A Review of the Ticks (Acari, Ixodida) of Brazil, Their Hosts and Geographic Distribution - 1. The State of Rio Grande do Sul, Southern Brazil

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A review of the ticks (Acari, Ixodida) of the State of Rio Grande do Sul, southern Brazil, was completed as a step towards a definitive list (currently indicated as 12) of such species, their hosts and distribution. The ticks: Argas miniatus *(poultry)*, Ixodes loricatus *(opossums)*, Amblyomma aureolatum *(dogs)*, A. calcaratum *(anteaters)*, A. cooperi *(capybaras)*, A. nodosum *(anteaters)*, A. tigrinum *(dogs) (Neotropical)* and Rhipicephalus sanguineus *(dogs) (introduced, cosmopolitan, Afrotropical) were confirmed as present, in addition to the predominant,* Boophilus microplus *(cattle) (introduced, pantropical, Oriental). Of the further 18 species thus far reported in the literature as present in the state, but unavailable for examination: only* Ornithodoros brasiliensis *(humans and their habitations) (Neotropical),* Ixodes affinis *(deer) (Nearctic/Neotropical) and* I. auritulus *(birds) (Nearctic/Neotropical/ Afrotropical/ Australasian) are considered likely; 13 species would benefit from corroborative local data but the majority appear unlikely; reports of* A. maculatum (*Nearctic/Neotropical, but circum-Caribbean) are considered erroneous; the validity of* A. fuscum *is in doubt. The very recent, first known report of the tropical* Anocentor nitens *(horses)(Nearctic/Neotropical), but still apparent absence of the tropical* A. cajennense *(catholic) (Nearctic/Neotropical) and the sub-tropical/temperate* Ixodes pararicinus *(cattle) (Neotropical) in Rio Grande do Sul are important for considerations on their current biogeographical distribution and its dynamics in South America. The state has relatively long established, introduced ("exotic"), Old World tick species* (B. microplus, R. sanguineus) *that continue to represent significant pests and disease vectors to their traditional, introduced domestic animal hosts, cattle and urban dogs. There are also indigenous, New World ticks* (A. miniatus, O. brasiliensis, A. aureolatum, A. nitens), *as both long established and possibly newly locally introduced species in the state, that should be considered as potential and emergent pests and pathogen vectors to humans and their more recently acquired, introduced domestic animal hosts; rural poultry, dogs and horses.*

Key words: tick species - Ixodida - Rio Grande do Sul - Brazil

Attention to the pan-tropical cattle tick, *Boophilus microplus*, (Oriental) in the State of Rio Grande do Sul, Brazil, has been extensive due to its considerable economic importance there (estimated losses, 1983, in excess of US$130 million/year; Horn 1985), in common with other sub-tropical and tropical areas of the world into which it has been introduced by man (Hoogstraal 1973a, Sutherst & Maywald 1985). The problem has been exacerbated in the state by the local tradition of the predominant use of highly tick susceptible *Bos taurus* breeds of cattle, averaging between 12-13 million head for beef as well as some dairy production. Only in recent years have there been some trends to crossbred cattle, involving the inclusion of more tick resistant *B. indicus*, although not always directly for reasons of improved tick control (Norton & Evans 1989). Thus *B. microplus* continues to merit priority of attention in research, development, training and extension activities in the state (Evans 1984, 1992a, Evans & Arteche 1984). This is especially in attempts to improve the efficiency of its

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control or, ideally, prevention of its direct debilitating effects as well as its transmission of the causal agents of bovine babesiosis and anaplasmosis (Martins & Corrêa 1995). The repeated ability of this tick to develop resistance to the compounds used as acaricides in its chemical control (Laranja et al. 1988, 1989, Martins et al. 1995b, Farias 1999) stresses the continuing need to fully understand its ecology, physiology and epidemiology (Evans 1989, 1992b). Such knowledge enables the design of practical integrated strategies against the tick and its transmitted diseases in Rio Grande do Sul (Evans 1984, Alves-Branco et al. 1989, Martins et al. 1994, 1995a, Anon 1995, 1998, Kessler & Schenk 1998) and elsewhere.

No extensive review of the state's tick fauna, other than *B. microplus* on cattle, has been attempted since the work of Pinto and Di Primio (1931), Corrêa (1948, 1955) and the series of Freire (1943, 1958, 1967a, 1967b, 1968, 1972) that terminated more than a quarter of a century ago. This is in spite of more recent reports of various tick species in the state (Silva & Gonzales 1972, Oliveira 1973, 1994, Gonzales & Oliveira 1994, Martins & Guglielmone 1995, Sinkoc et al. 1995, 1997), some corrections to previous mis-identifications (Guglielmone et al. 1982) and even reports of two new tick species in the surrounding geographic region (Keirans et al. 1985, Guglielmone et al. 1990). Rio Grande do Sul also forms part of a biogeographical transition zone between tropical and sub-tropical regions of SE South America, with expected similar transitions of tick species' natural distributions and those due to human activities.

