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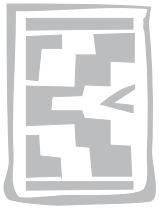

Redescription of *Haemaphysalis* (*Rhipistoma*) *elliptica* (Koch, 1844), an old taxon of the *Haemaphysalis* (*Rhipistoma*) *leachi* group from East and southern Africa, and of *Haemaphysalis* (*Rhipistoma*) *leachi* (Audouin, 1826) (Ixodida, Ixodidae)

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ABSTRACT

APANASKEVICH, D.A., HORAK, I.G. & CAMICAS, J-L. 2007. Redescription of *Haemaphysalis* (*Rhipistoma*) *elliptica* (Koch, 1844), an old taxon of the *Haemaphysalis* (*Rhipistoma*) *leachi* group from East and southern Africa, and of *Haemaphysalis* (*Rhipistoma*) *leachi* (Audouin, 1826) (Ixodida, Ixodidae). *Onderstepoort Journal of Veterinary Research*, 74:181–208

Koch (1844) originally described only the male of *Haemaphysalis* (*Rhipistoma*) *elliptica* (Koch, 1844), which he named *Rhipistoma ellipticum*. For the past century, however, this name has been considered a junior synonym of *Haemaphysalis* (*Rhipistoma*) *leachi* (Audouin, 1826), or a *nomen nudum*. We redescribe here the male and larva of *H.* (*R.*) *elliptica* and describe the female and nymph for the first time. Our redescription is based on the male holotype, plus numerous specimens from southern and East Africa. The adults of this tick parasitize domestic and wild carnivores, and the immature stages infest rodents in these regions. For comparative purposes redescriptions of all parasitic stages of *H.* (*R.*) *leachi* are provided. It parasitizes the same hosts as *H.* (*R.*) *elliptica* in Egypt, and in northeastern, Central, West and East Africa.

Keywords: Descriptions, geographic distribution, *Haemaphysalis (Rhipistoma) elliptica, Haemaphysalis (Rhipistoma) leachi*, hosts

INTRODUCTION

For those involved in their identification, the systematics of the African *Haemaphysalis* (*Rhipistoma*) *leachi* group of ticks has been fraught with problems. Before the studies of Hoogstraal and Camicas practically all ticks in the group were considered to belong to a single species, namely *Haemaphysalis* (*Rhipistoma*) *leachi* (Audouin, 1826). However, a redescription of an Egyptian population of *H.* (*R.*) *leachi* by Hoogstraal (1958), and his designation of a neotype, stimulated taxonomic studies of ticks belonging to this cluster of species. During the 1970s and 1980s Camicas and Hoogstraal and their co-workers elucidated taxonomic problems associated with this group and described or re-established a number

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of species. Hoogstraal & Kim (1985) consolidated the accumulated data on *Haemaphysalis* Koch, 1844 and on the subgenus *Rhipistoma* Koch, 1844 as well as on the *H.* (*R.*) *leachi* group. They placed these ticks in three subgroups, namely *H.* (*R.*) *leachi*, *Haemaphysalis* (*Rhipistoma*) *pedetes* and *Haemaphysalis* (*Rhipistoma*) *spinulosa*. Camicas, Hervy, Adam & Morel (1998) concurred with this decision and updated the species composition of the three subgroups. The *H.* (*R.*) *leachi* subgroup now consisted of five species, namely *H.* (*R.*) *elliptica* (Koch, 1844), *H.* (*R.*) *leachi* (Audouin, 1826), *Haemaphysalis* (*Rhipistoma*) *moreli* Camicas, Hoogstraal & El Kammah, 1972, *Haemaphysalis* (*Rhipistoma*) *paraleachi* Camicas, Hoogstraal & El Kammah, 1983, and *Haemaphysalis* (*Rhipistoma*) *punctaleachi* Camicas, Hoogstraal & El Kammah, 1973. The *H.* (*R.*) *pedetes* subgroup contained two species, viz. *H.* (*R.*) *pedetes* Hoogstraal, 1972 and *Haemaphysalis* (*Rhipistoma*) *zumpti* Hoogstraal & El Kammah, 1974, while the *H.* (*R.*) *spinulosa* subgroup incorporated four species, namely *Haemaphysalis* (*Rhipistoma*) *muhsamae* Santos Dias, 1954, *Haemaphysalis* (*Rhipistoma*) *norvali* Hoogstraal & Wassef, 1983, *H.* (*R.*) *spinulosa* Neumann, 1906 and *Haemaphysalis* (*Rhipistoma*) *subterra* Hoogstraal, El Kammah & Camicas, 1992.

There are only two synonyms for species within the *H.* (*R.*) *leachi* group, and these are *Haemaphysalis leachi* var. *humerosoides* Theiler, 1943, that has been synonymized with *H.* (*R.*) *leachi*, and *Haemaphysalis ethiopica* Santos Dias, 1958, that has been synonymized with *H.* (*R.*) *spinulosa*. Camicas *et al*. (1998), in their review of the ticks of the world, created two problems within the taxonomy of the *H.* (*R.*) *leachi* group by re-establishing two names, namely *H.* (*R.*) *elliptica* and *H.* (*R.*) *muhsamae*. The present paper addresses the taxonomic status of *H.* (*R.*) *elliptica*, while that of *H.* (*R.*) *muhsamae*, which for several decades has been considered a junior synonym of *H.* (*R.*) *spinulosa*, will be tackled in a future communication.

