The genus *Hyalomma* Koch, 1844. XI. Redescription of all parasitic stages of *H.* (*Euhyalomma*) *asiaticum* Schulze & Schlottke, 1930 (Acari: Ixodidae) and notes on its biology

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Abstract

The tick *Hyalomma* (*Euhyalomma*) *asiaticum* Schulze & Schlottke, 1930 is provisionally considered to belong to the *H*. (*E*.) *asiaticum* group of closely related species. Males of *H. asiaticum* can be distinguished from those of other species of the group by their long and very deep cervical grooves, long, narrow, straight adanal plates, long dorsal prolongation of the spiracular plates, dorsal posterior margin of the basis capituli deeply concave and angular, and unbroken ivory-coloured strip on

the dorsal aspect of the leg segments. Females of *H. asiaticum* can be distinguished from those of other species of the *H. asiaticum* group by their very deep cervical grooves, narrowly U-shaped genital aperture, with bulging preatrial fold. Larger domestic and wild ungulates are the principal hosts of the adults, while nymphs and larvae parasitize mainly rodents, leporids and hedgehogs. *Hyalomma asiaticum* is widely distributed in Asia, from Syria in the West to eastern China in the East. Here all the parasitic stages of *H. asiaticum* are illustrated and redescribed. Data on its disease relationships are also provided.

Introduction

Hyalomma (*Euhyalomma*) *asiaticum* Schulze & Schlottke, 1930 was originally described as a subspecies of *H*. *dromedarii*, namely *H*. *dromedarii asiaticum* (Schulze & Schlottke 1930). A few years later Schulze (1935) elevated its rank to species level. The name was widely accepted by former Soviet workers (Pomerantzev 1946, 1950), whereas for a while some western workers considered *H. asiaticum* a junior synonym of *H. dromedarii* (Delpy 1949; Hoogstraal 1956), now, however, *H. asiaticum* is universally accepted as a valid full species.

The tick exhibits great geographical and individual variability, thus causing many problems with its identification. Its considerable variability can best be illustrated by the several subspecies that have been described, namely *H. asiaticum kozlovi* Olenev, 1931, *H. asiaticum citripes* Schulze, 1935 and *H. asiaticum caucasicum* Pomerantzev, 1940 (Schulze 1935; Pomerantzev *et al*. 1940; Pomerantzev 1946, 1950). Two of these subspecies, namely *H. asiaticum kozlovi* and *H. asiaticum caucasicum*, have until recently still been considered as valid (Filippova *et al*. 1995; Camicas *et al*. 1998). Our examination of numerous

specimens collected throughout the geographical range *H. asiaticum* as well as a detailed study of the type specimens have led us to the conclusion that *H. asiaticum kozlovi* and *H. asiaticum caucasicum* should be treated as junior synonyms of *H. asiaticum*. Although we accept the presence of certain morphological patterns in some populations of *H. asiaticum*, we are of the opinion that assigning subspecies status to these ticks has been based on a few variable characters.

The aim of this study is to redescribe all the parasitic stages of *H. asiaticum*. These descriptions and accompanying illustrations should assist parasitologists and epidemiologists in their studies on the biology and medico-veterinary importance of this widely distributed asiatic *Hyalomma* species.

Materials and methods

A total of approximately 3700 males, 2100 females, 400 nymphs, and 700 larvae originating from Afghanistan, Armenia, Azerbaijan, China, Georgia, Iran, Iraq, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia, Tajikistan, Turkmenistan and Uzbekistan, were examined in the current study. Both field-collected and laboratory-reared specimens were studied. The type specimen has also been examined by the senior author (DAA). The specimens scrutinized are housed in the United States National Tick Collection (The James H. Oliver, Jr. Institute of Arthropodology and Parasitology, Georgia Southern University, Statesboro, USA), the Zoological Institute of the Russian Academy of Sciences (St. Petersburg, Russia), the Natural History Museum of Berlin (Berlin, Germany), the Gertrud Theiler Tick Museum at the Onderstepoort Veterinary Institute (Onderstepoort, South Africa) and in the Field Museum of Natural History (Chicago, USA).

The immature stages and the finer structures of the adults were mounted on glass slides and examined under a light microscope, and the macrostructures of males and females under a stereoscopic microscope. The spiracular plate of the nymph was studied using a scanning electron microscope. Measurements for the male conscutum and female scutum are given in millimetres (mm), and those for the various structures of the immature stages in micrometres (µm). The measurements are arranged as follows: minimum – maximum (average ± standard deviation, n = number of specimens measured), and their schematic layout is to be found in Apanaskevich (2003), and Apanaskevich and Horak (2006).

Taxonomy

Hyalomma (*Euhyalomma*) *asiaticum* Schulze & Schlottke, 1930

(Figs. 1–9)

Type specimens: the original description was based on male (unquantified) from Bukhara, Uzbekistan (Schulze and Schlottke, 1930). The type specimen (Syntypus; 1 male; Buchara; ZMB 10070) is deposited in the NHMB.

Synonyms (Camicas *et al*. 1998 with corrections): *Hyalomma dromedarii asiaticum* Schulze & Schlottke, 1930; *Hyalomma amurense* Schulze *in* Olenev, 1931; *Hyalomma kozlovi* Olenev, 1931; *Hyalomma asiaticum citripes* Schulze, 1935; *Hyalomma dromedarii citripes* Schulze, 1935 *sensu* Delpy, 1936; *Hyalomma tunesiacum amurense* Schulze *in* Olenev, 1931 *sensu* Schulze *in* Kratz, 1940; *Hyalomma asiaticum caucasicum* Pomerantzev *in* Pomerantzev, Matikashvili &

Lototsky, 1940 syn. nov.; *Hyalomma asiaticum asiaticum* Schulze & Schlottke, 1930 *sensu* Pomerantzev, 1946 syn. nov.; *Hyalomma asiaticum kozlovi* Olenev, 1931 *sensu* Pomerantzev, 1946 syn. nov.; *Hyalomma anatolicum asiaticum* Schulze & Schlottke, 1930 *sensu* Tselishchev, 1950.

The type specimens of *H. kozlovi* (Lectotype, 1 male, China, valley of Toretz, near Sogo Nur Lake, 14-15 March 1908, Mongolian-Sychuan expedition of P.K. Kozlov leg., *И*411; Paralectotypes: 1 female, data the same as for lectotype, *И*411a; 3 males and 4 females, data the same as for lectotype, *И*3810; 4 males and 5 females, lower Etzin Gol River, near Sogo Nur Lake, 24 March – 28 April1926, Mongolian-Sychuan expedition of P.K. Kozlov, N. Przhevalsky leg., *И*4998; 1 female, from journey of P.K. Kozlov from Orok Nur to Khara-Khoto, 7 July 1926, *И*3803; 2 females, China, Alashan, Dyn-yuan-in oasis, June 1908 and 1 female, Alashan Desert, end of September 1901, *И*4997; 1 female, Eastern Tsaidam, April 1900, Tibetan expedition of Kozlov and Koznakov and 1 female, Nan Shan Mountains, July 1879, Przhevalsky leg., *И*3801) are deposited in the ZIN RAS and have been examined by DAA. We consider this taxon a junior synonym, but not a subspecies of *H. asiaticum* (Pomerantzev 1946, 1950; Filippova *et al*. 1995; Camicas *et al*. 1998).