There is currently a greatly renewed interest in tick species that parasitise other domestic stock, pets, wildlife and especially man himself to enable their greater protection. Highly economically or emotionally valued animals are receiving more attention from their owners. Modern Brazil witnesses everincreasing contacts between man, pets, livestock and wildlife or their habitats and thus their ticks, so increasing the chances of acquisition of the irritations, toxicoses and anaemias they may cause and the pathogens they may transmit. The last major biogeograhical review of the ticks of Brazil, however, is now almost 40 years old (Aragão & Fonseca 1961). It is wise to know exactly what one has locally so that the relevant veterinary and public health personnel can be as well informed as possible. Such knowledge should include possible changes in pest status or spread of indigenous (Mangold et al. 1986) and introduced ("exotic") (Ribeiro et al. 1997) tick species. The immediate recognition of any previously unrecorded species being "imported" or in the initial stages of their establishment is also vital to implement appropriate quarantine, eradication or control actions. Such periodic reminders (Aragão 1936, Corrêa 1955, Freire 1972) should not be ignored. Clearly, to permit any further, *Rhipicephalus sanguineus* or, perhaps worse, *B. microplus*-like introductions and establishment could prove similarly economically disastrous.

Based on the above concerns, we considered it opportune to initiate a review of the known tick fauna (other than of *B. microplus* on cattle), its biogeographical distribution and host relations in Brazil, in this case of its most southern state, Rio Grande do Sul. We list all reports of tick species, their hosts and locations in the state up to the present time and of unreported material of the authors and some colleagues. These data are also discussed in the light of other biogeographical works in the region. An attempt at a definitive list of tick species of the state, as known at this time, is offered, as is a host-parasite list for these species. It is hoped that further studies on these important obligate ectoparasites will be assisted and encouraged in this manner. The adopted format of reappraisal of information on the known ticks and their hosts on a state by state basis, in collaboration with local specialists, provides a means to achieve fully up-dated, locally applicable reviews in Brazil, that are currently non-existent. A series of such documented state investigations can also be accumulated to constitute the long overdue, national review of the Ixodida.

MATERIALS AND METHODS

New tick collections, representing approximately 1,000 specimens, were obtained between 1977 and 1996 as the result of casual collections by two of the authors (DEE & JRM) and of tick specimens brought to the "Centro de Pesquisa Veterinária Desidério Finamor" (CPVDF) by colleagues and members of the public. The ticks underwent a preliminary identification using published keys: Boero (1957), Aragão and Fonseca (1961), Jones et al. (1972), Guglielmone and Hadani (1985) and Guglielmone and Viñabal (1994). The material was stored in 75% alcohol or Boardman's solution and is available for examination along with detailed catalogue sheets.

Lack of access to the cited "Previously reported material" of other workers has prevented further identification. Our "comments" on each of these species are thus based on the most reasonable personal interpretation of the facts at the present time, and necessarily remain open to further evaluation.

Data on geographic distribution and hosts of the ticks other than in Rio Grande do Sul are taken principally from a bibliographic review (Evans 1978) and a working guide to the principal literature on the taxonomy, geographic distribution and hosts of the ticks of Central and South America and the Caribbean, being prepared for publication by the senior author (DEE). Where possible, mammalian host specific names have been adopted according to Walker (1968) and Silva (1994) and added (in parentheses) after the local popular name if not available or different to the scientific name quoted in the original publication. Attention has been drawn to any divergences encountered over tick species' nomenclature (eg. synonyms and generic status), along with key references in the literature including those of Borges et al. (1998) and Camicas et al. (1998). Other than where especially cited (for *Amblyomma aureolatum* and *Anocentor nitens*), however, we have employed the species' names of the world checklist of the Ixodida by Keirans (1992) for the sake of some consistency. The current paper should thus not be interpreted as an attempt at a definitive taxonomic statement on our part. We have been more concerned to assist in a clearer understanding of the available biogeographical and host information of the ticks of Brazil, commencing with its southernmost state, Rio Grande do Sul.

RESULTS AND DISCUSSION

Our identifications of the initial samples of *Argas miniatus* were confirmed by Drs H Hoogstraal and HY Wassef (7 July 1979), Medical Zoology Department, US NAMRU-3, Cairo, Egypt; part of this material (HH22,060) is deposited in the Harry Hoogstraal Collection (now with the US National Tick Collection, IAP, Georgia Southern University, Statesboro, GA, USA). Identifications of *Amblyomma* species were confirmed or corrected by the third author (AAG), March 1993, and by him at the CPVDF, November 1994 and August 1995. The single known lot of *A. nodosum* from the state (Oliveira 1994) was confirmed (JRM) at the UFRGS, Porto Alegre, March 1999, after comparison with the single known lot of *A. calcaratum* from the state (Martins & Guglielmone 1995), both tick species having been collected off anteaters, *Tamandua tetradactyla*. M/MM, F/FF, N/NN, and/or L/LL denote males/males, female/females, nymph/nymphs and/or larva/larvae, respectively, in the listings of new tick material, followed by its host, location, collection date, collector and (collection reference) for each sample as is available. A biogeographic guide to all the locations in Rio Grande do Sul from which ticks are reported in the text is provided in the Table.