Koch (1844) originally described *Haemaphysalis* (*Rhipistoma*) *elliptica* (Koch, 1844) as *Rhipistoma ellipticum*. Neumann (1897) placed this species in the genus *Haemaphysalis* Koch, 1844 and synonymized it with *H.* (*R.*) *leachi* (Audouin, 1826). Thereafter the majority of tick taxonomists considered *H.* (*R.*) *elliptica* to be a junior synonym of *H.* (*R.*) *leachi*, or a *nomen nudum* (Nuttall & Warburton 1915; Camicas *et al*. 1972). Little more than a century later Camicas *et al*. (1998) re-established this taxon, but gave no reasons for their decision, thus begging the question, is *H.* (*R.*) *elliptica* a valid taxon or not?

After an exhaustive study of many collections of *Haemaphysalis* that had been identified as *H.* (*R.*) *leachi*, and a comparison of these ticks with true *H.* (*R.*) *leachi* from North Africa and with the holotype specimen of *H.* (*R.*) *elliptica*, we concluded that many of the southern and East African ticks previously identified as *H.* (*R.*) *leachi* are actually *H.* (*R.*) *elliptica*. Furthermore, these studies enabled us to delimit the geographic distributions of both ticks. We here redescribe the male [the first description is given by Koch (1844), under the name *Rhipistoma ellipticum*], and the larva [the first description is given by Bedford (1934), under the name *Haemaphysalis leachi*], and describe the female and nymph of *H.* (*R.*) *elliptica* for the first time. For comparative purposes we have also redescribed all stages of development of *H.* (*R.*) *leachi*.

MATERIAL EXAMINED

The material examined is summarized in Tables 1, 2 and 3. Specimens from South Africa and Mozambique were studied by IGH, or by IGH and DAA, and the remainder were examined by DAA. Because of difficulties experienced in the identification of specimens we used the following material for the present study:

(i) All primary identifications have been based on males.

(ii) With the exception of collections from Egypt and South Africa, collections containing only females have been excluded.

(iii) Females in collections containing males of two or more species have been excluded.

(iv) The immature stages that we have studied come only from laboratory-reared specimens from allopatric localities within the distribution ranges of the two ticks, namely South Africa for *H.* (*R.*) *elliptica*, and Egypt and the Central African Republic for *H.* (*R.*) *leachi*.

The records of JLC have not been included because they need to be rechecked in relation to the new characters that we have found.

The descriptions of the adults of various *Haemaphysalis* species by Hoogstraal and his co-authors are characterized by the use of proportions between measurements of particular structures, mainly those of the gnathosoma. However, we could not find any exact description of the scheme of measurements taken by Hoogstraal and his co-workers, who gave only brief explanations in the texts. The exact features or structures between which some of the meas-

urements were made are for the most part quite easily recognizable, but for several they are not. Consequently, we have taken those measurements that we consider are the most suitable for describing the species. Except for the measurements for which an explanation is given in the text, a scheme of the measurements that we have taken is illustrated in Fig. 1.

Because the larva and nymph have sometimes been inadequately described or not described at all, our set of measurements for them does not differ substantially from that used for these stages of development of previously described species. For the adults we tried to follow Hoogstraal's format so that our measurements would at least approximate those that had been used before.

Measurements for the male conscutum and female scutum and their total lengths are given in millimetres (mm), and those for the immature stages in micrometres (µm). The measurements are arranged as follows: minimum – maximum (average ± standard deviation, *n* = number of specimens measured).

When measuring the dorsal and ventral spurs on palpal segments II and III, it must be noted that they are not in the same plane as the gnathosoma as they are directed either dorsally or ventrally. Con-