The type specimens of *H. asiaticum caucasicum* (Lectotype, 1 male, Armenia, Arazdayan, sheep, 1932, Transcaucasia expedition leg., *И*413; Paralectotype, 1 female, data the same as for lectotype, *И*413a) are deposited in the ZIN RAS and have been examined by DAA. We also consider this name a junior synonym, but not a subspecies of *H. asiaticum* (Pomerantzev *et al*. 1940; Pomerantzev 1950; Filippova *et al*. 1995; Camicas *et al*. 1998).

Descriptions and illustrations of adults are available in a number of publications and we believe the most useful of these are to be found in Pomerantzev (1950). The larva and nymph are illustrated and described in Apanaskevich (2002).

Description

Male (Figs. 1A–C, 2A–G, 3A–C, 4A)

Conscutum (Fig. 1A–C): length 3.07–6.53 (4.72 ± 0.96, n = 100), width 1.82–4.32 (2.88 ± 0.70, n = 100), ratio length:width 1.48–1.86 (1.65 ± 0.09, n = 100); yellow- to red-brown; pale marbling absent; oval; widest close to mid-length; slight narrowing in region of spiracular plates; cervical grooves very deep, up to 1/2 length of conscutum; marginal grooves short, furrow-like, extending anteriorly to posterior 1/3 of conscutum; posteromedian groove separated from parma by smooth or wart-like surface; paramedian grooves clearly delineated; caudal field well defined, laterally demarcated by moderate ridges; large punctations sparse on lateral, central and caudal fields; medium and small punctations vary in density from practically absent to moderately dense, especially on caudal field; parma normally present; 4 distinct festoons. *Genital structures* (Fig. 2A) as illustrated. *Anal shields* (Fig. 2B): 3 pairs; adanal plates long, narrow, nearly straight, tapering slightly posterior to median projection, lateral margin slightly convex, anteriomedian margin concave, median projection fairly distinct, posteriomedian margin straight; subanal plates variable both in size and shape, usually moderate, suboval and longitudinally aligned. Ventral sclerotized plaque absent on median but present on paramedian festoons. *Spiracular plate* (Fig. 3A–C): dorsal prolongation long and clearly distinct from body of plate; perforated portion of prolongation gently curved throughout its length, moderately broad to very narrow. Circumspiracular setae sparse.

Basis capituli (Fig. 2C, D): without lateral projections; dorsal posterior margin angular, deeply concave; cornua modest. *Palpi* (Fig. 2E): segment I with more than 5 ventromedian setae. *Hypostome* (Fig. 2F): club-shaped; denticulate portion slightly longer than denticle-free portion (small scale-like projections posterior to last large denticle are not considered denticles).

Coxae (Fig. 2G): posteromedian and posterolateral spurs of coxa I long, subequal in length or posterolateral spur longer than posteromedian spur, juxtaposed, tapering to apices; coxae II–III each with distinct, arcuate posterolateral spur, and modest, broadly arcuate, posteromedian spur; lateral and internal spur on coxa IV distinct, triangular. Ivory-coloured enamel band encircles distal portion of each segment of legs; unbroken ivory-coloured strip on dorsal aspect of leg segments (Fig. 4A).

Female (Figs. 4B, 5A–C, 6A–F, 7A, B)

Scutum (Fig. 5A–C): length 1.92–3.17 (2.44 ± 0.24, n = 100), width 1.78–2.88 (2.28 ± 0.23, n = 100), ratio length: width 0.97–1.18 (1.07 ± 0.04, n = 100); yellow- to red-brown; pale marbling absent; nearly as long as broad; posterolateral angles prominent; cervical grooves very deep, extending to posterior margin of scutum; large punctations sparsely distributed on scutum; medium or small punctations vary from practically absent to moderately dense, uniformly covering scutum. *Genital structures* (Fig. 6A): genital aperture narrow, U-shaped; vestibular portion of vagina distinctly bulging; preatrial fold of genital aperture bulging (Fig. 6B). *Spiracular plates* (Fig. 7A, B): perforated portion of dorsal projection gently curved; from moderately broad to very narrow. Circumspiracular setae sparse.

Basis capituli (Fig. 6C, D): dorsolateral projections broad and short, absent ventrally; dorsal posterior margin straight; dorsal cornua inconspicuous. *Palpi* (Fig. 6E): segment I with more than 5 ventromedian setae. *Hypostome* (Fig. 6F): club-shaped; denticulate portion slightly longer than denticle-free portion.

Coxae (Fig. 6G): posteromedian and posterolateral spurs of coxa I long, subequal in length or posterolateral spur longer than posteromedian spur, tapering to apices, juxtaposed, posteromedian spur narrow; coxae II–IV each with distinct, broadly triangular posterolateral spur, with rounded apex; and each with modest, broadly arcuate, posteromedian spur. Coloration of legs similar to that of male (Fig. 4B).

Nymph (Figs. 8A–F)

Scutum (Fig. 8A): length 430–744 (591 ± 50, n = 322), width 483–768 (591 ± 51, n = 333), ratio length: width 0.80–1.13 (1.00 ± 0.05, n = 322), distance between posterior margin of eyes and posterior margin of scutum 163–302 (224 ± 26, n = 332), ratio width: length of posterior portion of scutum 2.07–3.33 (2.65 ± 0.18, n = 332); posterior margin of scutum broadly rounded; slight posterolateral depressions on either side of scutal extremity. *Setae of alloscutum* (Fig. 8B): without denticles, narrowing to rounded apex. *Spiracular plates* (Fig. 8C): irregularly oval; dorsal prolongation distinct, broad, blunt at apex; submarginal row of perforations incomplete.

Basis capituli (Fig. 8D, E): length 268–479 (386 ± 30, n = 307); width 259–390 (326 ± 23, n = 334), ratio length: width 1.02–1.29 (1.19 ± 0.04, n = 306); subhexagonal dorsally. *Palpi* (segment II) (Fig. 8D, E): length 137–228 (186 ± 14, n = 329), width 46–80 (59 ± 5, n = 329), ratio length: width 2.33–3.78 (3.15 ± 0.25, n =

329); palpal segment II proximally narrow, gradually widening distally. *Hypostome* (Fig. 8E): length 134–260 (201 ± 17, n = 298), width 42–84 (60 ± 7, n = 303), ratio length: width 2.48–4.37 (3.33 ± 0.26, n = 293); median file with 6 or 7 large denticles; transition of denticulate portion to denticle-free portion abrupt; denticulate portion nearly as long as denticle-free portion.

Coxae (Fig. 8F): coxa I with long, narrow, subtriangular spurs nearly equal in length; coxae II–IV each with moderate spur, spurs conspicuously decreasing in size from coxae II to IV; coxal pore present.