Tick species of Rio Grande do Sul, southern Brazil

Argasidae (the "soft" ticks)

Genus *Argas* Latreille, 1795

Argas miniatus Koch, 1844

New material: 15 MM, 12 FF, 10 NN, from chicken house* in Barra do Ribeiro, 03/01/79, JE Duarte Pinos (RJ Laranja), (DEE200a); 9 MM, 7 FF, 4 NN, from the same chicken house in Barra do Ribeiro, 08/01/79, JE Duarte Pinos (RJ Laranja), (DEE201a); 10 MM, 8 FF, 12 NN, from the same chicken house in Barra do Ribeiro, 08/01/79, JE Duarte Pinos (RJ Laranja), (DEE201b) [9 MM, 8 FF, 12 NN retained, from total of this sample, in the Harry Hoogstraal/US National Tick Collection, IAP, Georgia Southern University, USA (HH22,060)]; 12 MM, 8 FF, 10 NN, from chicken house** in São Luiz Gonzaga, 22/08/77, RJ Laranja, (DEE241a); 45 LL, from chicken house* in Barra do Ribeiro, 03/01/79, JE Duarte Pinos (RJ Laranja), (IPV108); 42 NN, 148 LL, from the same chicken house in Barra do Ribeiro, 03/01/79, JE Duarte Pinos (RJ Laranja), (IPV109); 3 FF, 1 N, from the same chicken house in Barra do Ribeiro, 03/01/79, JE Duarte Pinos (RJ Laranja), (IPV110); 4 MM, 4 FF, 9 NN, from chicken house** in São Luiz Gonzaga, 22/08/77, RJ Laranja, (IPV112); 3 MM, 3FF, 2 LL, from chicken house in Ijuí, 15/03/85, JE Stum (RJ Laranja), (IPV115); 4 MM, 6FF, from chicken house in Ijuí, 10/03/88, JE Stum, (IPV117); 34 LL, from chicken house** in São Luiz Gonzaga, 22/08/77, RJ Laranja, (IPV120); 3 MM, 2 FF, 46 NN, 2 LL, from chicken house* in Barra do Ribeiro, 03/01/79, JE Duarte Pinos (RJ Laranja), (IPV121).

Previously reported material: from *Gallus gallus domesticus* in the state (Freire 1943); chicken houses in Santo Ângelo (Corrêa & Gloss 1953, in Corrêa 1955); "galinha doméstica" (*G. gallus*) in Alegrete, Porto Alegre, Santo Ângelo, Santa Maria and Sarandí (Freire 1968).

Comments: the widespread Neotropical "soft" tick species that has adapted to and can reach pest status on poultry, in rustic conditions, including in Rio Grande do Sul.

Genus *Ornithodoros* Koch, 1844

Ornithodoros brasiliensis Aragão, 1923

New material: none

Previously reported material: from various types of poor quality human habitations, and environs and holes and burrows of *Conepatus* sp. and *Tayassus tajacu*, in São Francisco de Paula (Pinto & Di Primio 1931, in Aragão 1936, Davis 1952, Di Primio 1952); reported as "*Argas brasiliense* Aragão, 1923", a "ground tick" from sheltering

TABLE

Biogeographical guide to locations (or capital of municipal administrative district) in Rio Grande do Sul, Brazil, from which ticks are reported in the text