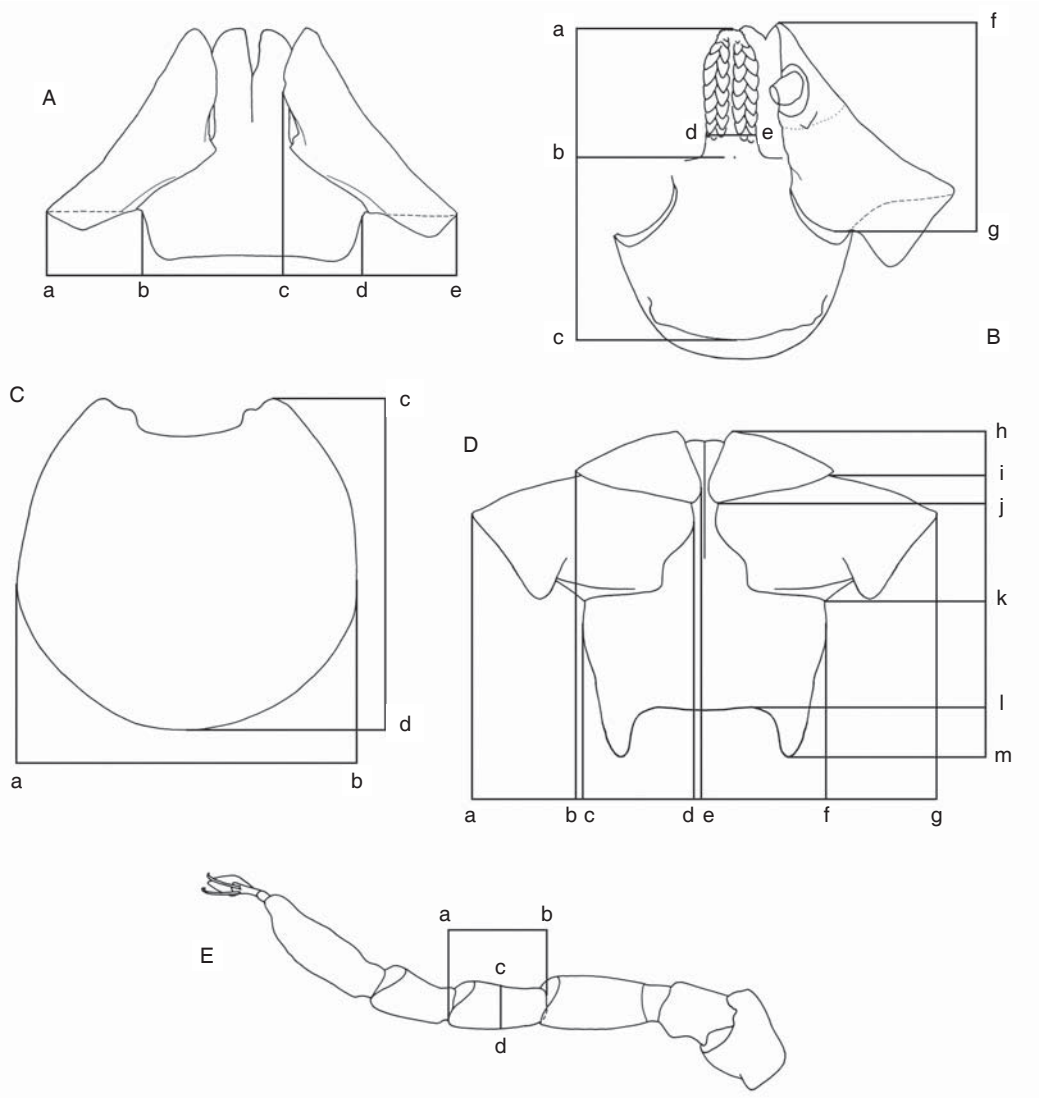

FIG. 1 Scheme of measurements for *Haemaphysalis*. A, nymph, gnathosoma dorsally: a-e—combined palpal width, b-d – width of basis capituli, c-e – width of palp; B, nymph, gnathosoma ventrally: a-b – length of hypostome, a-c – length of gnathosoma, d-e – width of hypostome, f-g – length of palp; C, nymph, scutum: a-b – width, c-d – length; D, male, gnathosoma dorsally: a-d – width of palpal segment II, a-g – combined palpal width, b-e – width of palpal segment III, c-f – width of basis capituli, h-j – length of palpal segment III, i-k – length of palpal segment II, k-m – length of basis capituli, l-m – length of dorsal cornua; E, nymph, leg I: a-b – length of genu, c-d – width of genu

sequently, the shape and the length of these spurs vary according to the plane along which they are observed. DAA's illustrations of the gnathosoma of the larvae and nymphs are based on slide-mounted specimens, but because of the differences in planes even in these preparations, the spurs on the palpal segments are in reality longer than illustrated. This observation has been verified by scanning electron microscopy. Furthermore, in order to simplify identification for persons who may in future examine these species we have attempted to use a minimum of poorly defined diagnostic characters.

Haemaphysalis (*Rhipistoma*) *elliptica* (Koch, 1844)

THE SOUTH AFRICAN CARNIVORE HAEMAPHYSALID
(Fig. 2–7)

Synonym

Haemaphysalis leachi humerosoides Theiler, 1943 *sensu* Theiler, 1943.

The collection lot (no. 2754), identified as *Haemaphysalis leachi* var. *humerosoides* by G. Theiler, contains nine vials. In the catalogue listing the specimens in the Onderstepoort Veterinary Institute tick collection the first vial (i) is marked as "Type": i (13 ♂, 17 ♀) – Bilene, Macia [Mozambique], 25.V.1940, PEAf Collection, XIII, Banino. According to its label, the second vial may also contain specimens of the original type series: ii (10 ♂, 15 ♀) – Angonia, Massoane [Mozambique], 12.VII.1940, PEAf Collection, XXV, Banino. DAA and IGH have identified all the specimens in these vials as *H.* (*R.*) *elliptica*. The other vials contain various ticks of the *H. leachi* group as well as *Rhipicephalus* Koch, 1844 collected from localities in Africa at a later stage.

Holotype

Male, Cape of Good Hope (Western Cape Province, South Africa), deposited in the Natural History Museum of Berlin, Berlin, Germany; collection no. ZMB 1099. This specimen has been examined by all of us and studied by DAA and JLC.

DESCRIPTION AND REDESCRIPTION

Male (Fig. 2A–C, 3A–F)

Length from palpal apices to posterior margin of conscutum 2.41–3.54 (3.00 ± 0.19, *n* = 323); *breadth* of conscutum (at widest point) 1.19–1.75 (1.47 ± 0.10, *n* = 322); ratio 1.78–2.32 (2.05 ± 0.10, *n* = 319). *Colour* reddish brown.