Larva (Figs. 9A–D)

Scutum (Fig. 9A): length 211–291 (244 ± 15, n = 554), width 331–462 (389 ± 23, n = 558), ratio length: width 0.53–0.71 (0.63 ± 0.02, n = 553), distance from posterior margin of eyes to posterior margin of scutum 40–80 (58 ± 7, n = 555), ratio width: length of posterior portion 5.29–9.14 (6.79 ± 0.62, n = 554). Portion of scutum posterior to eyes equal to 1/4–1/5 of scutal length; posterior margin of scutum broadly rounded; posterolateral depressions slight or indistinct.

Basis capituli (Figs. 9B, C): width 129–176 (154 ± 8, n = 567); subhexagonal dorsally; apex of dorsolateral projections directed slightly anteriorly; dorsolateral projections distinct and acute from ventral aspect. *Palpi* (segments II and III) (Fig. 9B, C): length 91–120 (103 ± 5, n = 562), width 36–48 (41 ± 2, n = 558), ratio length: width 2.19–2.86 (2.51 ± 0.11, n = 557); without ventral spur on palpal segment III. *Hypostome* (Fig. 9C): length 70–98 (84 ± 5, n = 525), width 20–29 (25 ± 2, n = 532), ratio length: width 2.89–4.00 (3.42 ± 0.19, n = 524); median file with 4 or 5 large denticles; transition of denticulate portion to denticle-free portion abrupt; denticulate portion approximately 1/2 of hypostome length.

Coxae (Figs. 9D): coxa I with small, subtriangular spur, with tapering apex directed posteriorly or medially coxae II–III each with small, arcuate or triangular spur. *Genu I*: length 137–176 (155 ± 8, n = 548), width 41–52 (46 ± 2, n = 367), ratio length: width 2.78–3.93 (3.35 ± 0.18, n = 367).

Variability

Adults of *H. asiaticum* exhibit great variability throughout its geographical range. This variability is reflected nomenclatorially in the recognition of three subspecies: *H. asiaticum caucasicum* in the western part, *H. asiaticum asiaticum* in the central part and *H. asiaticum kozlovi* in the eastern part of its geographical range (Filippova *et al*. 1995). The main criteria for discriminating between these subspecies have been characters of the adults: total size, punctation pattern of conscutum or scutum, length and breadth of dorsal prolongation of the spiracular plates, and size of the pulvilli. We agree that in certain populations a pattern of common character states is present. Thus, many specimens in western populations of *H. asiaticum* are small, densely punctate and have a broad and short dorsal spiracular prolongation, while specimens from eastern populations are mainly characterized by their very large size. Nevertheless, after examination of numerous specimens of *H. asiaticum* from throughout its geographical range we are of the opinion that the above mentioned characters, which have been considered as diagnostic for the subspecies, are variable even within these subspecies and cannot satisfactorily be utilized for identification. Furthermore, we have discovered numerous populations between the so-called subspecies with intermediate characters. Consequently we are unable to compile a diagnosis for *H. asiaticum kozlovi* or *H. asiaticum caucasicum* that will clearly define these taxa. We have therefore decided to synonymise *H. asiaticum*

kozlovi and *H. asiaticum caucasicum* with *H. asiaticum*. This should eliminate the constant confusion associated with their identification. The differences between the subspecies of the immature stages are all metric and not morphological (Filippova *et al*. 1995), and illustrate the variability within the species rather than discriminating between the taxa.

Related species

Based on its morphology, we provisionally consider that *H*. *asiaticum* belongs to the *H*. (*Euhyalomma*) *asiaticum* group of species. The other species in this group are *H*. (*E.*) *dromedarii* Koch, 1844; *H*. (*E.*) *impeltatum* Schulze & Schlottke, 1930; *H*. (*E.*) *schulzei* Olenev, 1931; and *H*. (*E.*) *somalicum* Tonelli Rondelli, 1935 (Apanaskevich *et al*. 2008; Apanaskevich & Horak 2009).

Males of *H*. *asiaticum* can be distinguished from those of other species in the group by a combination of the following characters: rounded posterior margin of conscutum (only slightly convex in *H. somalicum*), paramedian festoons not protruding beyond the posterior conscutal margin (protrude in *H. schulzei*), very deep and long cervical grooves (shallow or moderately deep and shorter in *H. impeltatum* and *H. somalicum*), posteromedian groove does not reach parma (reaches it in *H. dromedarii*), straight adanal plates (strongly curved in *H. dromedarii*, slightly curved in *H. impeltatum*, *H. schulzei* and *H. somalicum*), subanal plates generally moderate in size (normally very large in *H. dromedarii*), ventral sclerotized plates absent only on median festoon (absent on median, paramedian and 4th festoons in *H. impeltatum*, present on all festoons in *H. somalicum*), long dorsal prolongation of spiracular plates (very short in *H. schulzei*), dorsal posterior margin of basis capituli deeply concave and angular (slightly concave in *H. impeltatum*), proximally leg

segments with unbroken dorsal ivory-coloured enamel strip (with small spot in *H. somalicum*). Females of *H*. *asiaticum* can be distinguished from those of other species of the group by a combination of the following characters: very deep cervical grooves (moderately deep in *H. impeltatum* and *H. somalicum*); narrow U-shaped genital operculum (very wide U-shape in *H. schulzei*; narrow V-shaped in *H. dromedarii* and *H. somalicum*); preatrial fold of genital operculum bulging (flat in *H. dromedarii* and *H. somalicum*); posteromedian spur of coxa I relatively narrow, with tapering apex (relatively broad and blunt in *H. dromedarii* and *H. schulzei*); proximally leg segments with unbroken dorsal ivory-coloured enamel strip (small spot in *H. somalicum*). Nymphs of *H*. *asiaticum* can be distinguished from those of other species in the *H*. *asiaticum* group by a combination of the following characters: posterior margin of scutum with very slight posterolateral depressions on either side of its extremity (moderate posterolateral depressions in *H. dromedarii*, *H. schulzei* and *H. somalicum*); spiracular plates with short and narrow dorsal prolongation (longer and broader prolongation in *H. dromedarii*); submarginal row of perforations on spiracular plate incomplete (complete in *H. dromedarii*); presence of coxal pore (absent in *H. dromedarii* and *H. schulzei*); measurements and their ratios (see Apanaskevich *et al*. 2008 for *H. dromedarii* and *H. schulzei*, Apanaskevich & Horak 2009 for *H. impeltatum* and *H. somalicum*). Larvae of *H*. *asiaticum* can be distinguished from those of other species in the *H*. *asiaticum* group by a combination of the following characters: portion of scutum posterior to eyes 1/4–1/5 of scutal length (1/3.7 in *H. somalicum*); absence of spur on palpal segment III ventrally (present in *H. impeltatum*); small triangular tapering spur on coxa I directed posteriorly or medially (larger spur directed laterally in *H. schulzei* and *H. somalicum*, larger spur in *H. dromedarii* and *H. impeltatum*); measurements and their ratios (see

Apanaskevich *et al*. 2008 for *H. dromedarii* and *H. schulzei*, Apanaskevich & Horak 2009 for *H. impeltatum* and *H. somalicum*).

Hosts. *Hyalomma asiaticum* is a three-host species (Pomerantzev 1950).