Location - Sub-region[b]	Latitude S	Longitude W	Altitude (m)	Temperature (C)
Alegrete - I	29 46 47	55 47 15	121	18,6
Arroio Grande - A	**32 12[a]**	**53 05**	**100[a]**	**<17.0[a]**
Barra do Ribeiro - J	**30 15[a]**	**51 20[a]**	**0[a]**	**19.8[a]**
Braga - F	27 40 [a]	53 50	350[a]	19.0[a]
Cacapava do Sul - K	30 30 32	53 29 22	450	16,8
Cacimbinhas (Pinheiro Machado) - K	31 55[a]	53 23[a]	400[a]	<17.0[a]
Canoas - J	**29 55[a]**	**51 10[a]**	**50[a]**	**19.5[a]**
Candelária - C	29 35[a]	52 45[a]	250[a]	19.0[a]
Eldorado do Sul - J	**30 05[a]**	**51 25[a]**	**50[a]**	**19,8**
Encruzilhada do Sul - K	**30 32 35**	**52 31 20**	**427**	**16,5**
Guaíba - J	**30 04 25**	**51 43 42**	**46**	**19,8**
Herval do Sul - K	32 00[a]	53 25[a]	100[a]	<17.0[a]
Ijuí - G	**28 23 17**	**53 54 50**	**448**	**19.0[a]**
Itaquí - H	27 11 45	53 14 01	222	20
Jaguarão - A	32 33 32	53 23 20	50	17,2
Lagoa Vermelha - D	**28 10[a]**	**51 30[a]**	**400[a]**	**16.0[a]**
Lavras do Sul - K	30 45[a]	53 55[a]	400[a]	<17.0[a]
Pedras Altas - K	31 55[a]	53 50[a]	150[a]	17.0[a]
Pedro Osório - A	31 50[a]	52 50[a]	100[a]	<17.0[a]
Pelotas - A	**31 45 00**	**52 21 00**	**7**	**17,5**
Porto Alegre - J	**30 01 53**	**51 13 19**	**10**	**19,5**
Quaraí - I	30 20[a]	56 20[a]	100[a]	18.0[a]
Rio Grande - B	32 01 44	52 05 40	5	18,1
Rio Pardo - J	29 55[a]	52 20[a]	50[a]	19.5[a]
Rosário do Sul - I	54 55[a]	30 15[a]	100[a]	19.0[a]
Santa Maria - J	**29 41 25**	**53 48 42**	**95**	**19.2**
Santana do Livramento - I	**30 53 18**	**55 31 56**	**210**	**17.8**
Santa Vitória do Palmar - C	**33 31 14**	**53 21 47**	**5**	**16.6**
Santa Ângelo - H	28 18 14	54 15 52	289	19.6
Sapucaia do Sul - C	29 50[a]	51 05[a]	100[a]	19.5[a]
São Francisco de Assis - H	29 30[a]	55 10[a]	100[a]	18.5[a]
São Francisco de Paula - D	29 20 00	51 30 21	912	14.4
São Gabriel - I	30 20 27	54 19 01	124	18.5
São Jerônimo - J	29 55[a]	51 45[a]	50[a]	19.5[a]
São Luiz Gonzaga - H	**28 23 27**	**54 58 18**	**260**	**19,7**
Taquara - C	29 45 00	50 45 00	35	19,4
Três Passos - F	27 25[a]	53 55[a]	250[a]	19.5[a]
Tupanciretã - G	29 00[a]	53 50[a]	400[a]	18.5[a]
Uruguaiana - I	29 45 23	57 05 12	74	19,7
Vacaria - D	**28 33 00**	**50 42 21**	**960**	**15,2**
Viamão - J	**30 05[a]**	**51 05[a]**	**10[a]**	**19.0[a]**

Bold print denotes location with new or including new and/or confirmed tick material; *a*: denotes estimated values only available; latitude and longitude estimates from map, Ipagro, RS, 1969; altitude is metres (m) above sea level (estimates from map, Relêve, Porto Alegre, RS, 1971); temperature is 1931-1960 average annual mean (centigrade - C), estimates and average annual total rainfall (1100-2000 isohyets) from Ipagro, RS, 1969; Guaíba tick records prior to 1988 may be from what is now known as the municipal administrative district of Eldorado do Sul, RS; *b:* denotes geographical sub-regions of the State of Rio Grande do Sul (after Freire 1967) as: A: Southeastern Escarpment; B: Coastline; C: Lower Northeastern Escarpment; D: Sierra Highlands; E: Upper Northeastern Escarpment; F: River Uruguay Uplands; G: Intermediate Plateau; H: The Missions; I: Southwestern Hilly Lowlands; J: Central Depression; K: Southeastern Sierra. Aragão (1936) also reported ticks from Ilha do Curral and Rio Velha, apparently in Rio Grande do Sul, but we have been unable to identify these locations.

places of "porco do mato" (*T. tajacu*), "zorrilho" (*Conepatus chinga*), significant pest of humans (*Homo sapiens*) and in cellars of human habitations, from São Francisco de Paula, and artificially reared on laboratory guinea pigs (*Cavia porcellus*) (Corrêa 1955).
Comments: well documented as abundant only in this single, very distinctive (low winter temperature) climatic location, this Neotropical tick merits renewed phylogenetic, ecological and bio-medical attention. The spirochaete, *Borrelia brasiliensis* has been isolated from this tick (Davis 1952). A recent visit to São Francisco de Paula by two of the authors (DEE & JRM), 04/11/99 and interviews with local field veterinarians confirmed that this tick, commonly known to them as the "Mouro", is still found at this location and its bites cause severe irritation to humans. Current foci of this tick include cellars of abandoned rustic houses where free-range domestic and wild pigs sometimes take shelter. [This species has sometimes been referred to as a "dog" tick in the literature, apparently arising from a mis-spelling and subsequent translation of "cão" (dog) rather than "chão" (ground, floor) of the original reports in Portuguese].

Ornithodoros rostratus Aragão, 1911

New material: none
Previously reported material: from "cão" (*Canis familiaris*) in Taquara (Freire 1967b).
Comments: further, corroborative evidence is highly desirable before definitive conclusions can be reached as to the presence of this Neotropical tick in the state; possibly it is *O. brasiliensis*.