Conscutum (Fig. 2A–C): *ca* 1.9 times as long as broad; margins slightly convex, broadest at level of

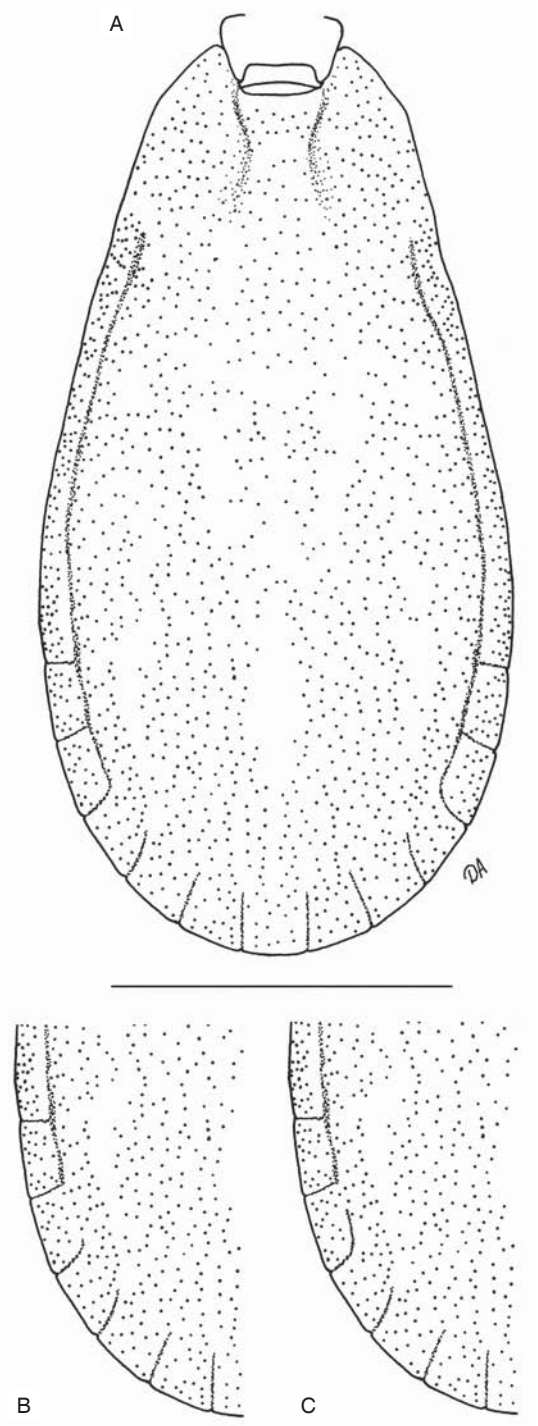

FIG. 2 *Haemaphysalis elliptica*, male, A, conscutum. Bar = 1 mm; B, C, left posterior half of conscutum . Bar = 1 mm. All setation is omitted

spiracular plates, smoothly rounded posteriorly. *Cervical pits* narrow, deep, converging. *Cervical grooves* indistinct, short, shallow, diverging. *Lateral grooves* deep, distinct, extend to anterior 1/4 of scutal length; enclose first or first and second festoons. *Punctations* dense, medium-sized, discrete, relatively deep. *Festoons* number 11. *Genital structures* (Fig. 3A): as illustrated. *Spiracular plates* (Fig. 3B): variable in

