venter (Fig. 16): Apodemes I well–developed, fused together in the middle, forming a short sternum, the latter free posteriorly, not fused with apodemes III. Apodemes II long fused medially with apodemes III. Sejugal apodemes well– developed, arched medially, but not fused with each other. Apodemes IV fused medially with median apodeme. Intermediate sternal apodeme and posterior one missing. Genital region small, genital setae (*ga*) thin, hardly visible, positioned posterolateral to genital opining. Coxal area I with disks (*1a*), coxal area III with disks (*3b*) and coxal area IV with disks (*4a*), all well–developed. Sucker plate (Fig. 18): Normal–developed, length 49 (45–52), width 43 (40–45), ovoid in shape, median suckers much larger than anterior ones.

Legs (Figs. 19–22): Length of legs I–IV: Legs I 118 (115–120); legs II 98 (95–100); legs III 88 (80–95); legs IV 95 (90–100). Apical setae *d* on legs I and II long and filiform, longer on legs I, apical setae *e* on legs III and IV also filiform. Measurements of setae on legs I–IV: Legs I: *vF* 6 (5–6), *mG* 8 (7–8), *cG* 8 (7–9), *δ* 9 (8–9), *hT* 8 (7–9), *gT* 9 (8–9), *α* 18 (17–19), *ω1* 14 (13–14), *ω3* 9 (8–9), *wa* 8 (7–8), *la* 7 (6–7), *ra* 6 (5–6), *q* 6 (5–6), *d* 39 (37–41), *e* 15 (14–16). Legs II: *vF* 7 (6–7), *mG* 7 (6–7), *cG* 7 (6–7), *δ* 7 (6–7), *hT* 9 (8–9), *gT* 8 (7–8), *α* 9 (8–9), *ω* 9 (8–9), *wa* 10 (9–10), *la* 8 (7–8), *ba* 6 (5–6), *q* 5 (4–5), *d* 25

(23–27). Legs III: *sR* 9 (8–9), *kT* 7 (6–8), *α* 12 (11–12), *w* 12 (11–12), *s* 8 (7–8), *r* 8 (7–8), *f* 5 (4–5), *p* 5 (4–5), *e* 15 (13–17). Legs IV: *wF* 9 (8–9), *kT* 9 (8–9), *α* 9 (8–9), *w* 13 (12–14), *d* 13 (12–14), *s* 7 (6–7), *r* 9 (8–9), *f* 5 (4–5), *p* 9 (8–9), e 16 (15–16).

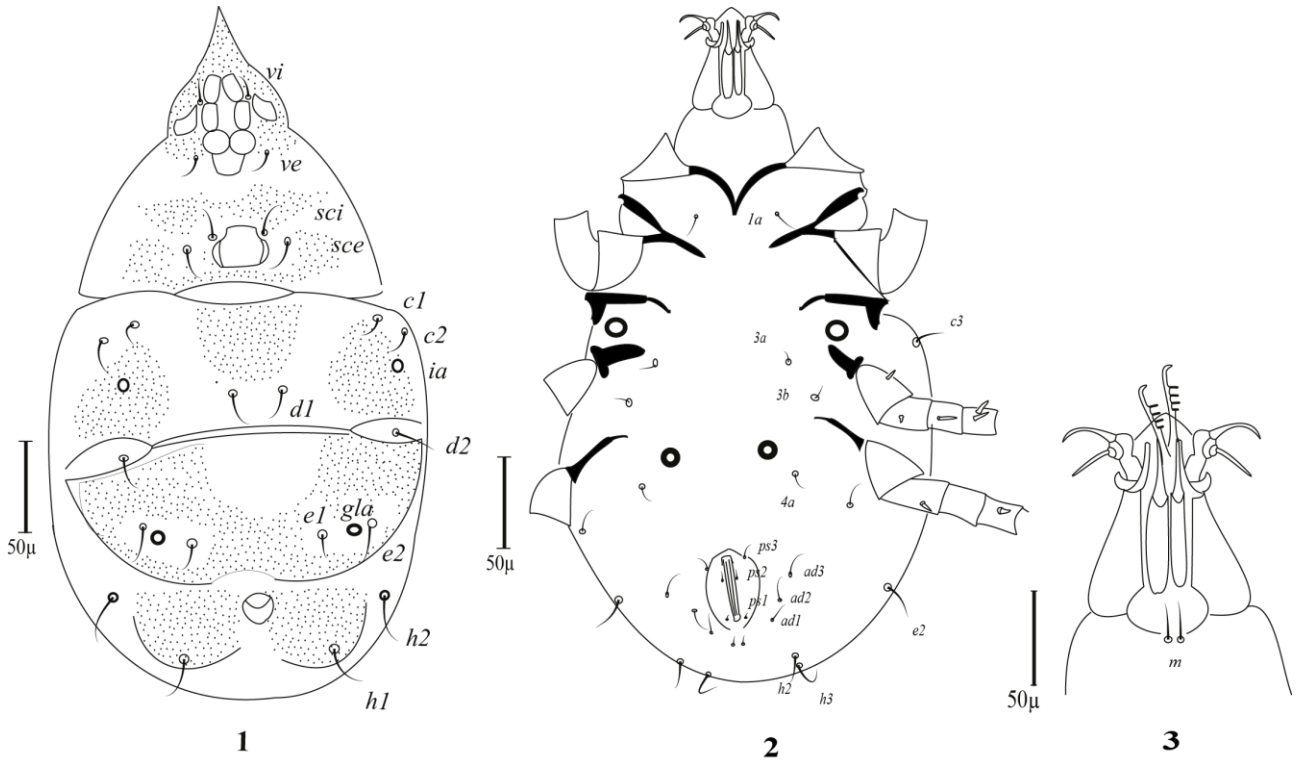
Remarks: Based on the shape of the hypopial stage (heteromorphic deutonymph) of the new species and the presence of some important characteristics such as: the shape of both apodemes III and apodemes sejugal; the absence of intermediate sternal apodemes, in addition to the shape of its dorsum and the chaetotaxy on legs I and II, the new species can be distinguished from all known congeners, but it shares some characteristics with *Histiostoma pickaxei* Eraki and Shoker 1995, and perhaps the new species may be distinguished from it by the following characters:

1- Prodorsal surface with characteristic pattern of two arcuate lines in *H. pickaxei*, and with two definite lines decurrently parallel with the body margin in the new species.

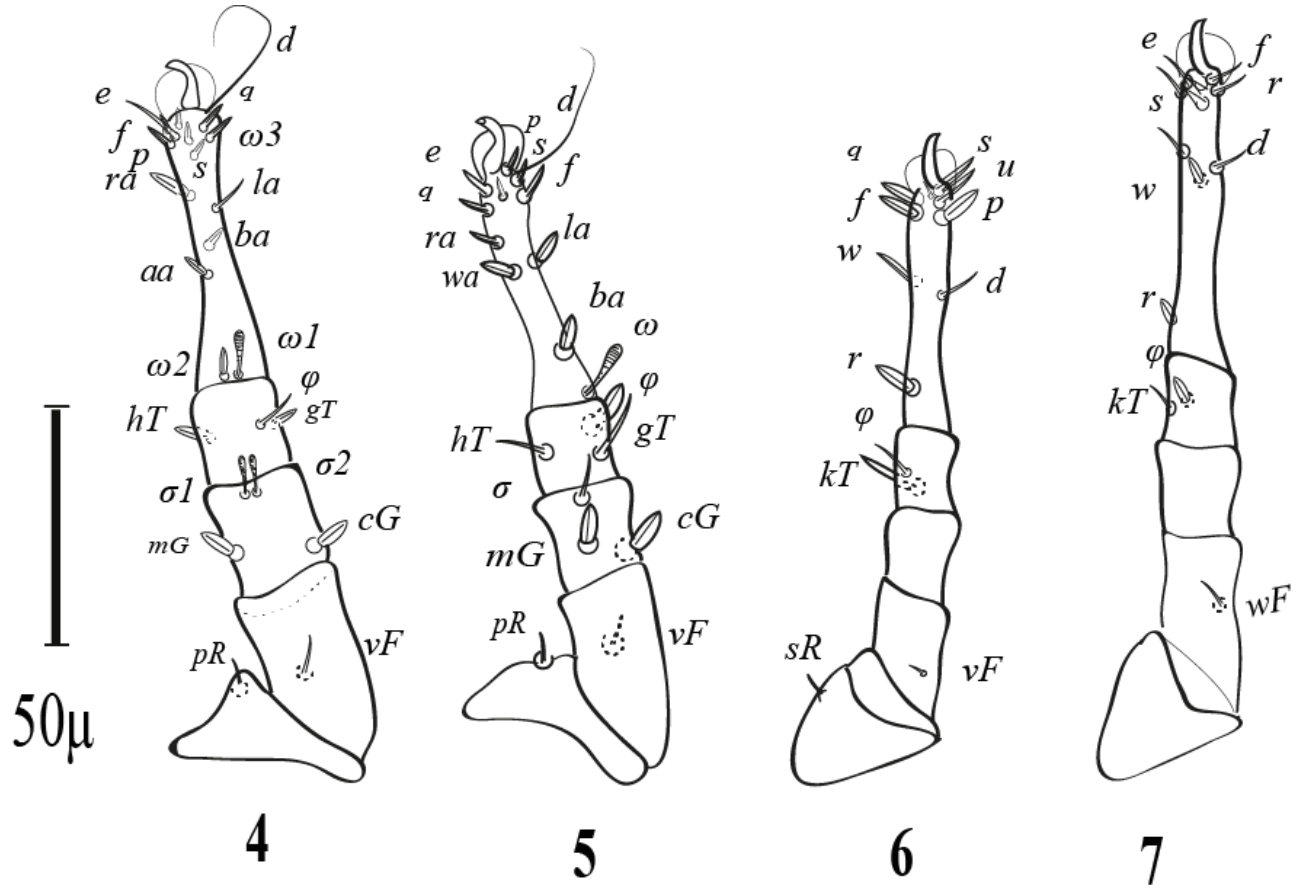
2- Arc of apodemes III free medially and intermediate sternal apodeme present, but short in *H. pickaxei*, while arc of apodemes III fused medially and intermediate sternal apodeme absent in the new species