The main hosts of the adults are large and medium-sized ungulates. Among these the adults clearly prefer camels and sheep. Smaller mammals (carnivores, leporids, rodents and hedgehogs), humans and birds are apparently secondary or occasional hosts of the adults The chief hosts of the immature stages are smaller mammals (rodents, leporids, hedgehogs and shrews), while carnivores, birds and reptiles are seemingly secondary or occasional hosts (Pomerantzev 1950; Berdyev 1980; Filippova *et al*. 1995).

The list of host species for *H. asiaticum* is very extensive. We have identified adults of *H. asiaticum* from the following hosts: domestic buffaloes, Bactrian camels, one-humped camels, cattle, donkeys, goats, horses, pigs, sheep, humans, wild goat *Capra aegagrus* Erxleben, onager *Equus hemionus* Pallas, goitered gazelle *Gazella subgutturosa* (Güldenstädt), argali *Ovis ammon* (Linnaeus), urial *Ovis orientalis* (Linnaeus), saiga *Saiga tatarica* (Linnaeus), wild boar *Sus scrofa* Linnaeus, long-eared hedgehog *Hemiechinus auritus* (Gmelin), Brandt's hedgehog *Paraechinus hypomelas* (Brandt), tolai hare *Lepus tolai* Pallas, Eurasian eagle-owl *Bubo bubo* (Linnaeus) and rock pigeon *Columba livia* Gmelin.

We have identified immature stages of *H. asiaticum* collected from the following host species: tundra shrew *Sorex tundrensis* Merriam, long-eared hedgehog *H. auritus*, Brandt's hedgehog *P. hypomelas*, Gobi jerboa *Allactaga bullata* Allen, small five-toed jerboa *Allactaga elater* (Lichtenstein), hairy-footed jerboa *Dipus sagitta* (Pallas), long-eared jerboa *Euchoreutes naso* Sclater, dwarf fat-tailed jerboa

Pygeretmus pumilio (Kerr), short-tailed bandicoot rat *Nesokia indica* (Gray), Libyan jird *Meriones libycus* Lichtenstein, mid-day jird *Meriones meridianus* (Pallas), Persian jird *Meriones persicus* (Blanford), Vinogradov's jird *Meriones vinogradovi* Heptner, house mouse *Mus musculus* Linnaeus, desert hamster *Phodopus roborovskii* (Satunin), grey dwarf hamster *Cricetulus migratorius* (Pallas), great gerbil *Rhombomys opimus* (Lichtenstein), long-clawed ground squirrel *Spermophilopsis leptodactylus* (Lichtenstein), yellow ground squirrel *Spermophilus fulvus* (Lichtenstein), long-tailed ground squirrel *Spermophilus undulatus* (Pallas), Afghan pika *Ochotona rufescens* (Gray), tolai hare *L. tolai*, red fox *Vulpes vulpes* (Linnaeus), long-legged buzzard *Buteo rufinus* (Cretzschmar) and Przewalski's wonder gecko *Teratoscincus przewalskii* Strauch.

Geographic distribution. The recorded distribution of *H. asiaticum* is confined to the Palearctic zoogeographic region. *Asia*: Afghanistan, Armenia, Azerbaijan, China, Georgia, Iran, Iraq, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia (Dagestan), Syria, Tajikistan, Turkey, Turkmenistan and Uzbekistan (our data; Kolonin 1983; Filippova *et al*. 1995).

Disease relationships. Crimean-Congo haemorrhagic fever, Tamdy and Wad Medani viruses have been isolated from *H. asiaticum*. It can also transmit the pathogens causing Q-fever, Siberian tick typhus, theilerioses and anaplasmosis (Hoogstraal 1979; Filippova *et al*. 1995).

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Fig. 1. *Hyalomma asiaticum*, male, conscutum (A, B, C – showing variations). Scale bar = 1 mm. All setae are omitted.

Fig. 2. *Hyalomma asiaticum*, male. A – genital structures; B – anal plates; C – gnathosoma dorsally; D – gnathosoma ventrally; E – palp ventrally; F – hypostome; G – coxae. Scale bars: A = 200 μm; B, C, D, G = 500 μm; E, F = 400 μm. All setae are omitted except illustration E where only setae of palpal segment IV are omitted.

Fig. 3. *Hyalomma asiaticum*, male, spiracular plate (A, B, C – showing variations; a – anterior, d – dorsal). Scale bar = 400 μm.

Fig. 4. *Hyalomma asiaticum*, genu IV. A – male: i – lateral view, ii – dorsal view, iii – medial view; B – female: i – lateral view, ii – dorsal view, iii – medial view. Scale bar = 1 mm. All setae are omitted.

Fig. 5. *Hyalomma asiaticum*, female, scutum (A, B, C – showing variations). Scale bar = 1 mm. All setae are omitted.

Fig. 6. *Hyalomma asiaticum*, female. A – genital structures; B – longitudinal section through preatrial fold of schematic genital aperture (a – anterior, p – posterior); C – gnathosoma dorsally; D – gnathosoma ventrally; E – palp ventrally; F – hypostome; G – coxae. Scale bars: A = 200 μm; E, F = 400 μm; C, D, G = 500 μm. All setae are omitted except illustration E where only setae of palpal segment IV are omitted.

Fig. 7. *Hyalomma asiaticum*, female, spiracular plate (A, B – showing variations; a – anterior, d – dorsal). Scale bar = 400 μm.

Fig. 8. *Hyalomma asiaticum*, nymph. A – scutum; B – seta of alloscutum; C – spiracular plate (a – anterior, d – dorsal); D – gnathosoma dorsally; E – gnathosoma ventrally; F – coxae. A = 400 μm; B, C = 50 μm; D, E, F = 200 μm. All setae are omitted except illustrations D and E where only setae of palpal segment IV are omitted.

Fig. 9. *Hyalomma asiaticum*, larva. A – scutum; B – gnathosoma dorsally; C – gnathosoma ventrally; D – coxae. Scale bars: A = 150 μm; B, C, D = 100 μm. All setae are omitted except illustrations B and C where only setae of palpal segment IV are omitted.