Ixodidae (the "hard" ticks)

Genus *Ixodes* Latreille, 1795

Ixodes affinis Neumann, 1899

New material: none
Previously reported material: 1F, from *Mazama gouazoubira* in Pinheiro Machado, —/—/1929, (IBSP 890) (Barros-Battetsi & Nysak 1999).
Comments: although only represented by this single specimen, it was found on a typical host, Cervidae, as throughout much of Central and South America, from where it has also been reported as its synonym, *I. aragaoi* Aragão & Fonseca, 1952.

Ixodes auritulus Neumann, 1904

New material: none
Previously reported material: 1F, from *Thamnophilus ruficapillus* in Herval do Sul, —/09/97, MB Labruna, (USP-FMVZ 77) (Arzua & Barros-Battetsi 1999).
Comments: although only represented by this single specimen, it was found on a typical Passeriforme bird host as throughout much of Central and South America.

Ixodes loricatus Neumann, 1899

New material: 2 FF, from *Didelphis marsupialis* in Pelotas, (DEE215/IPV21); 1 M, from *D. marsupialis* in Eldorado do Sul, 05/12//79, DE Evans/RJ Laranja, (DEE217); 1 M, from *D. marsupialis* in Eldorado do Sul, 03/08/81, L Borba, (DEE309/IPV38); 1 M, from *D. marsupialis* in Guaíba, 11/05/81, F Anderson, (IPV17); 1 F, from *D. marsupialis* in Guaíba, 04/05/81 (IPV28).
Previously reported material: in Rio Velha (in Aragão 1936); didelphids, "ratos" (*Rattus rattus*?), "preás silvestres" (wild guinea pigs) (*Cavia* sp.), "gato" (*Felis catus*), in the state, and from "gambá" (*Didelphis* sp.) in Pelotas (Corrêa 1955); from *F. catus domesticus* in the state (Freire 1943).
Comments: this Neotropical tick appears to be the usual species of *Ixodes* successfully infesting *Didelphis marsupialis* in the state, with casual incidence on other mammals of similar habits in common habitats.

Genus *Amblyomma* Koch, 1844

Amblyomma albopictum Neumann, 1899

New material: none
Previously reported material: from "tatús" (armadillos) in Guaíba (Freire 1972).
Comments: as this Neotropical tick seems to be infesting principally various species of iguana, in Central America, the Caribbean and northern South America and there is only this single report documented for Rio Grande do Sul, its presence here must necessarily remain in some doubt.

Amblyomma aureolatum (Pallas, 1772)

New material: 2 FF, from *C. familiaris* in Guaíba, 20/11/79, Sr Artémio/RJ Laranja, (DEE216); 2 FF, from *C. familiaris* in Guaíba, 02/01/80, JP Baptista, (DEE218); 1 M, from *C. familiaris* at IPVDF, Eldorado do Sul, 25/01/80, JP Baptista, (DEE235); 1 F from *C. familiaris* in Eldorado do Sul, 08/92, AR Pogetti, (IPV01); 1 F from *C. familiaris* in Guaíba, RJ Laranja, 14/02/82, (IPV04); 1F from *Felis catus* in Eldorado do Sul, 12/92, AR Pogetti, (IPV08); 1F from *C. familiaris* in Guaíba, 22/08/76, RJ Laranja, (IPV09); 1F from *F. catus* in Eldorado do Sul, 03/93, AR Pogetti, (IPV13); 1 F from *F. catus*, Eldorado do Sul, 12/92, AR Pogetti, (IPV18); 1 M, 1 F from *C. familiaris* in Guaíba, 06/09/89, RJ Laranja, (IPV24); 3 FF from *C. familiaris* in Guaíba, 10/12/80, RJ Laranja, (IPV26); 1 F from *C. familiaris* on Fazenda Santa Marta, Guaíba, 05/01/80, RJ Laranja, (DEE231/IPV27); 2 FF from *C. familiaris* in Viamão, 02/12/84, (IPV33); 1 F from *C. familiaris* in Eldorado do