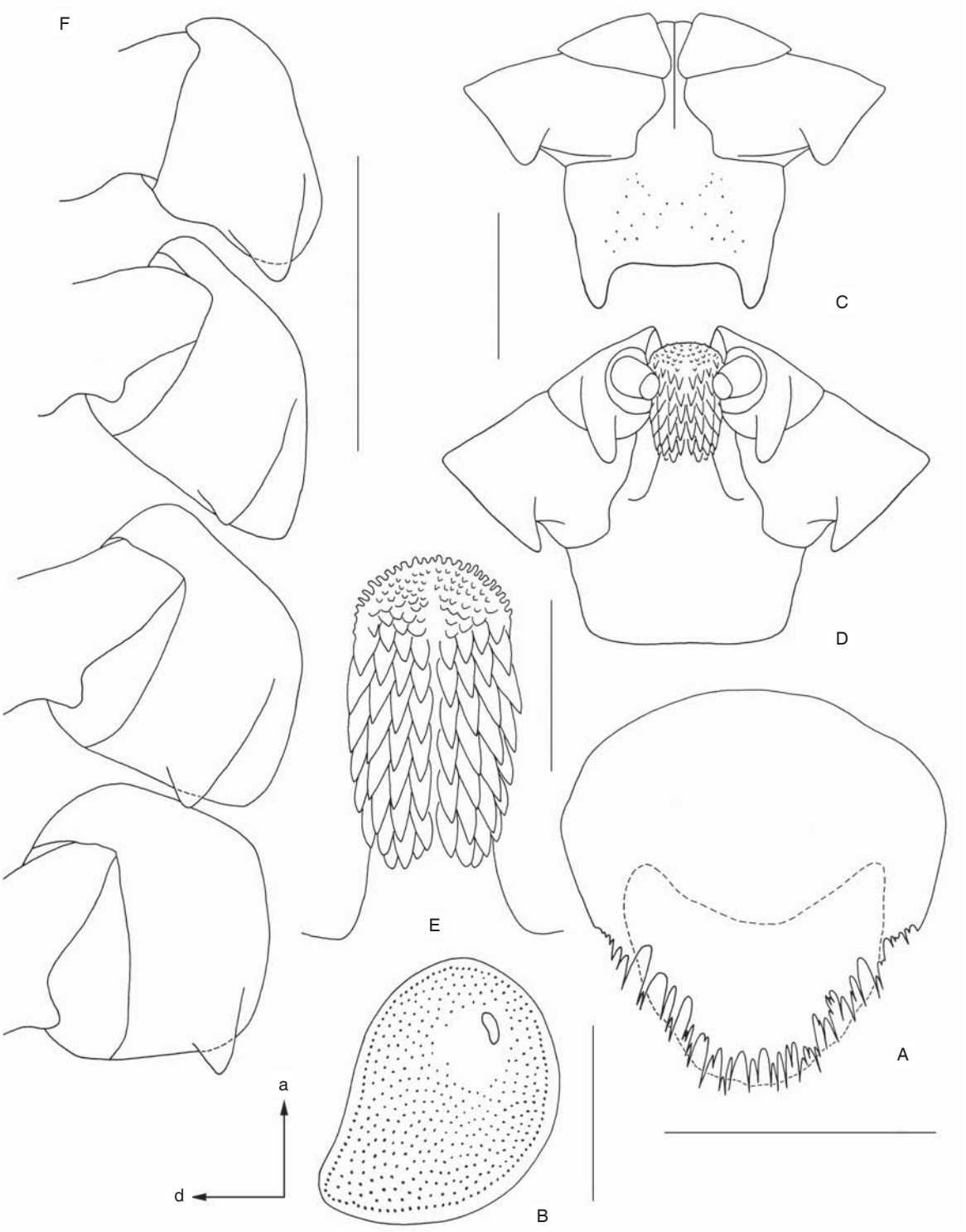

FIG. 3 *Haemaphysalis elliptica*, male, A, genital structures: apron and postgenital sclerite. Bar = 200 µm; B, spiracular plate (a – anterior; d – dorsal). Bar = 200 µm; C, gnathosoma dorsally. Bar = 200 µm; D, gnathosoma ventrally. Bar = 200 µm; E, hypostome. Bar = 100 µm; F, coxae. Bar = 500 µm. All setation is omitted

size, usually slightly broader than long; suboval; dorsal projection triangular.

Capitulum (Fig. 3C, D): *Basis capituli* dorsally *ca.* 1.7 times as broad as long; lateral margins diverging anteriorly; cornua elongately triangular, apices rounded, *ca.* 1/3 as long as length of basis capituli; ventrally as illustrated. *Palps* broadly salient (*leachi* type); combined breadth *ca.* 1.9 times breadth of basis capituli. Segment II *ca.* 1.7 times as broad as long; dorsomedian margin of segment II gradually widening anteriorly at level of its mid-length; posterodorsal spur large, triangular; posteroventral spur large, triangular, with straight lateral margin. Segment III *ca*. 1.6 times as broad as long; *ca*. 1/2 the length of segment II; ventral spur of segment III narrowly elongate, U-shaped apex at level of anterior 1/4 of length of segment II. *Hypostome* (Fig. 3E): slightly shorter than palps; dental formula 4/4; denticles in subequal-length files of 6 or 7.

Coxae (Fig. 3F): I to IV each with a short, subtriangular, more or less bluntly pointed spur, extending somewhat beyond coxal margin; spur of coxae IV usually subequal to that of coxae III.

Female (Fig. 4, 5A–F)

Length from palpal apices to posterior margin of scutum 1.42–1.92 (1.73 ± 0.10, *n* = 131); *breadth* of scutum (at widest point) 0.82–1.14 (1.02 ± 0.06, *n* = 133); *ratio* 1.50–1.86 (1.70 ± 0.07, *n* = 131).

Scutum (Fig. 4): *ca*. 1.3 times as long as broad; anterior margins diverging for anterior 1/5 of total length, subparallel 1/5 of the length, thence gradually converging, bluntly rounded posteriorly; slight postero-lateral angles. *Cervical grooves* narrow arcs extending 2/3 of total scutal length. *Punctations* moderately dense, denser on lateral fields, absent in cervical grooves; medium-sized, discrete, relatively deep. *Posterior lip of genital aperture* (Fig. 5A): broadly U-shaped. *Spiracular plates* (Fig. 5B): varying in size; irregularly suboval or subcircular; dorsal projection short, broadly triangular.

Capitulum (Fig. 5C, D): *Basis capituli* dorsally *ca*. 2.4 times as broad as long; external margins diverging anteriorly; cornua short, broadly triangular, bluntly pointed, *ca*. 1/6 as long as the length of the of basis capituli; porose areas elongate-oval, tilted inwards, moderate size, widely spaced. Basis capituli ventrally as illustrated. *Palps* broadly salient (*leachi* type); combined breadth *ca*. 1.6 times breadth of basis capituli. Segment II *ca*. 1.4 times as broad as long; dorsomedian margin of segment II gradually widening anteriorly at level of its midlength; posterodorsal spur large, triangular; posterolateral margin straight; posteroventral spur reduced to short rounded projection or curve. Segment III *ca*. 1.2 times as broad as long; *ca*. 0.7 times as long as segment II; ventral spur of segment III narrowly U-shaped, elongate, apex at level of anterior 1/3 of length of segment II. *Hypostome* (Fig. 5E): nearly as long as palps; dental formula 4/4; denticles usually in files of 9 or 10.

Coxae (Fig. 5F): I to IV each with a short, subtriangular, more or less bluntly pointed spur, extending somewhat beyond coxal margin; spur on coxae IV subequal to that of coxae III.

