

Amblyomma boeroi n. sp. (Acari: Ixodidae), a parasite of the Chacoan peccary *Catagonus wagneri* (Rusconi) (Artiodactyla: Tayassuidae) in Argentina

Santiago Nava · Atilio J. Mangold ·
Mariano Mastropaolo · José M. Venzal ·
Elena B. Oscherov · Alberto A. Guglielmone

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Abstract All parasitic stages of *Amblyomma boeroi* n. sp. (Acari: Ixodidae) are described here from *Catagonus wagneri* (Rusconi) in Argentina. The diagnostic characters for the male are a combination of orbited eyes, a 2/2 dental formula, coxa IV considerably larger than coxae I–III and with a long, sickle-shaped, medially directed spur arising from its internal margin, a scutum which is light grey to very pale ivory in colour, and the absence of a postanal groove. The diagnostic characters for the females are a combination of orbited eyes, a central pair and two marginal pairs of short, coarse notal setae, a 2/2 dental formula, and the absence of a postanal groove. The nymph has short palpi and a 2/2 dental formula arranged in 6 rows, its eyes are convex and orbited, and it has no postanal groove. The dorsally rectangular

basis capituli of the larva, its bulging eyes and slightly sinuous posterior scutal margin all serve to distinguish it from the larva of other species of the genus. The principal host for all parasitic stages is *C. wagneri* (Artiodactyla: Tayassuidae). Phylogenetically *A. boeroi* appears to represent an independent lineage within *Amblyomma* Koch, 1844.

Introduction

The tick family Ixodidae Murray, 1877 in the Neotropical Zoogeographic Region contains approximately 115 species, 58 of which belong to *Amblyomma* Koch, 1844 (see Guglielmone et al., 2003; Labruna et al., 2005; Barros-Battesti et al., 2007). With few exceptions, the ticks of this genus inhabit tropical or subtropical areas, and their host ranges comprise a wide variety of wild and domestic species, including amphibians, reptiles, birds, mammals and humans.

Twenty-two species of *Amblyomma* have been recorded in Argentina, some of which are frequently found on wild and domestic mammals of the order Artiodactyla and Perissodactyla (see Guglielmone & Nava, 2006). One of the well-represented families of wild artiodactyls in the Argentinean fauna is that of the Tayassuidae, or “peccaries”, in which three species occur, namely *Catagonus wagneri* (Rusconi) (“Chacoan peccary”), *Tayassu pecari* (Link) (“white-lipped peccary”) and *Tayassu tajacu* (Linnaeus) (“collared

S. Nava (✉) · A. J. Mangold · M. Mastropaolo ·
A. A. Guglielmone
Instituto Nacional de Tecnología Agropecuaria, Estación
Experimental Agropecuaria Rafaela, CC 22,
CP 2300 Rafaela, Santa Fe, Argentina
e-mail: snava@rafaela.inta.gov.ar

J. M. Venzal
Departamento de Parasitología Veterinaria, Facultad de
Veterinaria, Universidad de la República,
Regional Norte - Sede Salto, Rivera 1350,
CP 50000 Salto, Uruguay

E. B. Oscherov
Cátedra de Biología de los Parásitos, Facultad de Ciencias
Exactas y Naturales y Agrimensura, Universidad Nacional
del Noreste, Corrientes, Argentina

peccary”) (Barquez et al., 2006). The only tick species that have to date been collected from peccaries in Argentina are *Amblyomma cajennense* (Fabricius, 1787), *A. neumanni* Ribaga, 1902 and *A. parvum* Aragão, 1908 (Guglielmone & Nava, 2006; Nava et al., 2008). This is very probably due to a lack of sampling. We have, however, been fortunate enough to examine ticks from peccaries in the north-eastern Salta Province, Argentina, and this has resulted in the collection of a new species belonging to *Amblyomma* on *C. wagneri*. Here we present descriptions of all of the parasitic stages of this tick, with an analysis of its phylogenetic relationship to other species of the family Ixodidae.

Materials and methods

Morphological study

The males, females and nymphs used for description were collected from 14 carcasses of *Catagonus wagneri* at Rivadavia Banda Sur (24°11S; 62°53W), Salta Province, Argentina. Larvae collected from these animals were not used for descriptive purposes, as they were either partly engorged or damaged. Larvae were, however, obtained from engorged females collected from a peccary trapped by a local farmer at the same locality, which lies in a dry area of the Western Chaqueño District located in the Chaco phytogeographic province of the phytogeographic divisions described by Cabrera (1994).

Ticks were cleaned for both light and scanning electron microscopy with ultrasound (20 kHz) using distilled water and commercial detergent in a proportion of 9:1. Ten partly engorged adults and nymphs, and 10 unengorged larvae, were mounted in Hoyer’s medium to create semi-permanent slides for light microscopy. Representative specimens of each stage were measured and photographed using a Nikon Alphaphot-2 YS2 optical microscope for the descriptions that follow. All measurements are given in micrometres, with the mean followed by the standard deviation and range in parentheses. For two-dimensional measurements, length is given before breadth. Scanning electron photomicrographs were taken at the Servicio de Microscopía Electrónica, Museo de La Plata, Universidad Nacional de La Plata, Argentina, using a JEOL/JSM 6360 LV® Digital Scanning Microscope. Larval chaetotaxi

terminology follows that of Clifford & Anastos (1960). The use of ‘large wax glands’ rather than ‘campaniform sensilla’ in the description of the larva is according to Klompen et al. (1996).

Molecular study

DNA was extracted from representative specimens of each stage and processed using a polymerase chain reaction (PCR) following the methodology described by Mangold et al. (1998a, b). The DNA was then used to amplify a 460-bp fragment of the mitochondrial 16S rDNA gene and the complete sequence of the nuclear 18S rRNA gene, using the primers designed by Mangold et al. (1998a, b).

The sequences obtained were aligned with the CLUSTAL W program (Thompson et al., 1994), and a divergence matrix was constructed to compare the sequences of the ticks described here with those of other *Amblyomma* spp. deposited in GenBank. Phylogenetic relationships were assessed in terms of neighbour-joining distances (NJ) and maximum parsimony (MP) methods using 18S rDNA and 16S rDNA sequences. An NJ tree was generated from the Kimura two parameter distance, and gaps were excluded in the pair-wise comparisons. MP analysis was made using the heuristic search procedure, with the close neighbour interchange (CNI) set at search level 3 and the random addition of taxa (10 replicates), and gaps were excluded. Support for the NJ and MP topology was tested by bootstrapping over 1,000 replications for both methods. All of the above-mentioned procedures were performed using MEGA version 4.0 (Tamura et al., 2007). The DNA sequences of the tick species included in the phylogenetic study and their GenBank accession numbers are summarised in Table 1.

Amblyomma boeroi n. sp.

Type-host: *Catagonus wagneri* (Rusconi).

Type-locality: Rivadavia Banda Sur (24°11S; 62°53W), Salta, Argentina.