Sul, 12/92, AR Pogetti, (IPV35); 3 MM, 1 F, from *C. familiaris* in Encruzilhada do Sul, 20/11/82, RJ Laranja, (IPV36); 3 M from *Dusicyon thous* in Vacaria, 03/83, RJ Laranja & JR Martins, (IPV42); 1 M from *F. catus* in Eldorado do Sul, 04/93, AR Pogetti, (IPV44); 1 M from *F. catus* in Eldorado do Sul, 05/95, AR Pogetti, (IPV45); 1 M, 3 FF from *D. thous* in Guaíba, 12/11/85, RJ Laranja, (IPV47); 1 M from *F. catus* in Eldorado do Sul, 03/93, AR Pogetti, (IPV48); 1 M from *F. catus* in Eldorado do Sul, 12/92, AR Pogetti, (IPV49); 1 F from *F. catus* in Eldorado do Sul, 05/93, AR Pogetti, (IPV50); 1 M from *F. catus* in Eldorado do Sul, 06/93, AR Pogetti, (IPV51); 1 M from *C. familiaris* in Eldorado do Sul, 06/93, AR Pogetti, (IPV52); 1 F from *F. catus* in Eldorado do Sul, 06/93, AR Pogetti, (IPV57); 1 M from *C. familiaris* in Guaíba, 05/04/82, PJ Baptista, (IPV59); 1 M from *F. catus* in Eldorado do Sul, 06/93, AR Pogetti, (IPV61); 1 F from *F. catus* in Eldorado do Sul, 12/92, AR Pogetti, (IPV63); 1 F from *F. catus* in Eldorado do Sul, 12/92, AR Pogetti, (IPV67); 1 M from *F. catus* in Eldorado do Sul, 04/93, AR Pogetti, (IPV68); 1 M from *F. catus* in Eldorado do Sul, 12/92, AR Pogetti, (IPV70); 1 M from *F. catus* on Fazenda Santa Marta, Guaíba, 02/01/80, RJ Laranja, (DEE230/IPV71); 1 F from *F. catus* in Eldorado do Sul, 10/92, AR Pogetti, (IPV73); 1 F from *F. catus* in Eldorado do Sul, 12/92, AR Pogetti, (IPV75); 1 M from *F. catus* in Eldorado do Sul, AR Pogetti, 03/93, (IPV79); 2 FF from *C. familiaris*, 01/93, JR Martins, (IPV80); 1 F from *F. catus* in Eldorado do Sul, 03/93, AR Pogetti, (IPV82); 1 M from *F. catus* in Eldorado do Sul, 12/92, AR Pogetti, (IPV84); 1 F from *F. catus* in Eldorado do Sul, 12/92, AR Pogetti, (IPV85); 1 F from *F. catus* in Eldorado do Sul, 03/93, AR Pogetti, (IPV86); 1 F from *F. catus* in Eldorado do Sul, 03/93, AR Pogetti, (IPV87); 1 F from *F. catus* in Eldorado do Sul, 12/92, AR Pogetti, (IPV89); 1 F from *F. catus* in Eldorado do Sul, 12/92, AR Pogetti, (IPV91); 1 F from *F. catus* in Eldorado do Sul, AR Pogetti, 12/92 (IPV92); 1 F from *C. familiaris* in Porto Alegre, 08/94, AA Guglielmone, (IPV103); 1 F from *C. familiaris* in Eldorado do Sul, 03/93, AR Pogetti, (IPV114); 1 F from *F. catus* in Eldorado do Sul, 30/11/94, AR Pogetti, (IPV122); 1 M from *C. familiaris* in Eldorado do Sul, 12/12/94, D Borba, (IPV123)

Previously reported material: from "cão" (*C. familiaris*) (Corrêa 1955); from *C. familiaris* in Arroio Grande, Pelotas, and Três Passos (Freire 1972), Pelotas (Oliveira 1973), Porto Alegre (Freire 1972, Ribeiro et al. 1997) and Rio Grande do Sul (Silva & Gonzales 1972), and from "graxaim" ("*Canis brasiliensis*") (*Dusicyon thous*/*D gymnocercus*?) in Arroio Grande and Encruzilhada do Sul (Freire 1972), from "gato" and "gato doméstico" (*F. catus*) in the state (Corrêa 1948, Silva & Gonzales 1972) and in Jaguarão (Freire 1972), and "guaxinim / mão pelada" (*Procyon cancrivorus*) in Três Passos (Freire 1972).

Comments: previously reported material of *A. ovale* on dogs (*C. familiaris*) may be or include material of the Neotropical tick species, *A. aureolatum*. The synonymy of *A. aureolatum* and *A. striatum* Koch, 1844, has been reviewed (Guglielmone & Viñabal 1994). *A. aureolatum* has been adopted here, due to its greater use amongst South American workers based on its precedence, despite it being cited as *A. striatum* in the world checklist of valid tick species of Keirans (1992) to which we have generally adhered. Camicas et al. (1998) list *A. striatum* as a synonym of *A. aureolatum*. From the material and reports received at the CPVDF, Eldorado do Sul, RS, our (DEE & JRM) personal impression is that this tick is becoming increasingly common on domestic dogs that live in or have access to rural environments. Its vector potential for pathogens to dogs appears to be unknown.

Amblyomma auricularium (Conil, 1878)

New material: none

Previously reported material: from "tatús" (armadillos) in Arroio Grande and Uruguaiana (Freire 1972).

Comments: a Neotropical tick infesting principally various species of armadillos, throughout this Faunal Region and therefore possibly also present in Rio Grande do Sul. More samples are of interest to attempt to corroborate the reports from this state.

Amblyomma brasiliense Aragão, 1908

New material: none

Previously reported material: from "mulita" ("*Dasypus septemcinctus*") (*D. novemcinctus*?) in Rio Grande (Corrêa 1955).