Nymph (Fig. 6A–E)

Length (unengorged) from palpal apices to posterior body margin 1 366–1 683 (1 543 ± 77.93, *n* = 32); *breadth* of idiosoma (at widest point) 756–988 (896 ± 62.33, *n* = 32); *ratio* 1.60–1.85 (1.73 ± 0.06, *n* = 32).

Scutum (Fig. 6A): length 431–510 (472 ± 20.95, *n* = 32), breadth 421–549 (427 ± 27.71, *n* = 32), ratio 0.92–1.08 (1.00 ± 0.04, *n* = 32); irregularly circular. *Spiracular plates* (Fig. 6B): suboval.

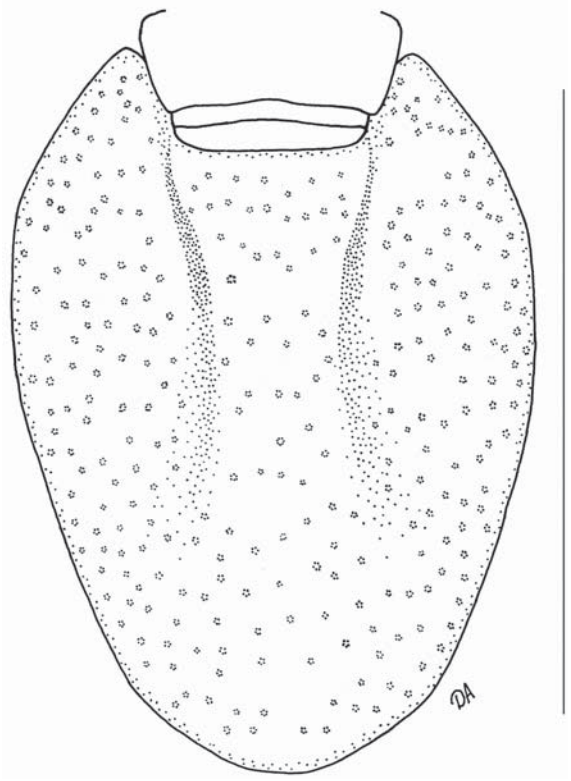

FIG. 4 *Haemaphysalis elliptica*, female, scutum. Bar = 1 mm. All setation is omitted

Capitulum (Fig. 6C, D): length 240–284 (265 ± 11.91, *n* = 32), breadth (palps combined) 336–402 (371 ± 16.97, *n* = 32), ratio 0.69–0.79 (0.71 ± 0.004, *n* = 32). *Basis capituli* dorsally subrectangular; cornua slight bulges; ventrally as illustrated. *Palps*: length 167–198 (182 ± 8.69, *n* = 32), breadth 147–181