Type-material: Holotype ♂ and allotype ♀, 1 paratype ♂, 1 paratype ♀, 1 paratype nymph and 4 paratype larvae (larvae obtained in the laboratory from engorged females), collected November, 2007 by A.J. Mangold, S. Nava and M. Mastropaolo, deposited in the U.S National Tick Collection, Georgia Southern University, Statesboro (RML 124087);

Table 1 DNA sequences of tick species included in the phylogenetic study and their GenBank accession numbers

18S rDNA		16S rDNA	
Species	GenBank No.	Species	GenBank No.
<i>Amblyomma auricularium</i>	FJ464426	<i>Amblyomma americanum</i>	L34313
<i>Amblyomma boeroi</i>	FJ464420	<i>Amblyomma aureolatum</i>	AF541254
<i>Amblyomma dubitatum</i>	FJ464425	<i>Amblyomma auricularium</i>	FJ627951
<i>Amblyomma fimbriatum</i>	AF018644	<i>Amblyomma boeroi</i>	FJ464416
<i>Amblyomma glauerti</i>	AF115372	<i>Amblyomma cajennense</i>	L34317
<i>Amblyomma latum</i>	L76347	<i>Amblyomma dubitatum</i>	DQ858955
<i>Amblyomma maculatum</i>	L76344	<i>Amblyomma glauerti</i>	U95853
<i>Amblyomma neumanni</i>	FJ464424	<i>Amblyomma hebraeum</i>	L34316
<i>Amblyomma parvitarsum</i>	FJ464423	<i>Amblyomma maculatum</i>	AY498559
<i>Amblyomma parvum</i>	FJ464422	<i>Amblyomma neumanni</i>	AY498560
<i>Amblyomma pseudoparvum</i>	FJ464421	<i>Amblyomma ovale</i>	AF541255
<i>Amblyomma triguttatum</i>	AF018641	<i>Amblyomma parvitarsum</i>	AY498561
<i>Amblyomma tuberculatum</i>	L76345	<i>Amblyomma parvum</i>	EU306136
<i>Amblyomma variegatum</i>	L76346	<i>Amblyomma pseudoconcolor</i>	AY628137
<i>Amblyomma vikirri</i>	AF018642	<i>Amblyomma pseudoparvum</i>	FJ627952
<i>Bothriocroton concolor</i>	AF018643	<i>Amblyomma tigrinum</i>	DQ342290
<i>Bothriocroton glebopalma</i>	AF115370	<i>Amblyomma triste</i>	AY498563
<i>Bothriocroton hydrosauri</i>	AF115371	<i>Amblyomma tuberculatum</i>	U95856
<i>Bothriocroton undatum</i>	AF018645	<i>Amblyomma variegatum</i>	L34312
<i>Dermacentor andersoni</i>	L76340	<i>Ixodes loricatus</i>	AY510268
<i>Dermacentor marginatus</i>	Z74480	<i>Ixodes persulcatus</i>	L34295
<i>Haemaphysalis inermis</i>	L76338	<i>Ixodes scapularis</i>	L34293
<i>Haemaphysalis leachi</i>	AF018647		
<i>Haemaphysalis leporispalustris</i>	L76339		
<i>Haemaphysalis punctata</i>	Z74478		
<i>Hyalomma dromedarii</i>	L76348		
<i>Hyalomma rufipes</i>	L76349		
<i>Ixodes affinis</i>	L76350		
<i>Ixodes cookei</i>	L76351		
<i>Ixodes holocyclus</i>	AF018650		
<i>Ixodes kopsteini</i>	L76352		
<i>Ixodes luciae</i>	AF115367		
<i>Ixodes persulcatus</i>	AY274888		
<i>Ixodes pilosus</i>	AF115366		
<i>Ixodes ricinus</i>	Z74479		
<i>Ixodes uriae</i>	AF115369		
<i>Rhipicephalus appendiculatus</i>	AF018653		
<i>Argas lahorensis</i>	L76354		
<i>Argas persicus</i>	L76353		
<i>Ornithodoros coriaceus</i>	AF096274		
<i>Ornithodoros moubata</i>	L76355		
<i>Ornithodoros puertoricencis</i>	L76357		
<i>Otobius megnini</i>	L76356		

paratypes 20 ♂♂, 20 ♀♀, 5 nymphs and 20 larvae, deposited in the tick collection of INTA Rafaela, Santa Fe, Argentina; paratypes 4 ♂♂, 4 ♀♀, 1 nymph and 20 larvae, deposited in the Facultad de Ciencias Veterinarias, Universidad Nacional del Litoral, Santa Fe, Argentina; paratypes 1 ♂, 1 ♀ and 6 larvae, deposited in the Departamento de Parasitología Veterinaria, Facultad de Veterinaria, Universidad de la República, Montevideo, Uruguay; paratypes 1 ♂, 1 ♀ and 6 larvae, deposited in the Faculdade de Medicina Veterinária e Zootecnia, Universidade de São Paulo, São Paulo, Brazil; paratypes 1 ♂, 1 ♀ and 6 larvae, deposited in the Instituto Butantan, São Paulo, Brazil; paratypes 1 ♂, 1 ♀ and 6 larvae, deposited in the Departamento de Parasitología Veterinaria, Facultad de Veterinaria, Universidad de Zaragoza, Zaragoza, Spain; paratypes 1 ♂, 1 ♀, 1 nymph and 6 larvae, deposited in Onderstepoort Veterinary Institute, South Africa.

Etymology: The species is named for Juan José Boero, in recognition of his contribution to the study of Argentinean ticks.

Description

Male (Figs. 1–11)