Comments: a common Neotropical tick species, but on *Tayassus* (*Tayassu*) *tajacu*, humans and to a lesser extent "*Tayassus albirostris*" (*Tayassu pecari*), "*Tapyrus americanus*" (*Tapirus terrestris*) and *Hydrochoerus capivara* (*H. hydrochaeris*) in other regions of Brazil (Aragão 1936).

Amblyomma cajennense (Fabricius, 1787)

New material: none

Previously reported material: from *Hydrochoerus hydrochaeris* in Herval do Sul and Jaguarão (Freire 1972); from "cão" (*Canis familiaris*) (Corrêa 1955), in Alegrete, São Francisco de Assis (Freire 1967b, 1972); from "suino" (*Sus scrofa*) (Corrêa 1955) and "porco" (*S. scrofa*) (Freire 1967b); in Pedras Altas (or Granja de Pedras Altas, Cachimbinhas?) and Porto Alegre (in Aragão 1936).

Comments: despite being the principal Neotropical *Amblyomma* species encountered throughout Brazil, it was considered to be of "low occurrence" in Rio Grande do Sul (Corrêa 1955). It is, however, here suspected to be *A. cooperi*, when on *H. hydrochaeris* and *S. scrofa* (?), and *A. aureolatum*, when on *C. familiaris*.

Amblyomma calcaratum Neumann, 1899

New material: 12 MM and 5 FF from *Tamandua tetradactyla* in Vacaria, 01/03/93, JR Martins/JJ Bangel (IPV31, 39, 46, 54, 56, 58, 65) (Martins & Guglielmone 1995).
Previously reported material: none
Comments: this is the first known report for this Neotropical tick species in Rio Grande do Sul; possibly this is also its most southern known location (28.30S, 50.56W, 955m). An isolated report is available (Boero & Delpietro 1971) of its presence in Iguazú, Misiones, Argentina (approximately 26S, 54W, 0-200m).

Amblyomma cooperi Nuttall & Warburton, 1908

New material: 1 F, 6 NN, 1 L, from *Hydrochoerus hydrochaeris* in São Diego, Santana do Livramento, 31/08/80, O Bandeira (Instituto Veterinário), (DEE303); 1 M, 1 F, 3 NN (moulted to 1 M, 2 FF, in incubator), from *H. hydrochaeris* Arroio Espinilho, (S do Livramento), 14/10/80, (DEE305a & 305b); 3 MM, 18 FF, from *H. hydrochaeris* on Fazenda Santo Antonio, Sarandi (S do Livramento), 7º Distrito, 21/8/81, O Bandeira (JA Simões Pires Neto), (DEE306 & 307); 1 M, 1 F, 37 NN, from *H. hydrochaeris* on Fazenda Santo Antonio, (S do Livramento), 7º Distrito, 19/07/81, M Simões Pires, (DEE308); 3 FF, from *H. hydrochaeris* on Fazenda Santo Antonio, (S do Livramento), 7º Distrito, 01/11/81, JA Simões Pires Neto, (DEE313); 2 MM, 1 F, 8 NN, from *H. hydrochaeris* in Arroio Grande, 06/06/82, RJ Laranja, (IPV77); 1 M, *H. hydrochaeris*, RM Gloss, (IPV98); 2 FF, from *H. hydrochaeris* in Santa Vitória do Palmar, 01/08/94, JR Martins, (IPV101).
Previously reported material: from "capivara" ("*Hydrochoerus capibara*") (*H. hydrochaeris*) in Arroio Grande (Corrêa 1955); from *H. hydrochaeris* in Santa Vitória do Palmar (Gonzales & Oliveira 1994) and, as *A. lutzi* Aragão, 1908 (synonym), in Uruguaiana (Freire 1972) and in Taim, Rio Grande (Sinkoc et al. 1995) and as *A. cooperi* there (Sinkoc et al. 1997).
Comments: this is the well-known Neotropical tick of capybaras throughout South America. There has been some tendency for this tick to be confused with "*Amblyomma cajennense*" as a tick of *H. hydrochaeris* in Rio Grande do Sul. This may partly explain why it has not been found, at least occasionally or "accidentally", infesting especially horses, but also cattle, other domestic stock, pets and humans, as would be expected for *A. cajennense* in more tropical regions nearby [see comment; Walker (& Olwage) 1987] and of the Neotropics at large. *A. cooperi* is used here to comply with the world checklist of Keirans (1992). Camicas et al. (1998) list both *A. cooperi* and *A. lutzi* as synonyms of *A. dubitatum* Neumann, 1899, that we have found to be very little used in the Central and South American and Caribbean literature.

Amblyomma fuscum Neumann, 1907

New material: none
Previously reported material: from "lagarto" (a lizard; *Lacertideo* sp.?) in Rio Velha (?), in Ilha do Curral (?) (in Aragão 1936); and from "tatú" (an armadillo) and "cão" (*Canis familiaris*) (Corrêa 1955).
Comments: *A. fuscum* was included in the list of the ticks of Brazil by Pinto (1945), although he indicated that the report of Aragão (1936) was of incorrectly identified material. *A. fuscum* was not included in the world checklist of valid tick species of Keirans (1992) but appeared in that of Camicas et al. (1998).