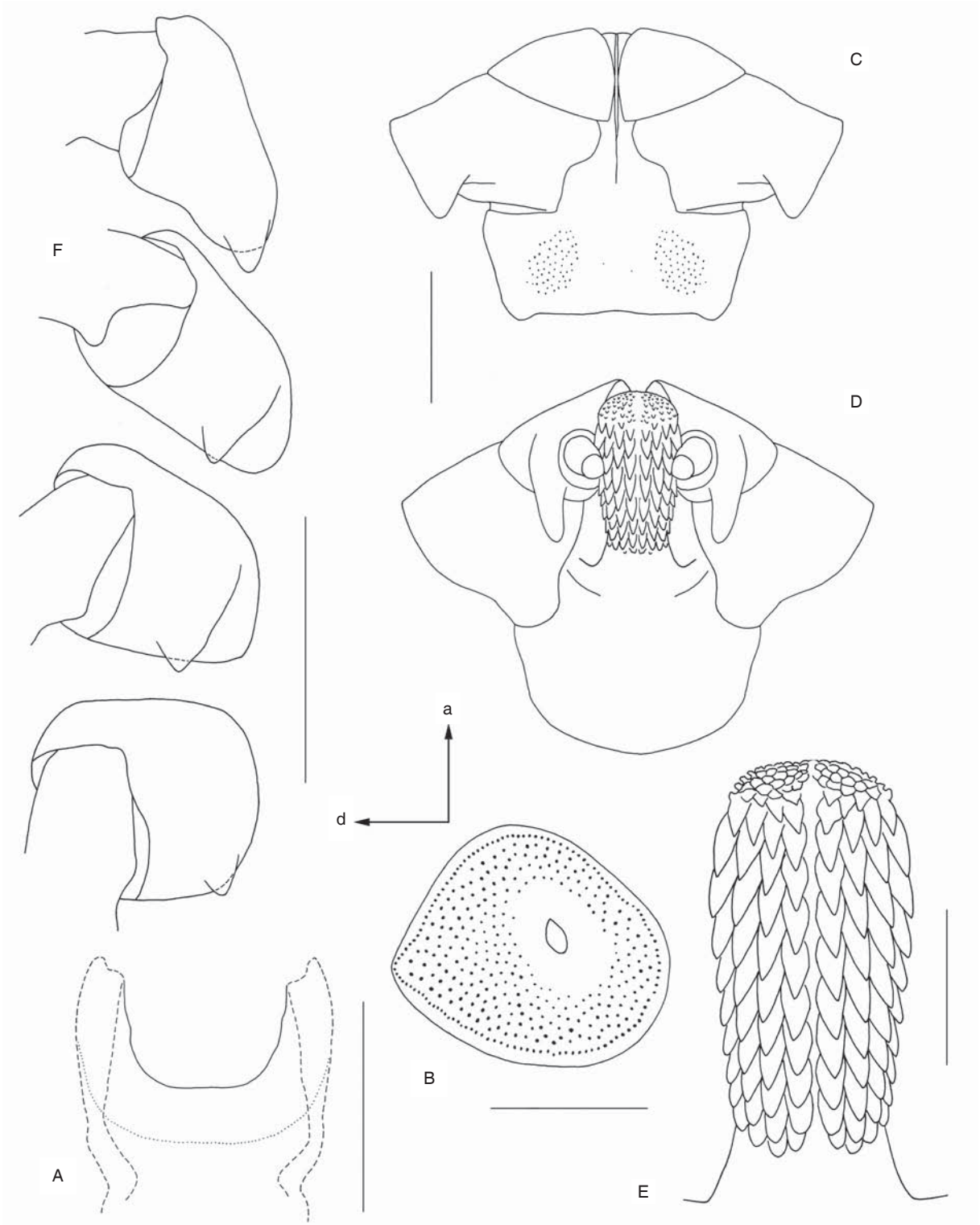

FIG. 5 *Haemaphysalis elliptica*, female, A, genital structures: posterior lip of the genital aperture and vestibular part of vagina. Bar = 200 µm; B, spiracular plate (a – anterior; d – dorsal). Bar = 200 µm; C, gnathosoma dorsally. Bar = 200 µm; D, gnathosoma ventrally. Bar = 200 µm; E, hypostome. Bar = 100 µm; F, coxae. Bar = 500 µm. All setation is omitted

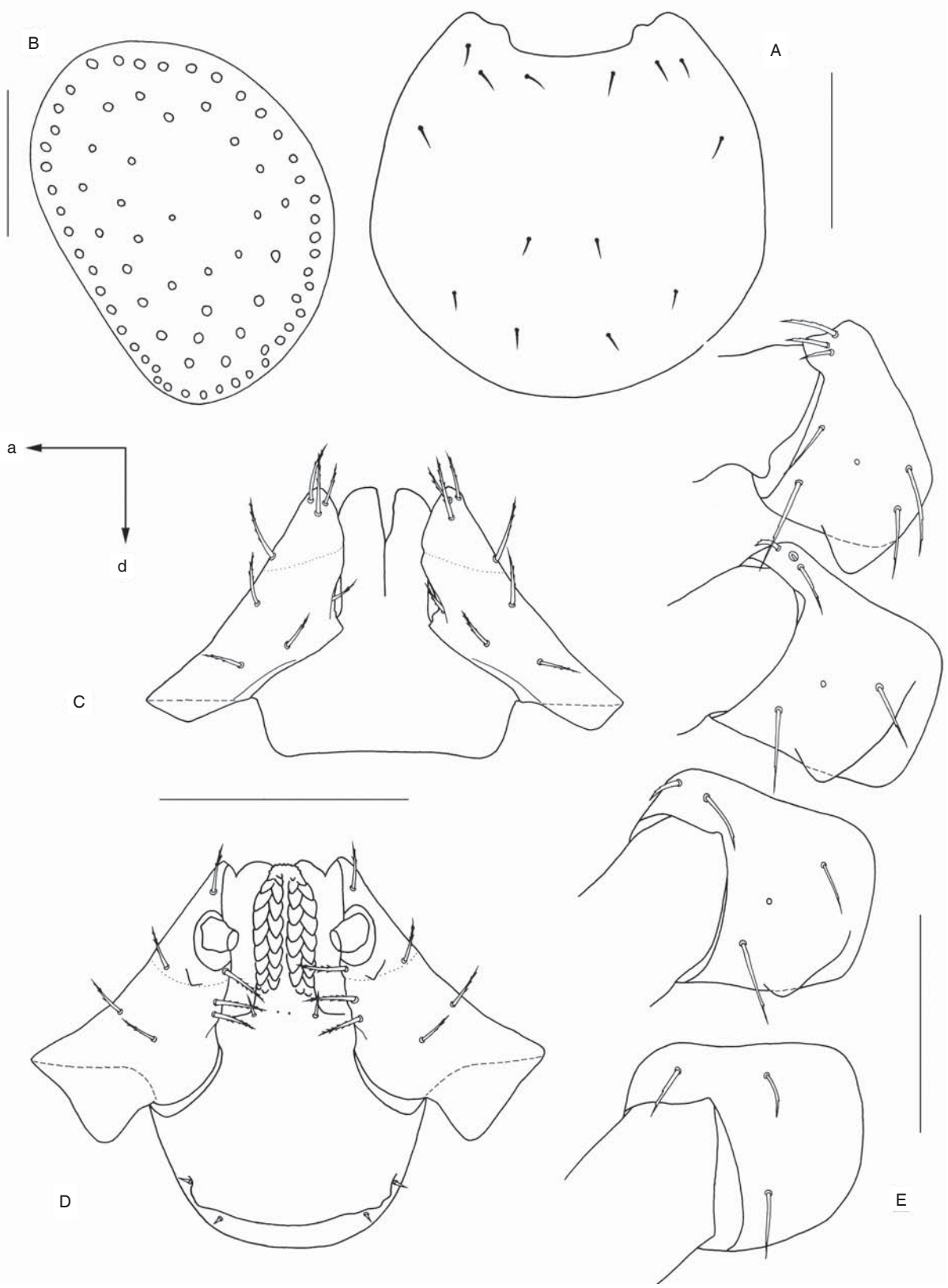

FIG. 6 *Haemaphysalis elliptica*, nymph, A, scutum. Bar = 200 µm; B, spiracular plate (a – anterior; d – dorsal). Bar = 50 µm; C, gnathosoma dorsally. Bar = 200 µm; D, gnathosoma ventrally. Bar = 200 µm; E, coxae. Bar = 200 µm. Setation of palpal segment IV is omitted