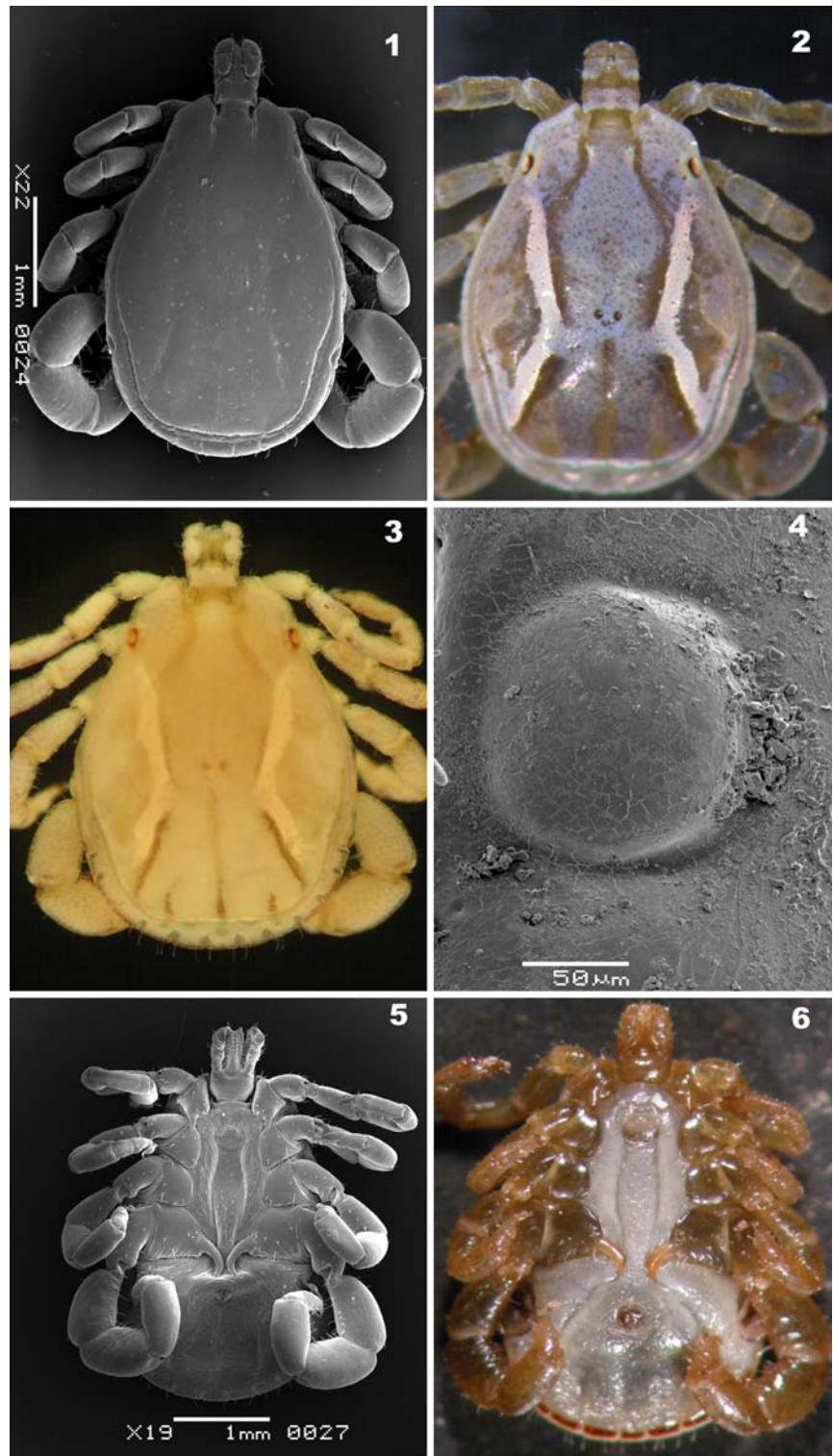
Body outline pyriform, broadest at level of legs IV (Fig. 1), with 11 festoons; length from apex of hypostome to posterior body margin $3,893 \pm 168$ (3,425–4,150); length from apices of scapulae to posterior body margin $3,343 \pm 128$ (3,000–3,575); greatest width $2,560 \pm 62$ (2,375–2,640); *scutum* ornate, coloration variable, from light grey to very pale ivory, with single bilateral white stripe converging toward foveal level and then diverging posteriorly (Figs. 2–3); eyes large, convex, orbited (Fig. 4), with distinct brown margin; cervical grooves deep and almost parallel, diverging as shallow depressions posteriorly; marginal groove complete, commencing at level of legs IV; dorsal *foveae* distinct; genital aperture U-shaped, located between coxae II (Fig. 5); sclerotised ventral plates on all festoons (Fig. 6); ventral plate of central festoon 210 ± 15 (180–230) long, those of lateral festoons 266 ± 9 (250–280) in length; postanal groove absent (Figs. 5, 6). *Capitulum* (Fig. 7): *basis capituli* dorsally rectangular, wider than long; cornua large; length from apex of hypostome to posterior margin 855 ± 15 (840–870); length from Ph1 setae to posterior margin 445 ± 35

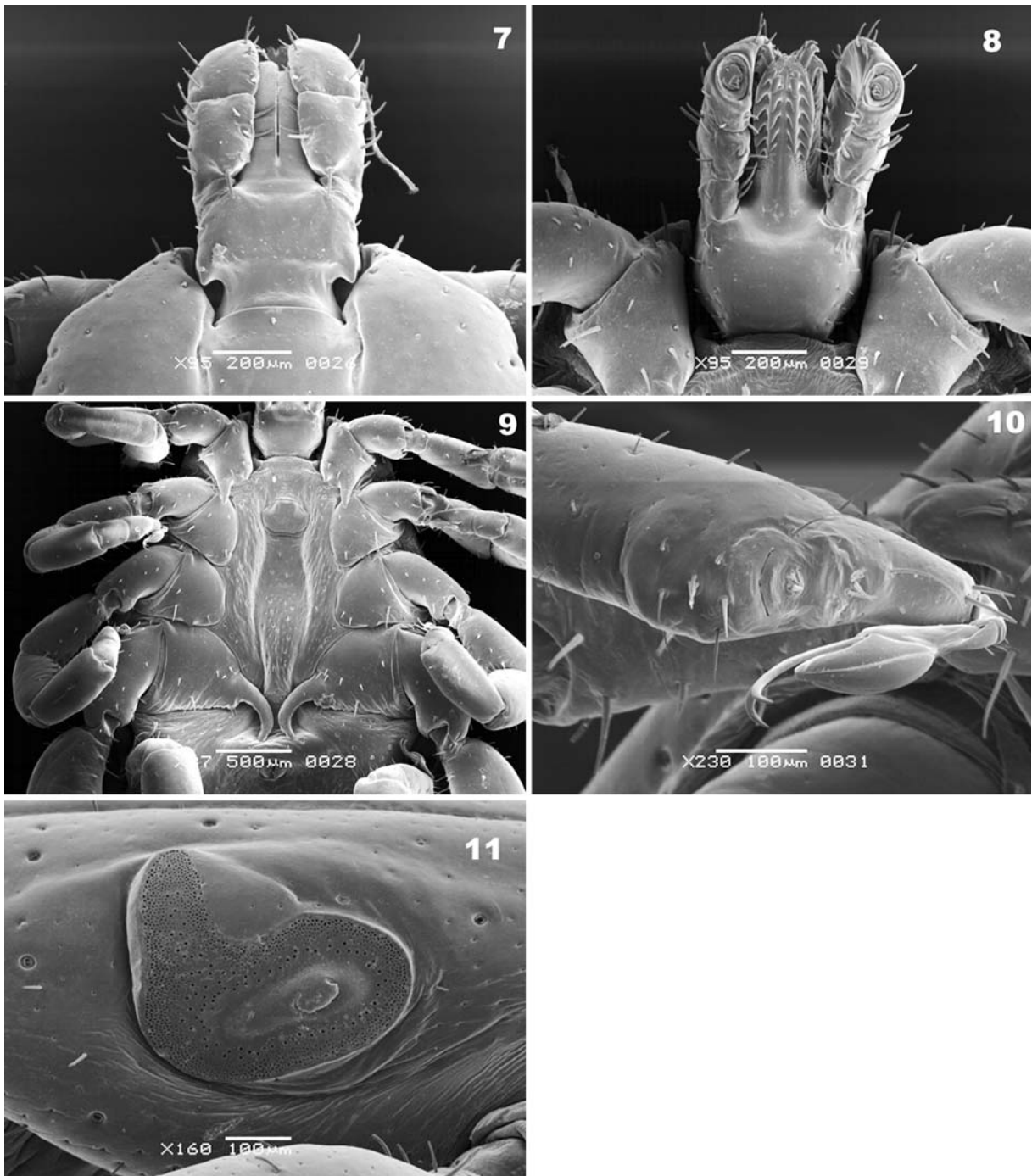
(410–480); width 500 ± 42 (390–580); *Palpi* length 520 ± 20 (460–550); article I 60 ± 15 (30–80) \times 105 ± 15 (90–120); article II 266 ± 9 (250–280) \times 185 ± 5 (180–190); article III 207 ± 24 (160–240) \times 180 ± 20 (160–200); article II with posteriorly directed salience on dorsal surface, on which is single retrograde seta (Fig. 7); ventral prolongation on palpal article I absent; suture between articles II and III distinct. *Hypostome* (Fig. 8): apically rounded (spatulate); length from apices to Ph1 setae 440 ± 40 (400–480); width 225 ± 25 (200–250); dental formula 2/2, with 8 teeth in file 1 and 7 in file 2. *Legs* (Fig. 9): *coxa* I with 2 unequal spurs; external spur larger and reaching anterior margin of coxa II; *coxae* II–III each with small triangular spur; coxa IV considerably larger than coxae I–III, with long, sickle-shaped, medially directed spur arising from its internal margin; leg IV long, with robust segments; spurs absent on *trochanters*; *tarsus* I 687 ± 22 (650–750) \times 270 ± 11 (240–290); *Haller's organ* as illustrated in Fig. 10, with transverse capsular aperture and 7 prehalleral setae (6 internal and 1 external); *tarsus* IV 532 ± 16 (500–570) \times 280 ± 8 (260–300). *Spiracular plate* roughly pear-shaped, 432 ± 25 (360–470) \times 230 ± 29 (180–280); dorsal prolongation of perforated portion broad, slightly curved and with round apex (Fig. 11).