3- Tibiotarsal group of solenidia composed of 4 members (ω1, ω3, α, ε) in *H. pickaxei*, and 3 members (ω1, ω3, α) in the new species

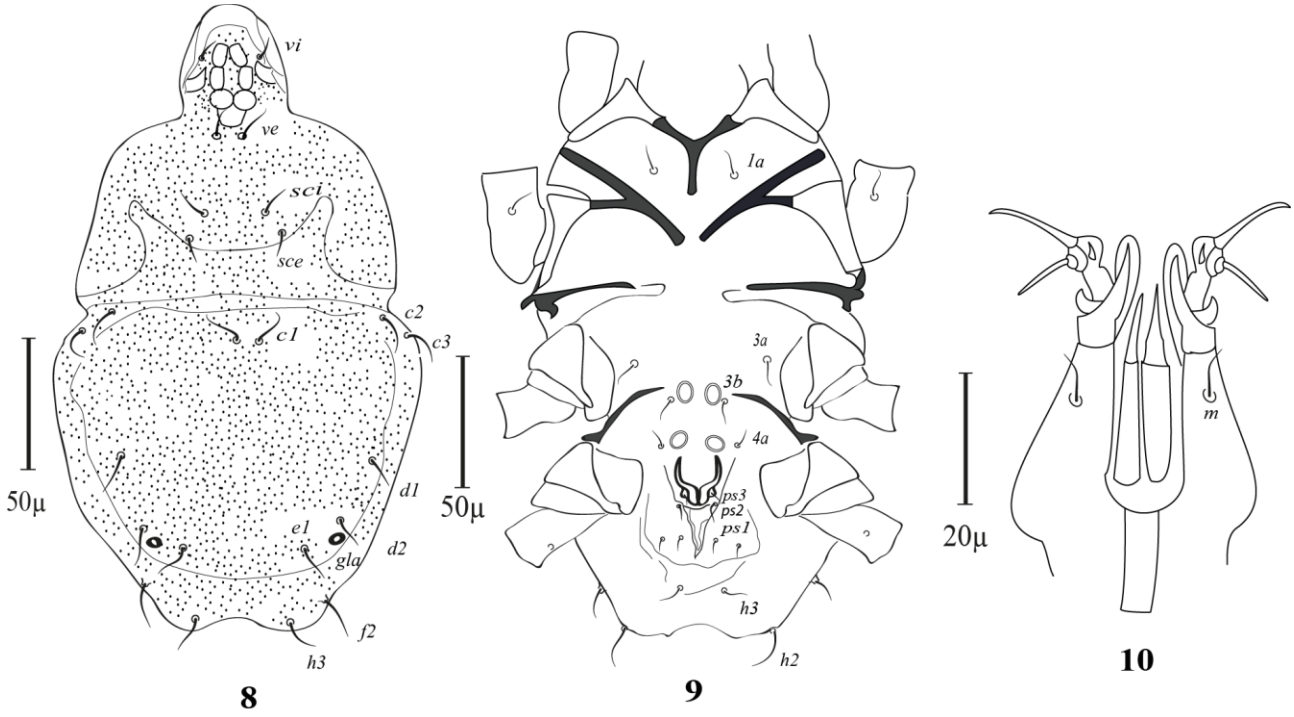
Material examined: Holotype female and five paratypes females, six paratypes males and six paratypes deutonymphs were collected from laboratory stock culture at Shandaweel Research Station, Sohag, Egypt. Coll. Azza A. Mohamed, November 23, 2023. Holotype female and three paratypes of each stage (female, male and deutonymph) deposited in the Acari collection of Plant Protection Research Institute, Sohag, Egypt. Two paratypes females, males and deutonymphs deposited in the mite reference collection of Fruit Tree Mites Department, Plant Protection Research Institute, Agricultural Research Centre, Dokki, Giza governorate, Egypt (PPRI-ARC). Two paratypes females and three paratypes of both males and deutonymphs deposited in the Acari collection of Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut 71526 Egypt.