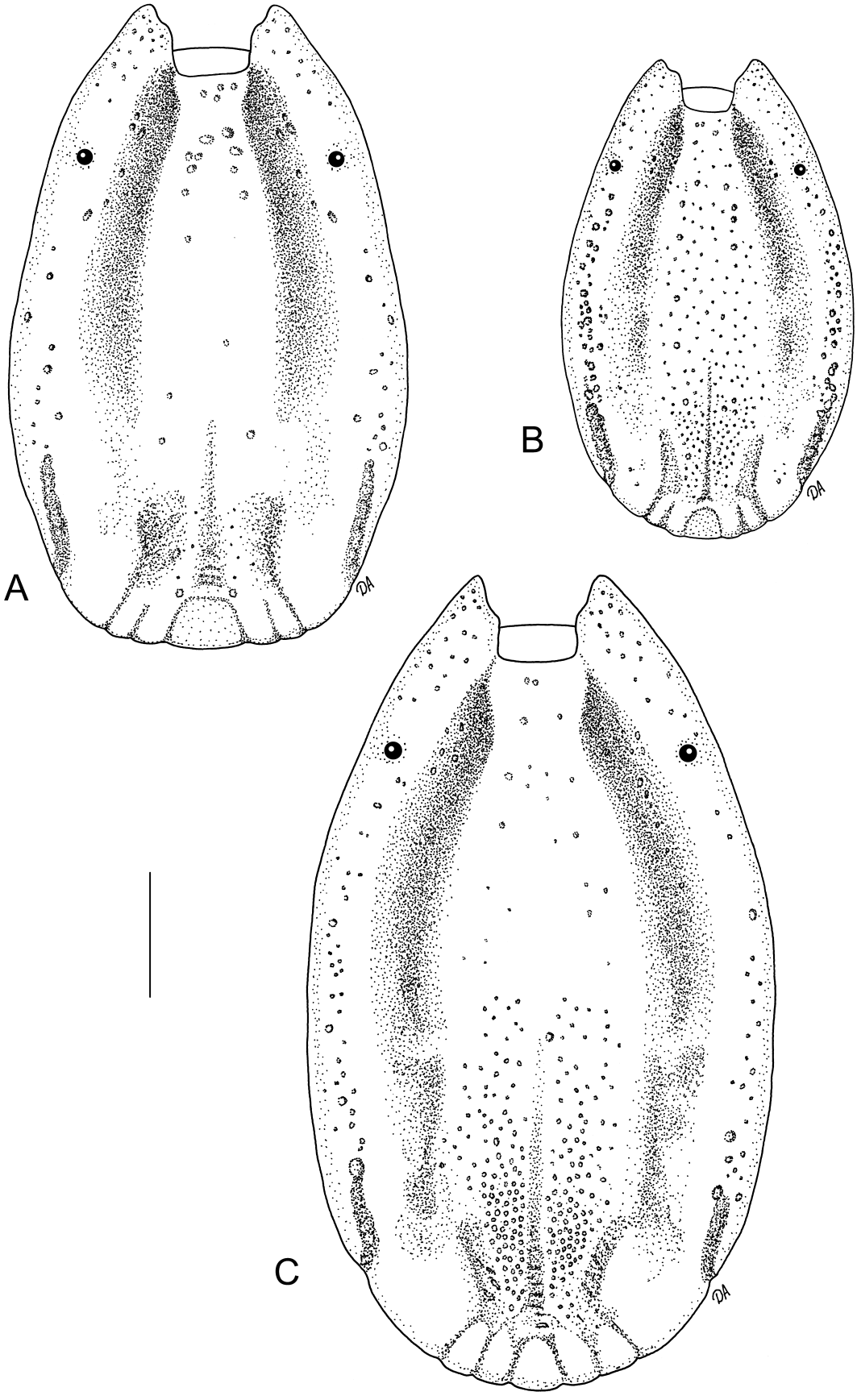

Fig. 1

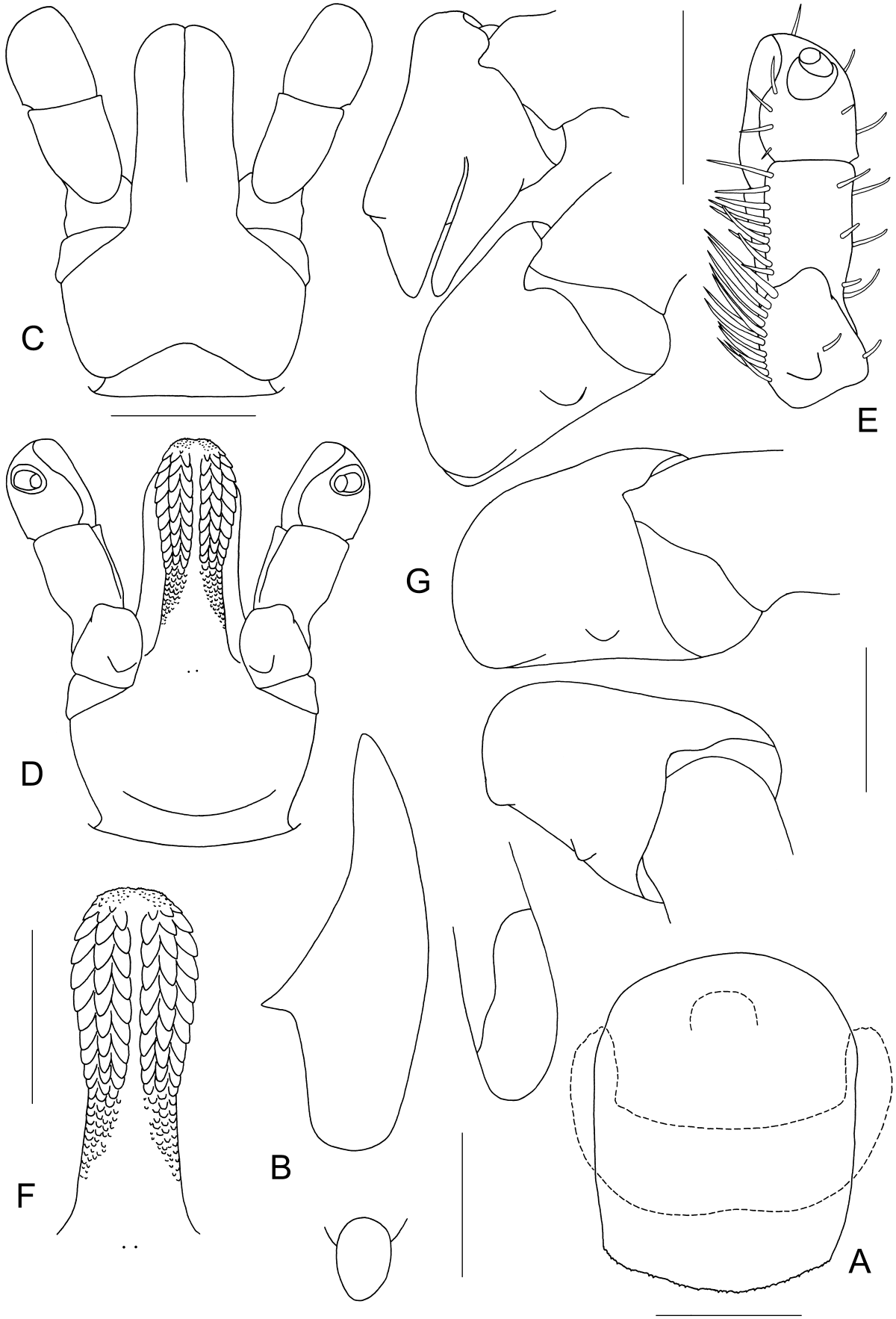

Fig. 2