Female (Figs. 12–19)

Body outline pyriform, with 11 festoons in unengorged specimens (Figs. 12–14); length from apex of hypostome to posterior body margin $5,550 \pm 112.5$ (5,250–5,750); length from apices of scapulae to posterior body margin $4,919 \pm 116$ (4,650–5,125); greatest width $3,325 \pm 71$ (3,175–3,500); *dorsal notal setae* short, coarse, ivory in colour, slightly curved, comprising 1 central pair and 2 marginal pairs (Figs. 12, 15); 4–6 *setae* on margin of each festoon, similar in shape to those on *notum*; dorsal *foveae* distinct; genital aperture U-shaped, situated between coxae II; postanal groove absent (Fig. 14); *ventral body setae* short, pale, evenly distributed. *Scutum* $1,612 \pm 46$ (1,500–1,700) \times 1612 ± 62 (1450–1750); ornate, with 3 dark stripes on pale, enamelled back-ground, with central stripe reaching posterior scutal margin and lateral stripes externally concave (Fig. 12); cervical grooves deep, converge anteriorly then diverge as shallow depressions; scapulae

Figs. 1–6 *Amblyomma boeroi* n. sp., male. 1–3. Dorsal view. 4. Orbited eyes. 5–6. Ventral view

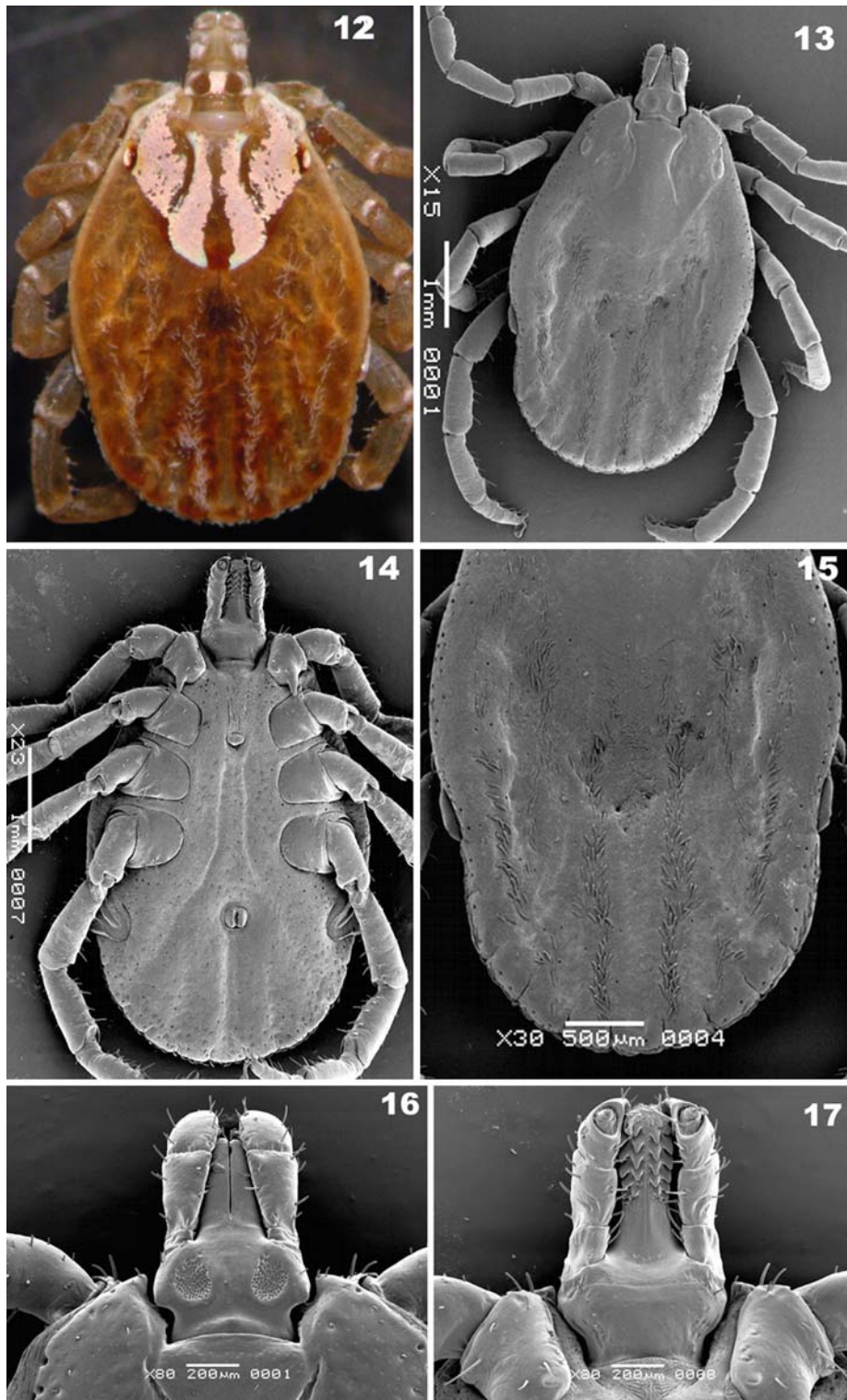




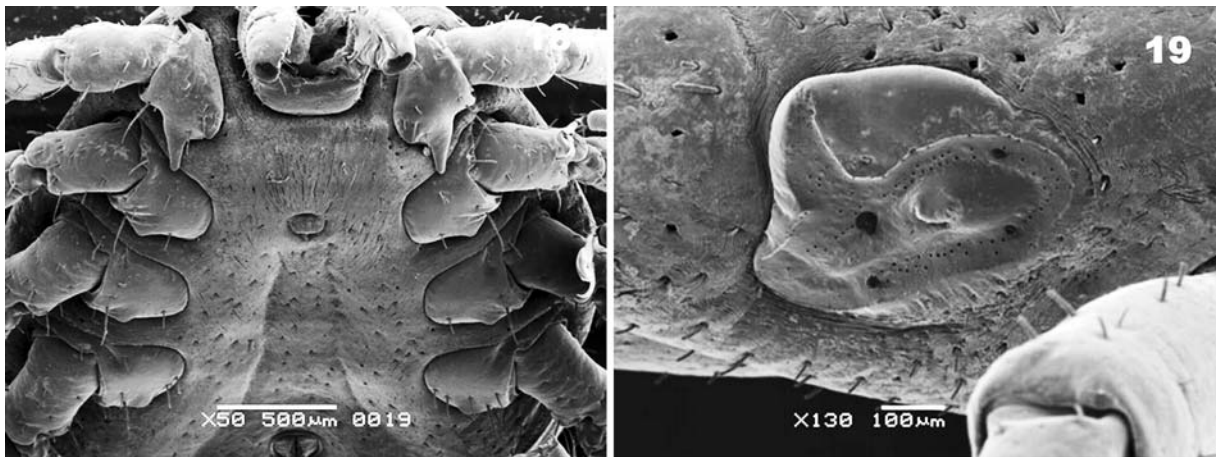
Figs. 7–11 *Amblyomma boeroi* n. sp., male. 7. Capitulum, dorsal view. 8. Hypostome. 9. Coxae I–IV. 10. Haller's organ. 11. Spiracular plate