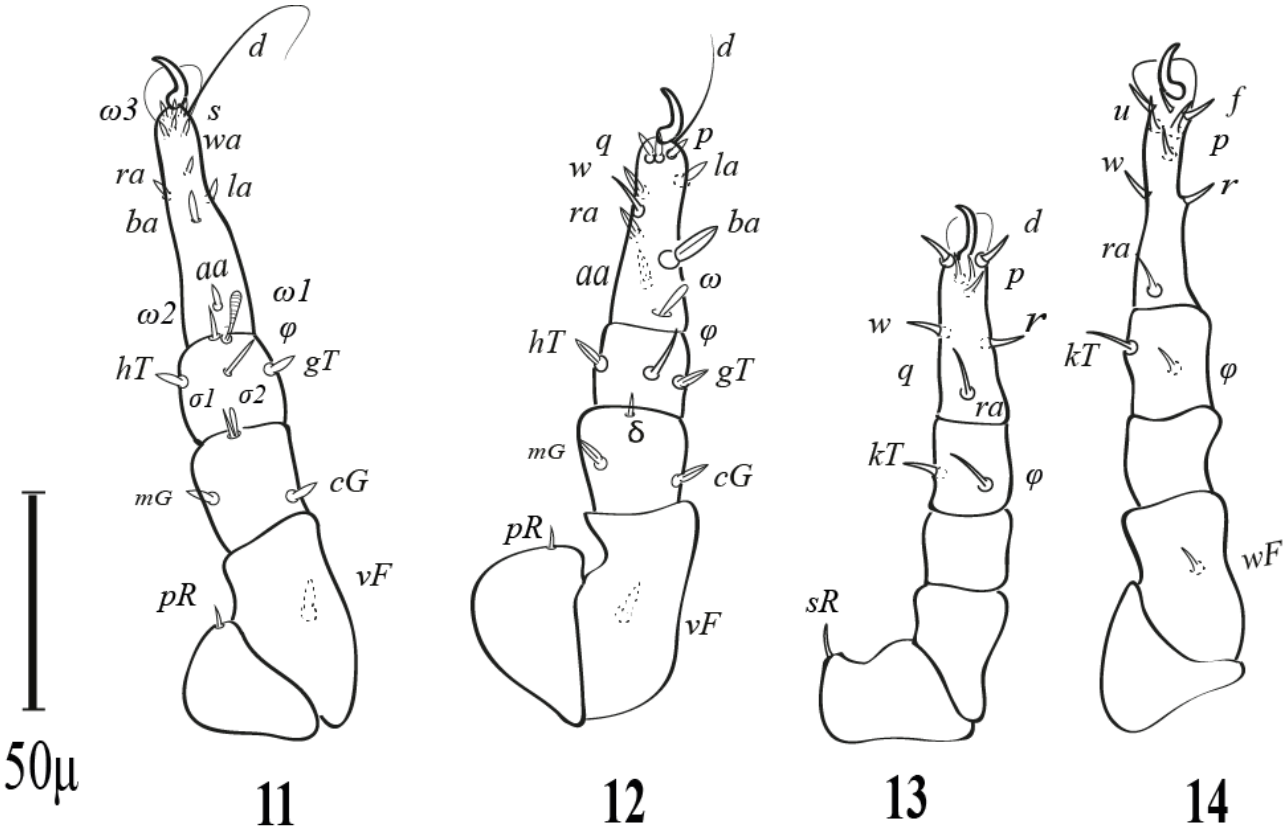
Figs. 1–3: *Histiostoma shandaweeli* **sp. nov.** (female): 1. Dorsum, 2. Venter, 3. Gnathosoma.