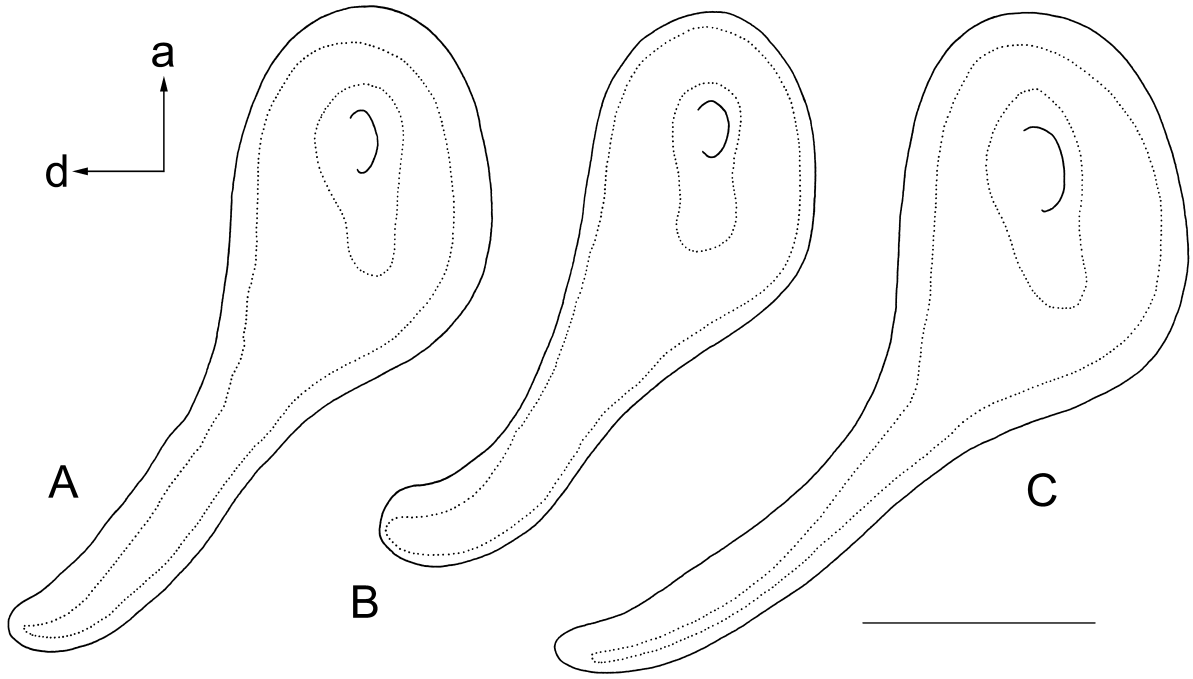

Fig. 3

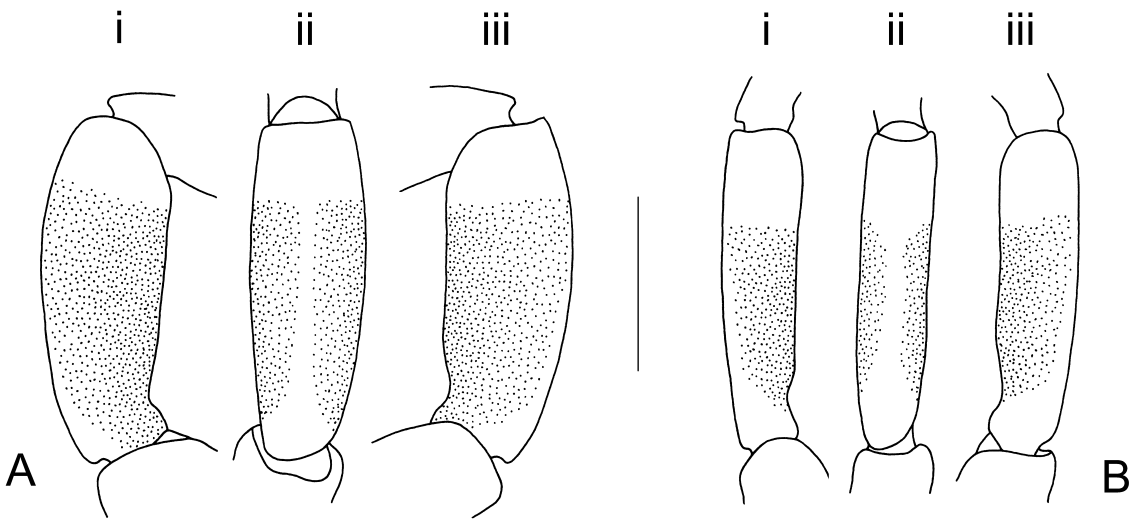

Fig. 4

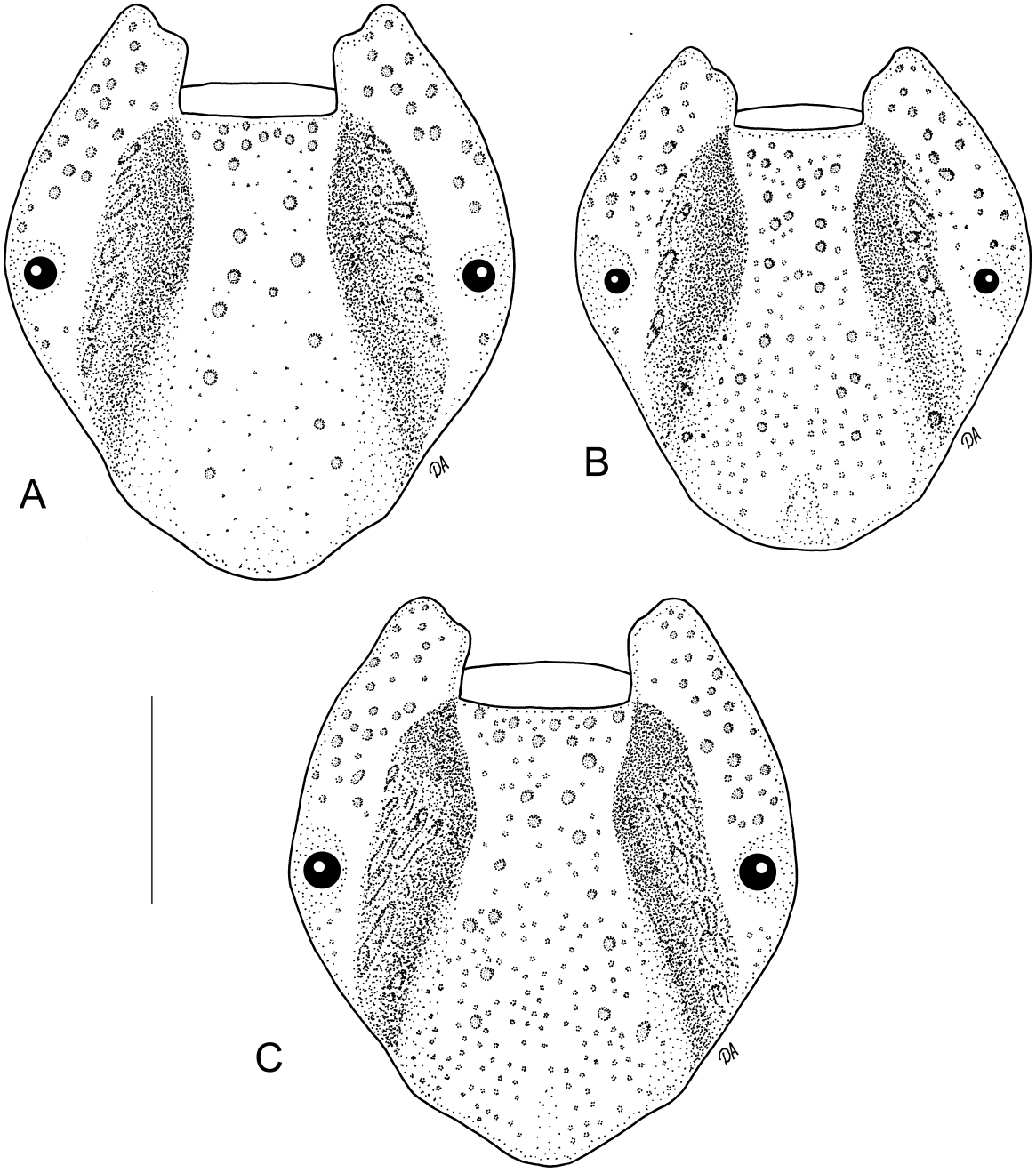