prominent; eyes large, convex, orbited, with distinct brown margin; marginal groove absent. *Capitulum* (Fig. 16): *basis capituli* dorsally rectangular, wider

than long; cornua short; porose areas large and tear-shaped, greater than their own diameter apart; length from apex of hypostome to posterior margin 980 ± 11



Figs. 12–17 *Amblyomma boeroi* n. sp., female. 12–13. Dorsal view. 14. Ventral view. 15. Setae on notum. 16. Capitulum, dorsal view. 17. Hypostome



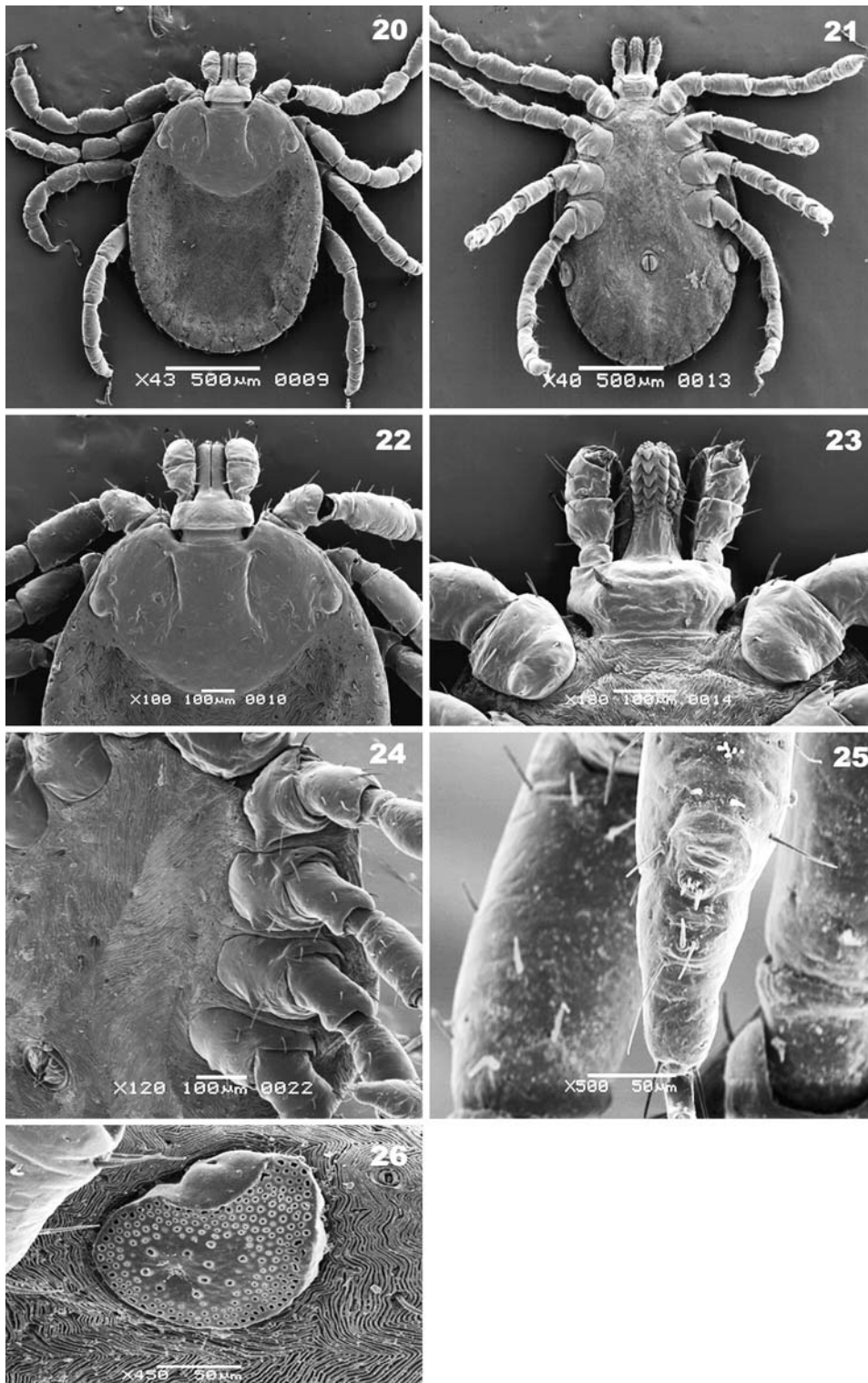
Figs. 18–19 *Amblyomma boeroi* n. sp., female. 18. Coxae I–IV. 19. Spiracular plate

(950–1,000); length from Ph1 setae to posterior margin 462 ± 10 (440–480); width 610 ± 15 (580–650); *Palpi* length 600 ± 23 (550–660); article I 55 ± 3 (50–60) \times 127 ± 5 (120–140); article II 327 ± 7 (310–340) \times 210 ± 6 (200–220); article III 215 ± 10 (200–240) \times 210 ± 6 (200–220); article II of palpi with salience on dorsal surface similar to that of male, surmounted by retrograde seta; ventral prolongation on palpal article I absent; suture between articles II and III distinct. *Hypostome* (Fig. 17): apically rounded (spatulate); length from apices to Ph1 setae 512 ± 22 (450–550); width 227 ± 5 (220–240); dental formula 2/2, in files of 7, with third internal file of small denticles. *Legs* (Fig. 18): *coxa* I with 2 spurs, external being larger; *coxae* II–IV each with small triangular spur; *trochanters* lack spurs; *tarsus* I 835 ± 12 (800–850) \times 325 ± 24 (300–400); *Haller's organ* with capsular aperture and setae similar to male; *tarsus* IV 752 ± 6 (740–770) \times 252 ± 13 (230–290). *Spiracular plate* broadly pear-shaped, 583 ± 22 (550–625) \times 450 ± 10 (425–475); dorsal prolongation of perforated portion narrows with rounded apex (Fig. 19).