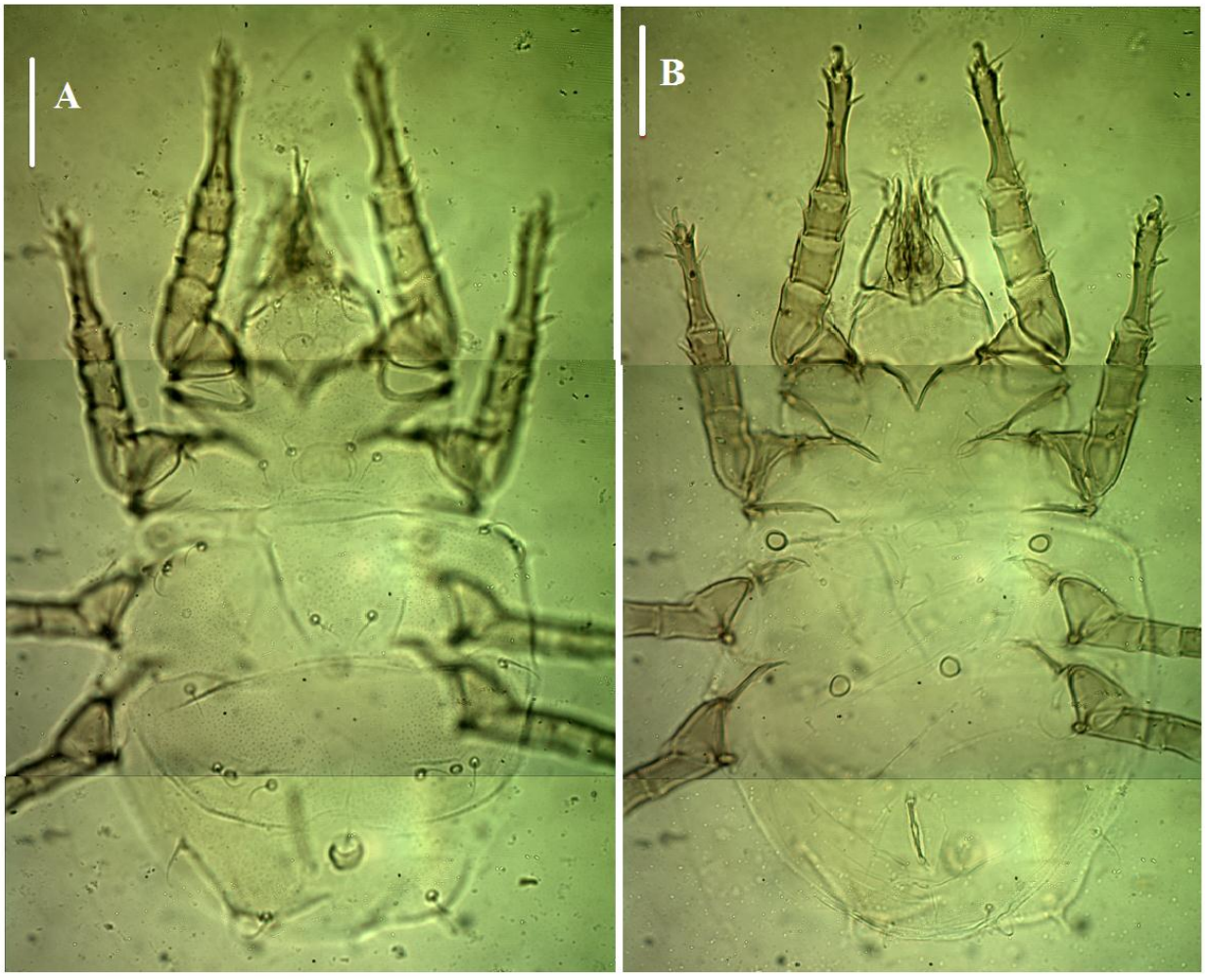
Figs. 4–7: *Histiostoma shandaweeli* **sp. nov.** (female): 4. Leg I, 5. Leg II, 6. Leg III, 7. Leg IV.