(160 ± 7.77, *n* = 32), ratio 1.08–1.21 (1.14 ± 0.03, *n* = 32); broadly salient; anterolateral margin slightly concave. Dorsomedian margin of segment II gradually widening anteriorly at level of its midlength; dorsal spur moderate; ventral spur large, broad; lateral margin of spur slightly concave. Ventral spur of segment III distinct, broadly triangular, with sharp apex. *Hypostome* (Fig. 6D): length 97–116 (107 ± 5.47, *n* = 32), breadth 40–48 (45 ± 2.05, *n* = 32), ratio 2.20–2.67 (2.39 ± 0.10, *n* = 32); nearly as long as palps; dental formula 2/2; denticles in files of 7 to 9 (usually 8).

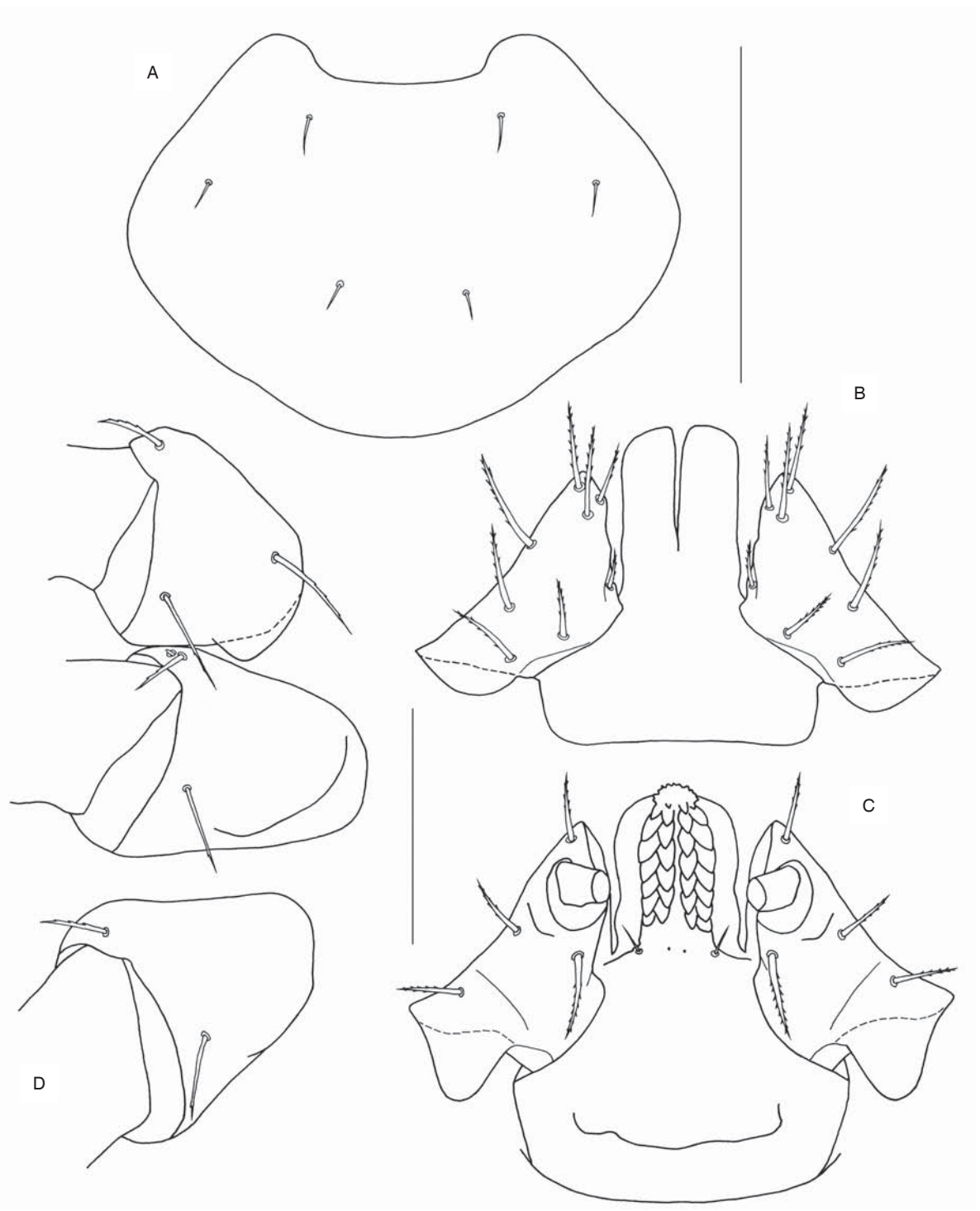

FIG. 7 *Haemaphysalis elliptica*, larva, A, scutum. Bar = 200 µm; B, gnathosoma dorsally. Bar = 100 µm; C, gnathosoma ventrally. Bar = 100 µm; D, coxae. Bar = 100 µm. Setation of palpal segment IV is omitted