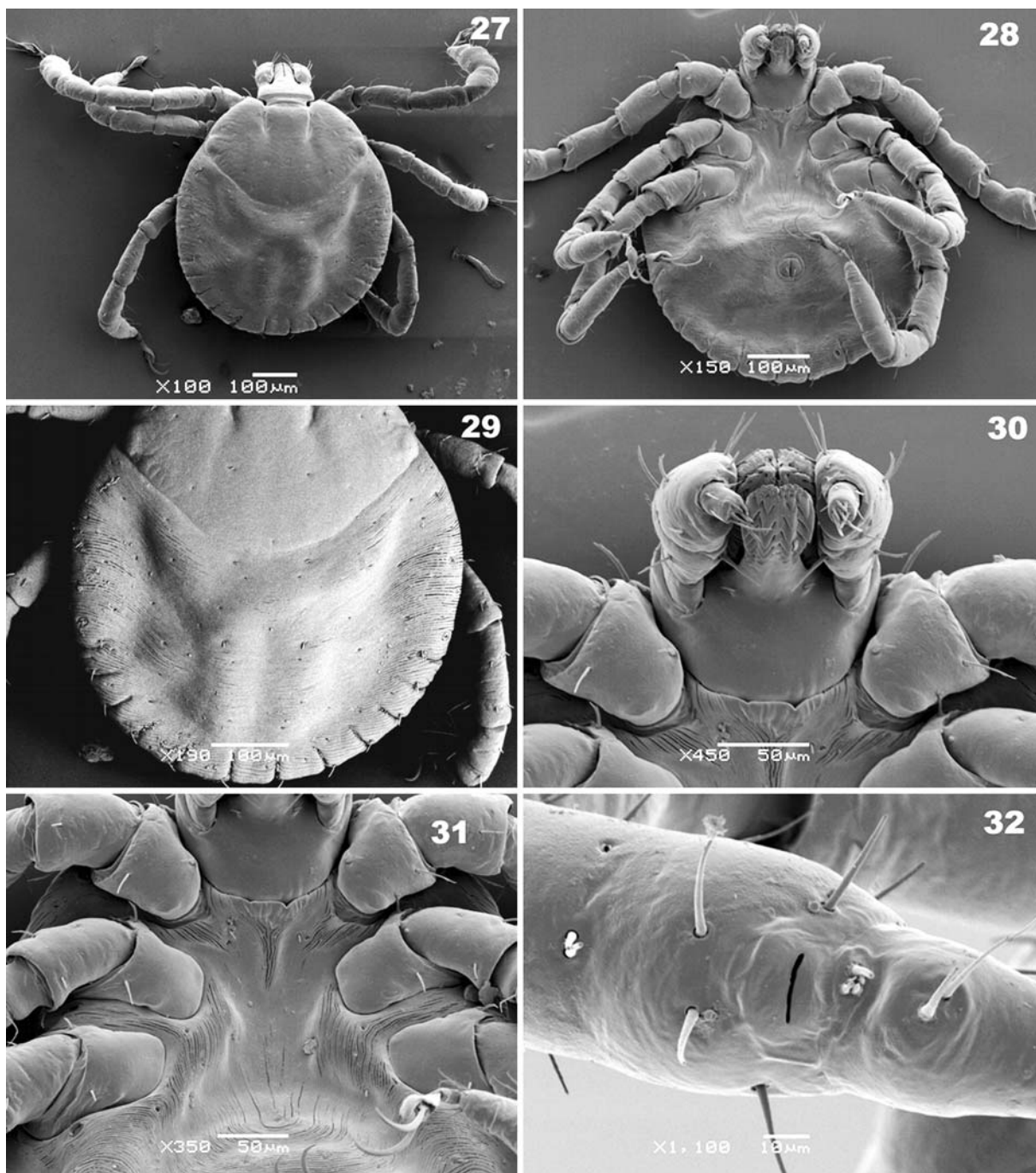
Nymph (Figs. 20–26)

Body outline oval, with 11 festoons (Fig. 20); post-anal groove absent (Fig. 21); length from apex of hypostome to posterior body margin $1,845 \pm 19$ (1,775–1,950); length from apices of scapulae to posterior body margin $1,619 \pm 20$ (1,550–1,750); greatest width $1,225 \pm 14$ (1,150–1,275); setae on

notum irregularly distributed, more numerous on margins than in centre; marginal groove absent (Fig. 20). *Scutum* wider than long (Figs. 20, 22), 577 ± 19 (500–660) \times 801 ± 12 (750–850), innate with few punctuations; cervical grooves deep, parallel at mid-length and then slightly divergent; eyes convex, orbited, 90 ± 4 (80–108) \times 68 ± 2 (60–75), positioned at lateral scutal angles. *Capitulum* (Fig. 22): *basis capituli* dorsally rectangular; cornua present; length from apex of hypostome to posterior margin 361 ± 8 (320–380); length from Ph1 setae to posterior margin 186 ± 8 (150–205); width 264 ± 4 (250–280); *Palpi* short and irregularly shaped (Fig. 22), with length 211 ± 6 (190–235); article I 23 ± 1 (20–26) \times 61 ± 3 (52–77); article II 101 ± 5 (85–112) \times 93 ± 4 (77–112); article III 92 ± 2 (82–100) \times 96 ± 4 (82–120); suture between articles II and III distinct. *Hypostome* (Fig. 23): apically rounded (spatulate); length from apices to Ph1 setae 174 ± 2 (160–180), width 86 ± 2 (80–95); dental formula 2/2, in files of 6 teeth; apex with corona of fine denticles. *Legs* (Figs. 23, 24): *coxa* I with triangular, large, external spur and minute, rounded, internal spur; *coxae* II–IV each with small triangular spur; *trochanters* lack spurs; *tarsus* I 326 ± 5 (300–340) \times 106 ± 2 (100–110); *Haller's organ* as illustrated in Fig. 25; *tarsus* IV 293 ± 4 (275–310) \times 90 ± 1 (90–95). *Spiracular plate* bluntly triangular, 156 ± 3 (145–165) \times 109 ± 5 (90–145); dorsal prolongation of perforated portion short, broad, slightly curved, with rounded apex (Fig. 26).



Figs. 20–26 *Amblyomma boeroi* n. sp., nymph. 20. Dorsal view. 21. Ventral view. 22. Capitulum, dorsal view. 23. Hypostome. 24. Coxae I–IV. 25. Haller's organ. 26. Spiracular plate



Figs. 27–32 *Amblyomma boeroi* n. sp., larva. 27. Dorsal view. 28. Ventral view. 29. Scutum and notum. 30. Hypostome. 31. Coxae I–III. 32. Haller's organ

Larva (Figs. 27–32)