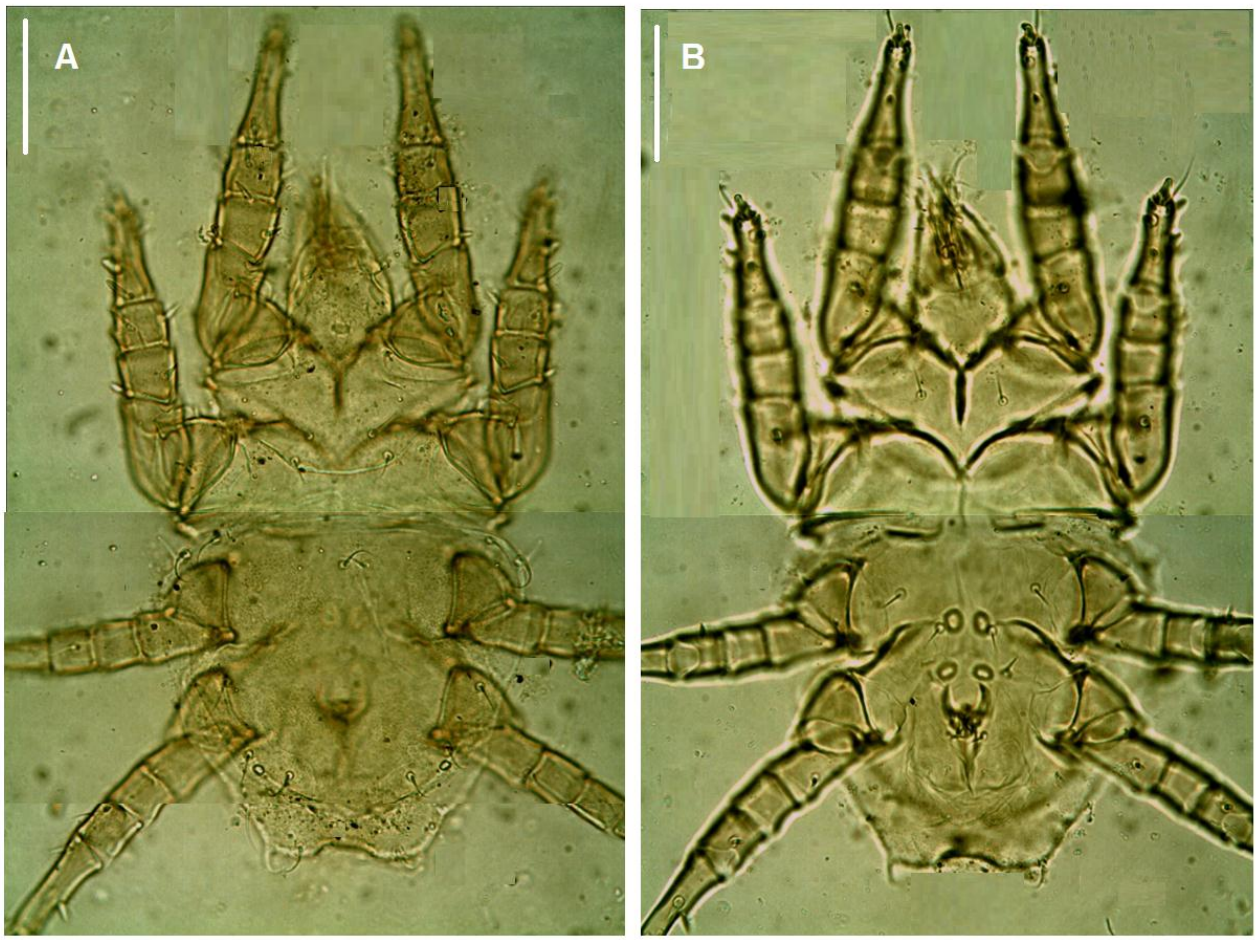
Figs. 8–10: *Histiostoma shandaweeli* **sp. nov.** (male): 8. Dorsum, 9. Venter, 10. Gnathosoma.