Fig. 5

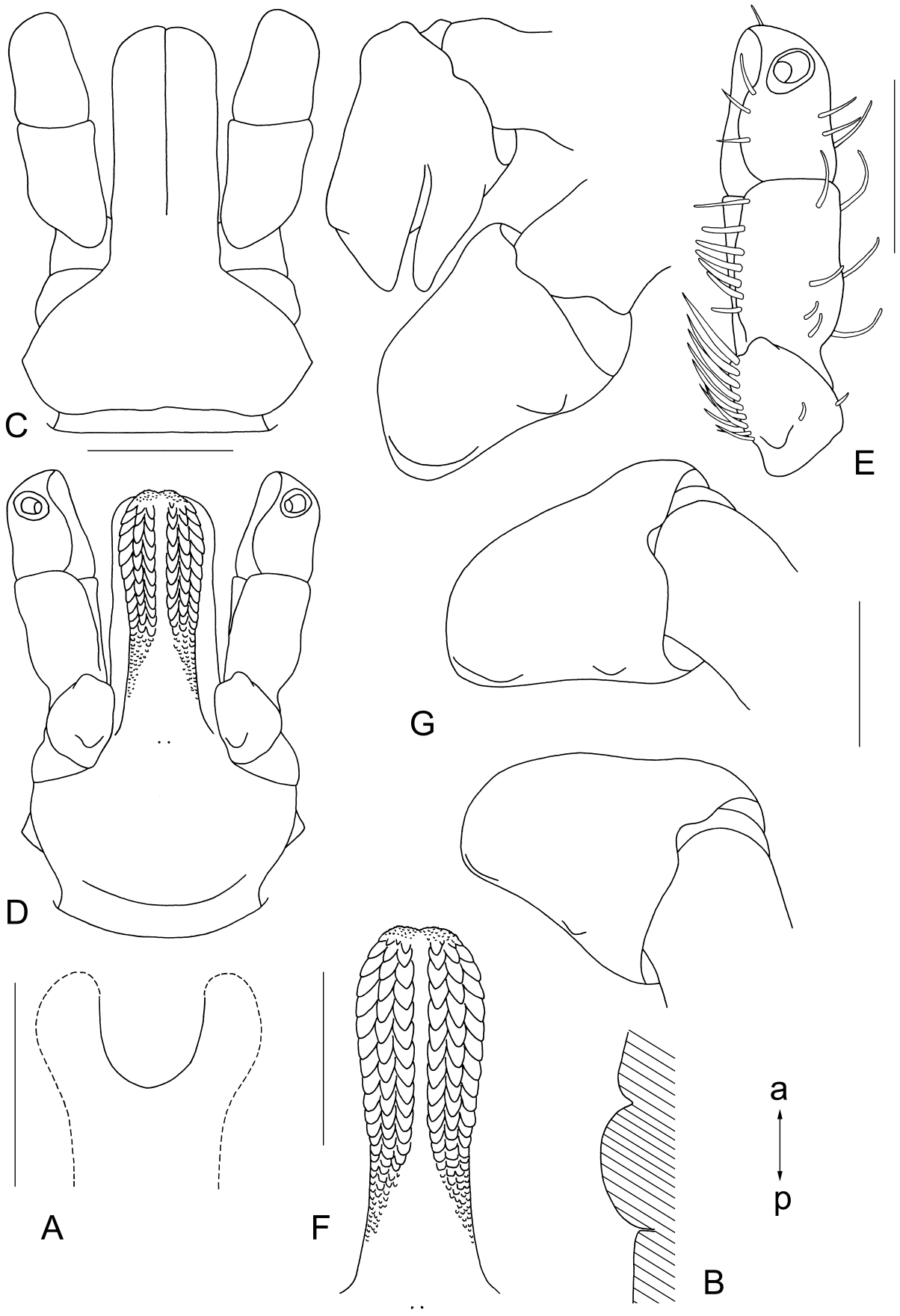

Fig. 6

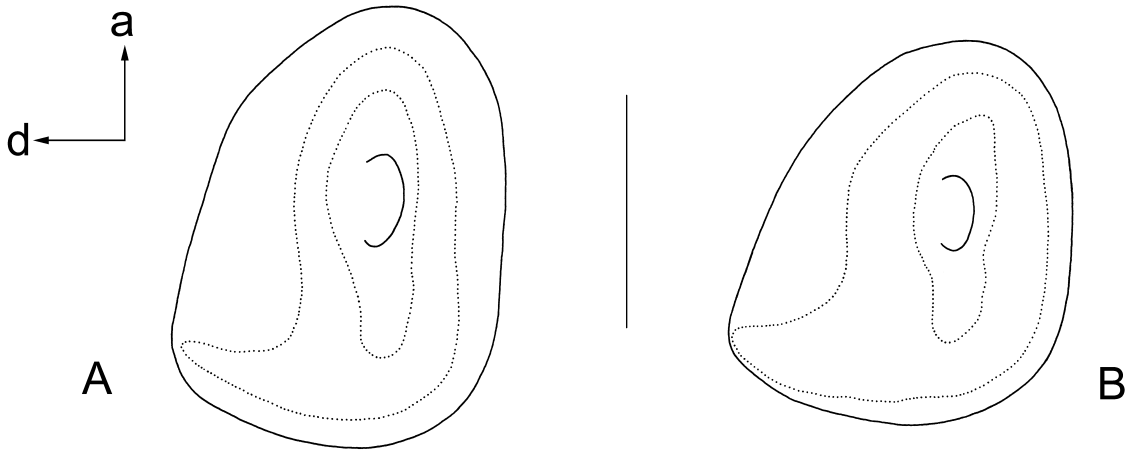