Body outline rounded, with 11 festoons (Figs. 27, 28); length from apex of hypostome to posterior body margin 813 ± 6 (790–850); length from apices of

scapulae to posterior body margin 652 ± 4 (640–680); greatest width 592 ± 11 (540–650); 10 pairs of dorsal body setae – 2 pairs central and 8 marginal; 15 pairs of ventral setae – 3 sternal pairs, 2 pre-anal pairs, 4

premarginal pairs, 5 ventral marginal pairs and 1 pair on anal valves. Large wax glands: 1 dorsal pair on lateral margin of alloscutum and 1 ventral pair on 5th festoon and 1 pair located posterior to each coxa. *Scutum* (Figs. 27, 29): outline subtriangular with posterior margin slightly sinuous; 280 ± 2 (270–290) \times 441 ± 2 (430–450); 3 pairs of minute setae; eyes very large and bulge markedly, 47 ± 1 (45–50) \times 40 ± 1 (35–45), located at maximum width of *scutum*; cervical grooves deep and parallel. *Capitulum*: *basis capituli* dorsally rectangular, with straight posterior margin; 1 pair of ventral posthypostomal setae (Ph1); distance between Ph1 48 ± 1 (45–50); *cornua* absent; length from apex of hypostome to posterior margin 196 ± 2 (188–202); length from Ph1 setae to posterior margin 96 ± 1 (87–100); width 146 ± 1 (142–150); *Palpi* length 134 ± 1 (130–140); article I 13 ± 1 (12.5–15) \times 31 ± 1 (25–35); article II 41 ± 1 (37–45) \times 50 ± 1 (47.5–52); article III 29 ± 1 (27–35) \times 46 ± 1 (42–50); sutures between all articles distinct; setae: none on article I, 4 dorsally and 2 ventrally on both articles II and III, and 12 on article IV. *Hypostome* (Fig. 30): rounded apically; length from apices to Ph1 setae 101 ± 1 (98–105); width 51 ± 1 (50–52.5); dental formula 2/2, with 5 or 6 teeth in file 1 and 5 teeth in file 2. *Legs* relatively long (Figs. 28, 31): *coxa* I with 1 triangular spur; *coxae* II and III each with 1 short spur; *trochanters* lack spurs; *tarsus* I 213 ± 2 (200–225) \times 70 ± 1 (65–75); *Haller's organ* as illustrated in Fig. 32, with transverse capsular aperture and 6 setae in anterior pit.

DNA sequences and phylogenetic position

The DNA sequences of the 16S gene were identical for all parasitic stages of *A. boeroi* n. sp. (GenBank accession numbers: FJ464416 for female sequence, FJ464417 for male sequence, FJ464418 for nymph sequence and FJ464419 for larval sequence). The rooted NJ trees derived from both 18S and 16S genes are presented in Figs. 33 and 34, respectively (MP reconstructions showed similar topologies). These phylogenetic trees displayed no close association between *A. boeroi* and any other sequenced *Amblyomma* spp. This result should, however, be considered preliminary, because all of the Neotropical species of this genus have as yet not been sequenced, and especially those with a high degree of specificity for peccaries, namely *Amblyomma pecarium* Dunn, 1933 and *A. naponense* (Packard, 1869).

Discussion

Species relationships

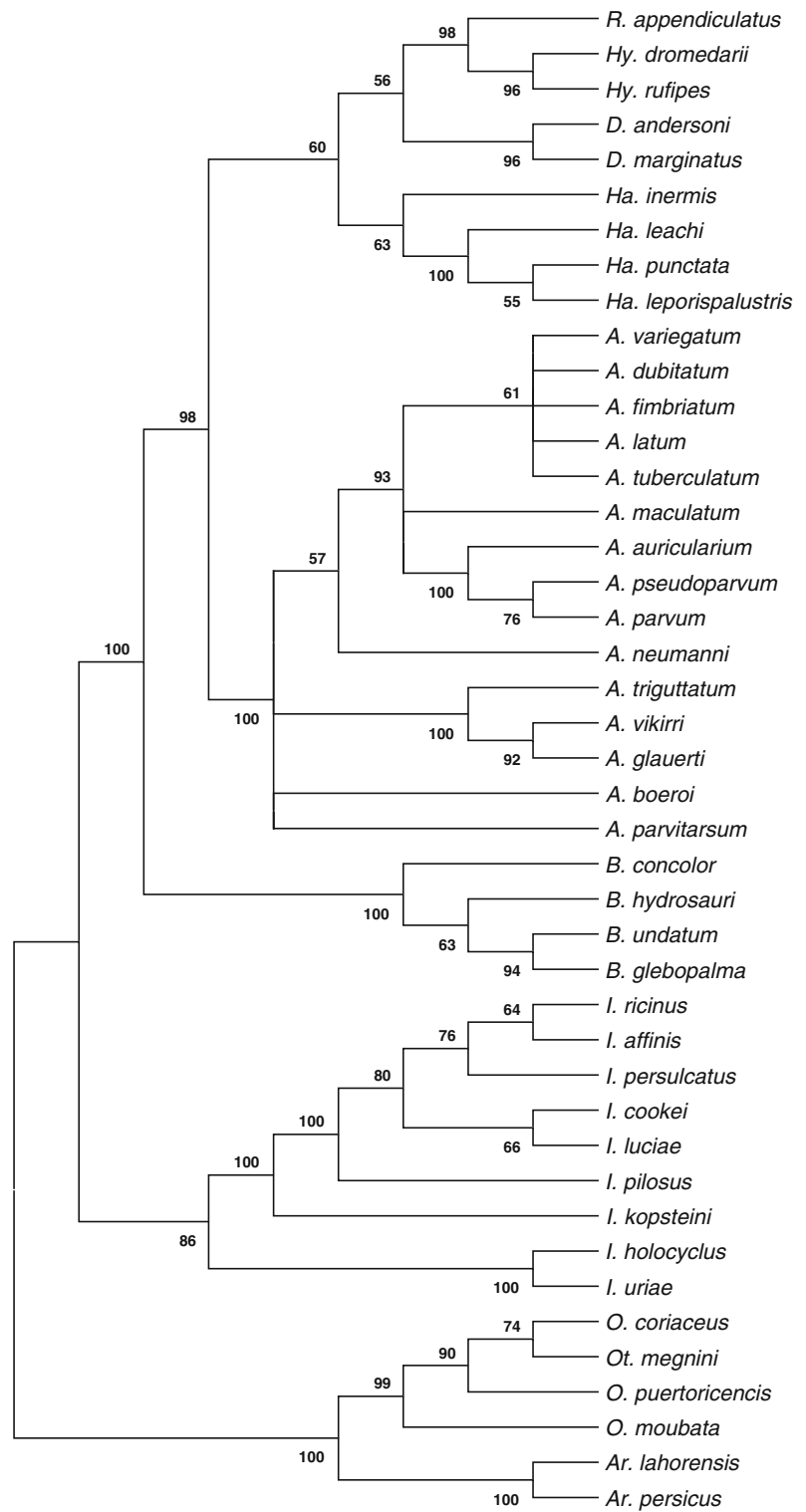
The diagnostic characters unique for the males of *A. boeroi* n. sp. are a combination of its pattern of scutal ornamentation on a light grey to pale ivory background, convex, orbited eyes with a distinct brown margin, a 2/2 dental formula, coxa IV with a long, sickle-shaped, medially directed spur arising from its internal margin, and the absence of a postanal groove. Females of *A. boeroi* can easily be distinguished from other *Amblyomma* spp. by a combination of four characters, namely eyes convex, orbited and with a distinct brown margin, the distribution pattern of the notal setae, a 2/2 dental formula and the absence of a postanal groove.

Phylogenetically *A. boeroi* appears to represent an independent lineage within the genus *Amblyomma*. Despite it not being linked to any *Amblyomma* species in the phylogenetic analyses carried out with both 18S and 16S genes, it shares some morphological characters with both *Amblyomma parvitarsum* Neumann, 1901 and *A. neumanni* Ribaga, 1902. The males of these three species have a piriform body outline, a similar shape to the capitulum and palpi, convex, orbited eyes (not in *A. neumanni*), and coxa IV with a long internal spur. However, its scutal ornamentation, 2/2 dental formula, shape of the spur on coxa IV, absence of a postanal groove, and the absence of spines on tibiae II to III make it possible to differentiate *A. boeroi* from the other two species.