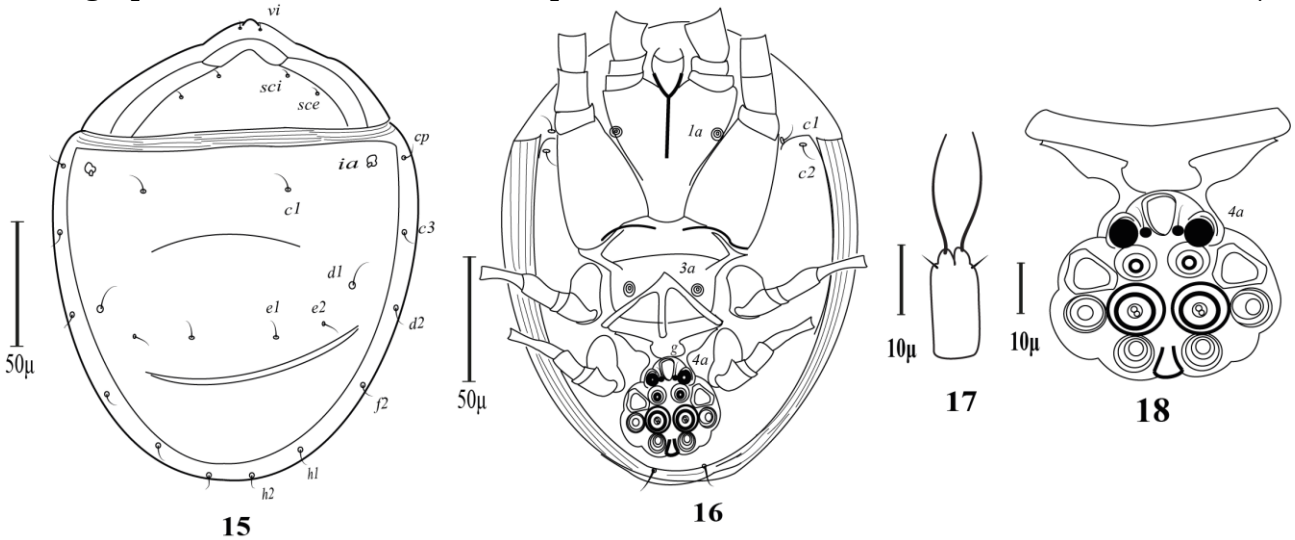
Figs. 11–14: *Histiostoma shandaweeli* n. sp. (male): 11. Leg I. 12. Leg II, 13. Leg III. 14. Leg IV.



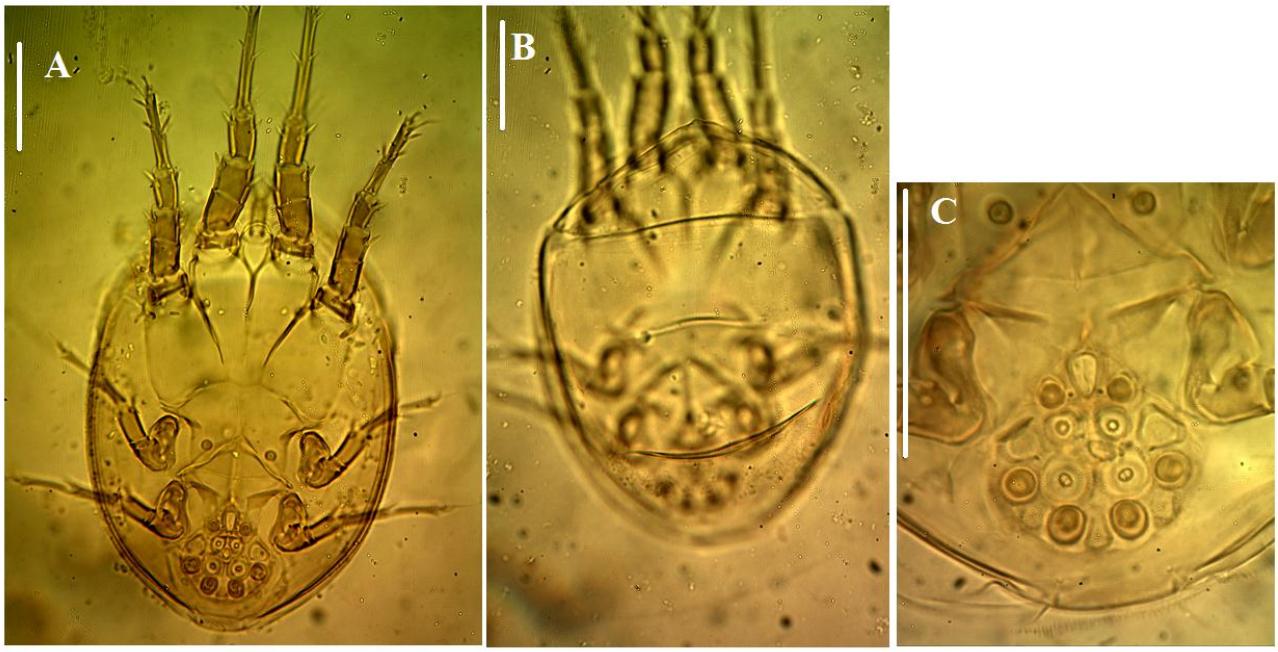
Photograph 1. *Histiostoma shandaweeli* **sp. nov.** A. Female dorsum, B. Female venter. Scale bare 50 µm.