Fig. 7

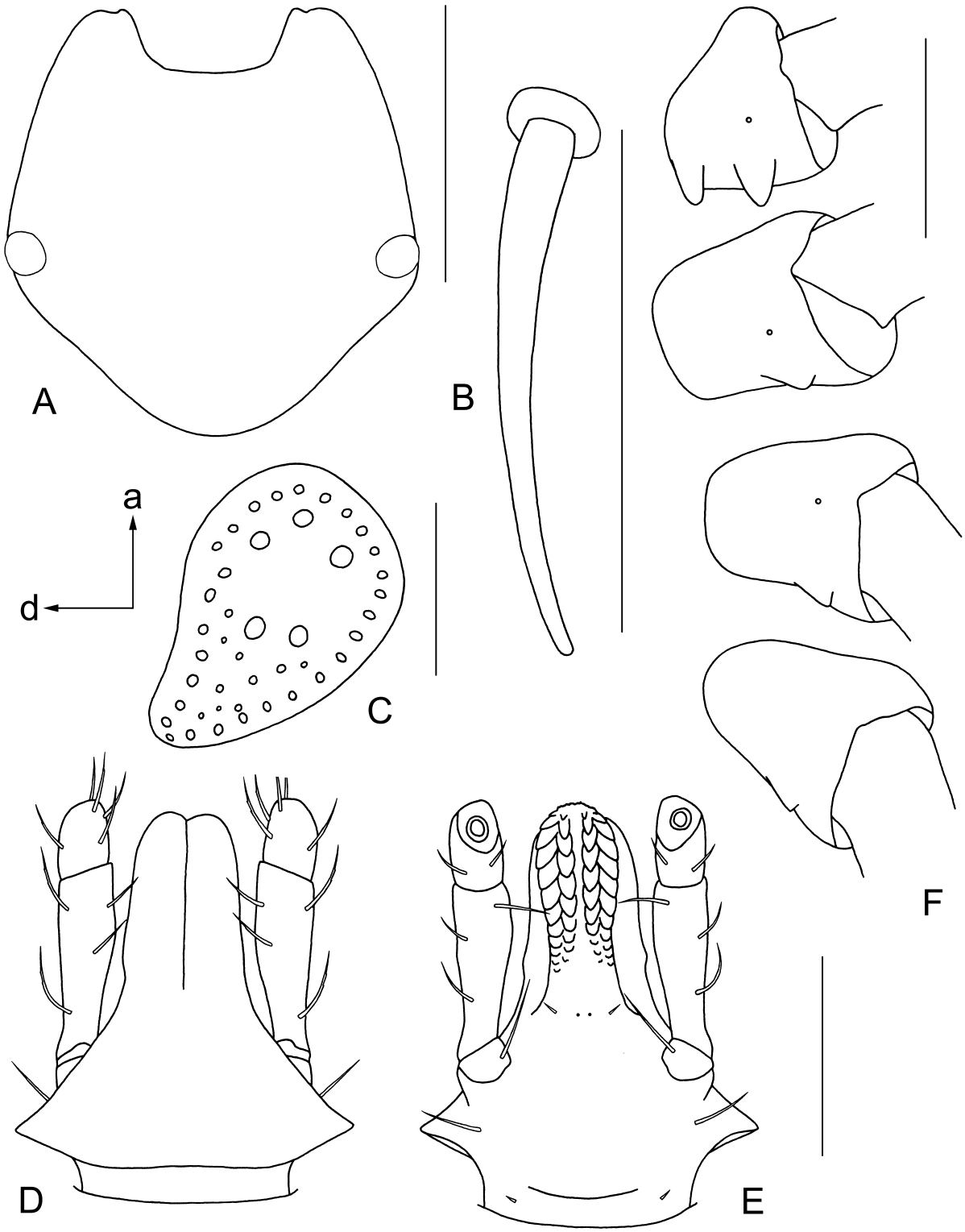

Fig. 8

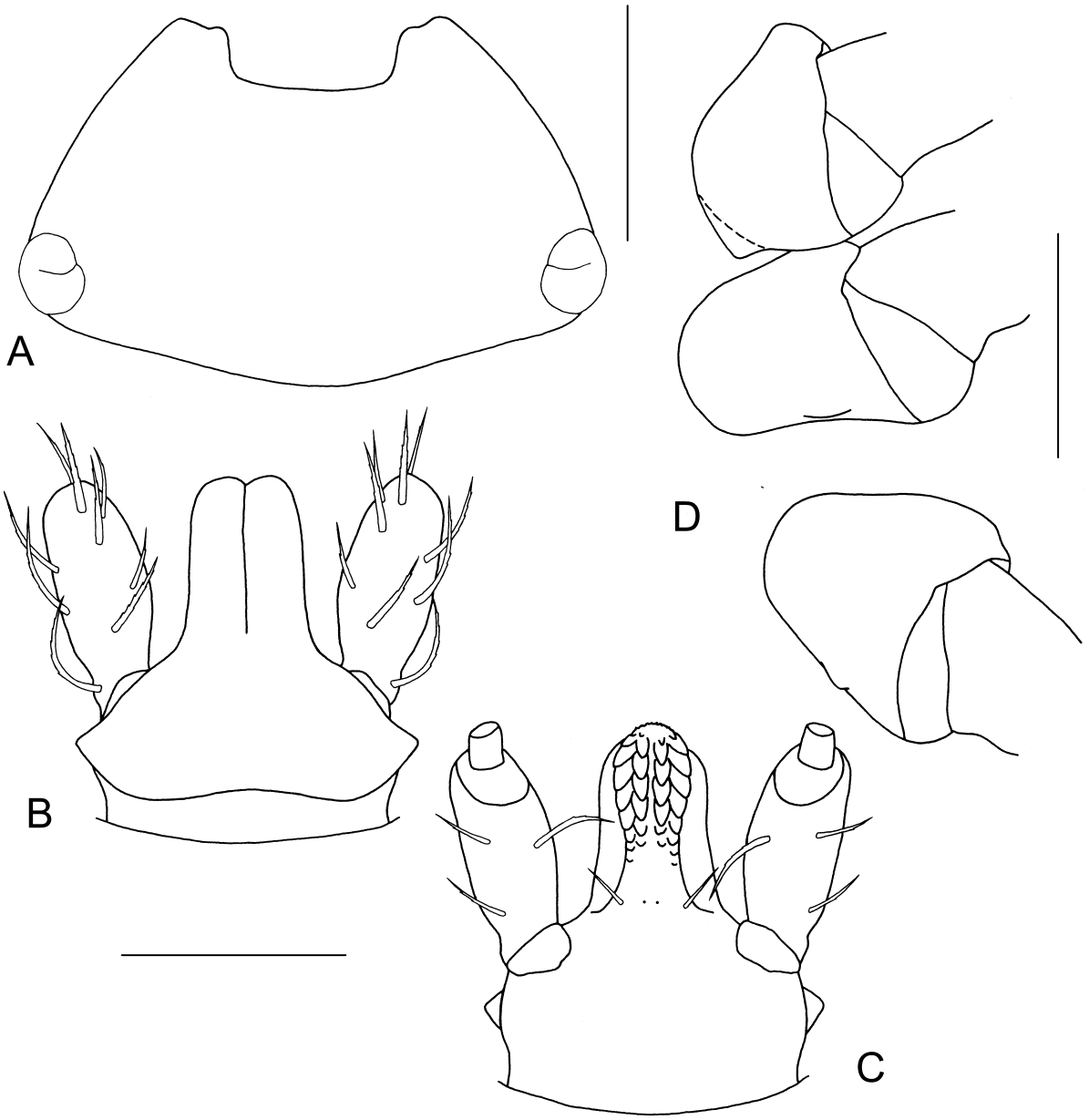

Fig. 9