Females of *A. boeroi* and *A. neumanni* share a broader than long, dorsally rectangular *basis capituli*, coarse, ivory-coloured, slightly curved notal setae, and similarly shaped spurs on coxa I, but their distributional pattern of notal setae, 2/2 dental formula, absence of a postanal groove, and absence of spines on tibiae II–III, are characters that clearly distinguish *A. boeroi* females from those of *A. neumanni*.

The nymph of *A. boeroi* resembles that of *A. neumanni* in that it has short and irregularly shaped palpi, a 2/2 dental formula, a broader than long *scutum* with deep cervical grooves that are parallel at their mid-length and then slightly divergent, no marginal groove, *coxa* I with a large external spur and a very minute, rounded, internal spur, and *coxae* II–IV with a small triangular spur. However, the nymph of *A. boeroi* can be separated from that of

Fig. 33 Neighbour-joining condensed tree constructed from 18S rDNA sequences and the Kimura two-parameter distance. Numbers represent bootstrap support generated from 1,000 replications. Only bootstraps >50% are presented. *Abbreviations:* *R.*, *Rhipicephalus*; *Hy.*, *Hyalomma*; *D.*, *Dermacentor*; *Ha.*, *Haemaphysalis*; *A.*, *Ambylomma*; *B.*, *Bothriocroton*; *I.*, *Ixodes*; *O.*, *Ornithodoros*; *Ot.*, *Otobius*; *Ar.*, *Argas*



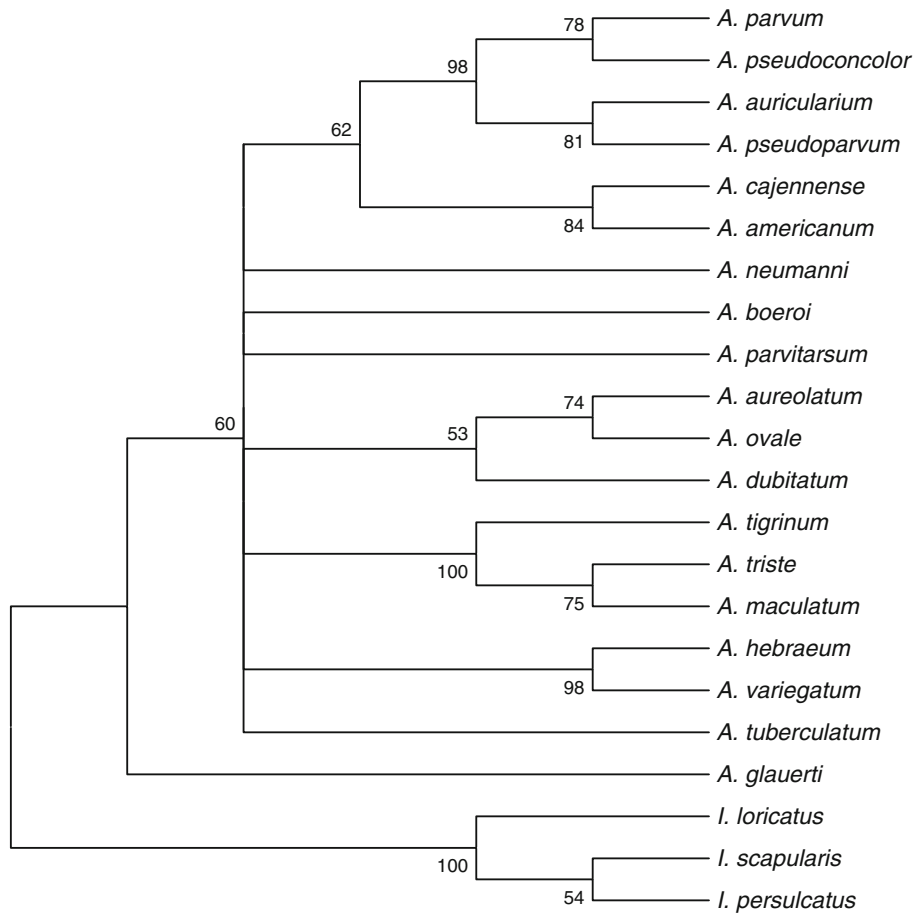


Fig. 34 Neighbour-joining condensed tree constructed from 16S rDNA sequences and the Kimura two-parameter distance. Numbers represent bootstrap support generated from 1,000 replications. Only bootstraps >50% are presented. Abbreviations: *A.*, *Amblyomma*; *I.*, *Ixodes*

A. neumanni because it has a dorsally rectangular *basis capituli* with cornua, orbited, convex eyes located on its lateral scutal angles, a 2/2 dental formula in rows of 6 denticles (*A. neumanni* has denticles in rows of 9 or 10), and the absence of a postanal groove.

The larvae of *A. boeroi*, *A. neumanni* and *A. parvitarsum* have a similar capitular morphology, and those of *A. boeroi* and *A. parvitarsum* have bulging eyes, which distinguish them from those of *A. neumanni*. Larvae of *A. boeroi* are smaller than those of *A. parvitarsum* and have a scutum with a slightly sinuous posterior margin, compared to the broadly rounded posterior scutal margin of the latter species. Thus, the capitular morphology of the larva of *A. boeroi*, its bulging eyes and slightly sinuous posterior scutal margin all serve to distinguish it from

those of other species of *Amblyomma*. We agree with Keirans et al. (1996) that the use of chaetotaxy to separate the larvae of *Metastratia* tick species is not reliable.

Hosts

The Chacoan peccary *Catagonus wagneri* is the principal host of *A. boeroi*, and its distribution is restricted to the semi-arid thorn forest and steppe of the Gran Chaco of Argentina, Paraguay and Bolivia, with most records being from the first two countries (Mayer & Wetzel, 1986). The tick species previously reported from *C. wagneri* are, in Argentina, *A. parvum* (see Nava et al., 2008) and, in Paraguay, *A. cajennense* and *A. parvum* (see Nava et al., 2007). Several new records of ticks infesting *C. wagneri* were

obtained during this study, as *A. cajennense*, *A. neumanni* and *Rhipicephalus microplus* (Canestrini, 1887) were collected from these animals at Rivadavia (these ticks are deposited in the Tick Collection of INTA Rafaela; accession numbers: 1990, 1994, 2000, 2001, 2004, 2005 and 2007).

Historically *A. cajennense* and *A. neumanni* have been collected from the peccaries *Tayassu pecari* and *T. tajacu* in the western Chaco district, including Rivadavia (these ticks are housed in the Tick Collection of INTA Rafaela; accession numbers: 1989, 1992, 1993, 1997, 1999, 2002 and 2008). However, no *A. boeroi* were encountered on these animals. This implies that *A. boeroi* might be a parasite with a high degree of host-specificity for *C. wagneri*, especially considering that this peccary species share its habitat with *T. pecari* and *T. tajacu* (see Mayer & Wetzel, 1986; Taber et al., 1993). If this hypothesis is correct, the distribution of *A. boeroi* should be restricted to that of its preferred host, *C. wagneri*. This and the unique morphology of *A. boeroi* warrant further studies on its biology, host-specificity and distribution.

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