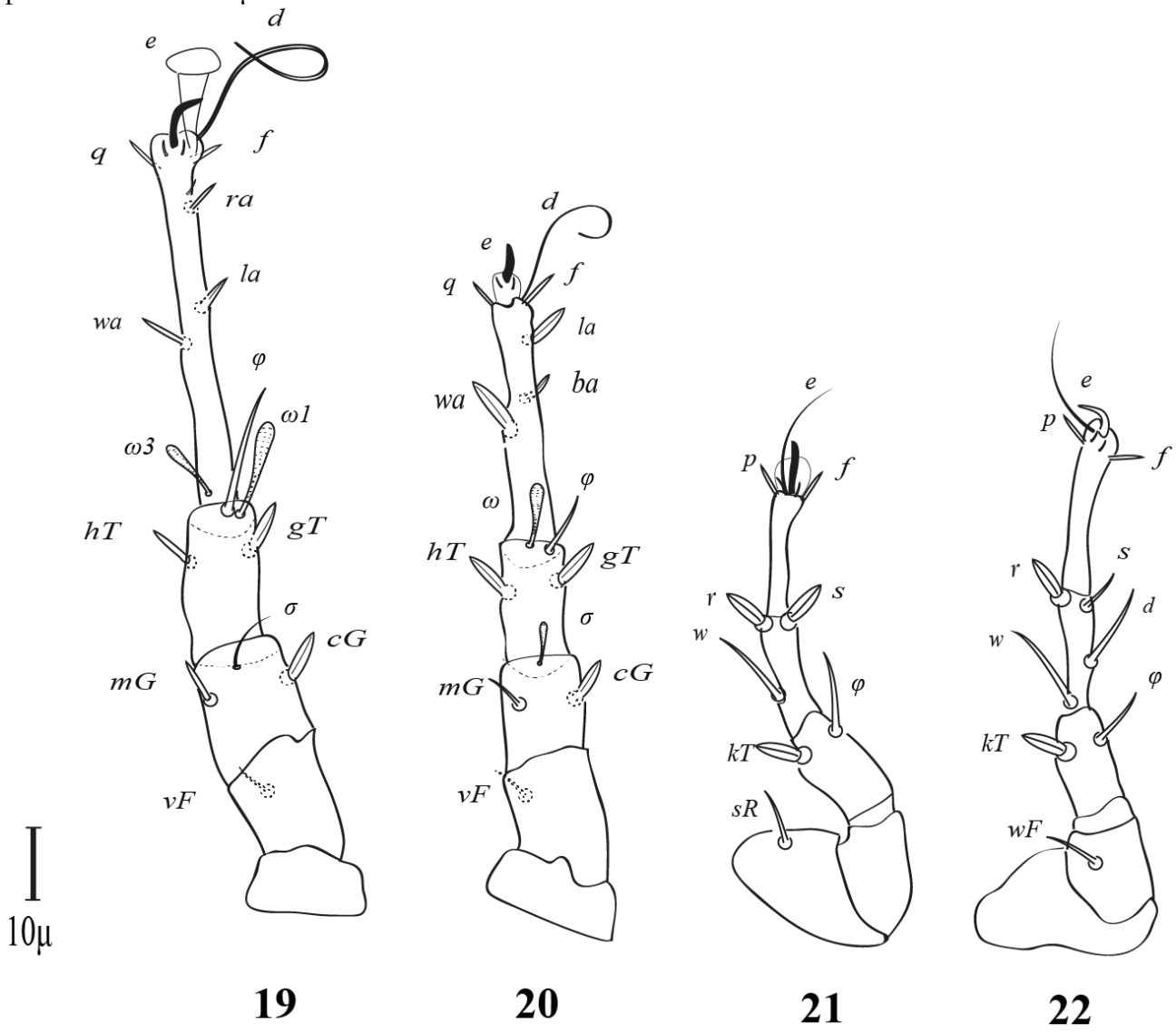
Photograph 2. *Histiostoma shandaweeli* **sp. nov.** A. Male dorsum, B. Male venter. Scale bare 50 µm.



Figs. 15–18: *Histiostoma shandaweeli* **sp. nov.** (deutonymph): 15. Dorsum, 16. Venter, 17, Gnathosoma 18. Sucker plate.



Photograph 3. *Histiostoma shandaweeli* **sp. nov.** (deutonymph): A. Venter, B. Dorsum, 17, Sucker plate. Scale bare 50 µm.



Figs. 19–22: *Histiostoma shandaweeli* **sp. nov.** (deutonymph): 19 Leg 1, 20. Leg 11, 21. Leg III. 22 Leg IV.

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