Amblyomma humerale Koch, 1844

New material: none
Previously reported material: from "cão doméstico" (*Canis familiaris*) in Jaguarão (Freire 1972).
Comments: as other locations reported for this Neotropical tick species tend to be of more Central and northern South America and there is only this single report documented for Rio Grande do Sul, the presence of *A. humerale* here must necessarily remain in some doubt.

Amblyomma incisum Neumann, 1906

New material: none
Previously reported material: from "cão doméstico" (*C. familiaris*) in Arroio Grande (Freire 1972).
Comments: as other locations reported for this Neotropical tick species tend to be of more northern and tropical South America and principally on tapirs and there is only this single report documented for Rio Grande do Sul, the presence of *A. incisum* here must necessarily remain in some doubt.

Amblyomma maculatum Koch, 1844

New material: none
Previously reported material: from *C. familiaris* in Jaguarão, Pedras Altas, São Francisco de Assis (Freire 1967b, 1972) and Cacimbinhas* (Pinto & Di

Primio 1931); from "guarachaim" (*Chrysocyon brachyurus*?) and "nosso cão" (*C. familiaris*) (Corrêa 1955); and *Felis catus domesticus* in the state (Freire 1943) and in Pedras Altas (Freire 1972) and Porto Alegre (in Freire 1967b); in Pedras Altas (or Granja de Pedras Altas, Cachimbinhas*?) (in Aragão 1936).
Comments: previously reported material of this Neotropical tick species is suspected to be predominantly *A. tigrinum*, or possibly some examples of *A. triste*, in Rio Grande do Sul (Kohls 1956, Guglielmone et al. 1982). The geographic distribution of this "Gulf Coast Tick" is well established as being circum-Caribbean; it would thus be difficult to encounter it in such a southern location as this state.

Amblyomma nodosum Neumann, 1899

New material: none
Previously reported material: from *Tamandua tetradactyla* in Lagoa Vermelha (Oliveira 1994).
Comments: whereas this is apparently the first and only report of this tick species in Rio Grande do Sul, it has been documented as present in many Neotropical countries, including Brazil, on anteaters. Further evidence of this Neotropical tick species in the state is thus highly desirable. One of us (JRM) was able to compare the original material (Oliveira 1994) with our own material (Martins & Guglielmone 1995), from specimens of *T. tetradactyla* from Rio Grande do Sul, and confirmed them as being the two different tick species.

Species *Amblyomma ovale* Koch, 1844

New material: none
Previously reported material: from *C. familiaris* in Alegrete, Porto Alegre, Santa Vitória do Palmar, Viamão, Jaguarão (Freire 1967b, 1972), Pelotas (Oliveira 1973) and Cacimbinhas* (Pinto & Di Primio 1931); from "graxaim" ("*Canis brasiliensis*") (*Dusicyon thous*/*D. gymnocercus*?) in São Francisco de Assis and Guaíba (Freire 1972) and São Francisco de Paula (Freire 1958); and "Grachaim" (*Pseudolopex = D. gymnocercus*) (in Freire 1967b); as *A. fossum* Neumann, 1809 from *C. familiaris* in the state (Freire 1943) and "cão" and "cão doméstico" (*C. familiaris*) in the state (Corrêa 1948) and in Porto Alegre (Corrêa 1955); in Pedras Altas (or Granja de Pedras Altas, Cacimbinhas*?) (in Aragão 1936).
Comments: a Neotropical tick species of carnivores throughout this Faunal region, infesting domestic dogs in more rural environments. *A. fossum* Neumann, 1809 can be considered synonymous with *A. ovale* that is adopted here for use in conjunction with the world checklists of valid tick species (Keirans 1992, Camicas et al. 1998). This previously reported material, above, could be or include *A. aureolatum* and/or *A. tigrinum.*

Amblyomma parvum Aragão, 1908

New material: none
Previously reported material: from "tatús" (armadillos) in Rosário do Sul and São Francisco de Assis (Freire 1972).
Comments: this Neotropical tick species is very similar to *A. pseudoparvum* Guglielmone, Mangold & Keirans, 1990 (Guglielmone et al. 1990); both have been reported for the much drier, NW Argentina (Guglielmone & Hadani 1980).

Amblyomma rotundatum Koch, 1844

New material: none
Previously reported material: from "jibóia" (a snake) in Rio Grande do Sul (Silva & Gonzales 1972).
Comments: more material on this unique, parthenogenetic Neotropical tick species would be most welcome to corroborate its presence in the state; it is reported throughout this Faunal Region, including Brazilian and Argentinian locations, on amphibians and reptiles.

Amblyomma scutatum Neumann, 1899

New material: none.
Previously reported material: from "lagarto" (*Tupinambis teguixin*) in Rio Grande (Corrêa 1955); from "lagarto" (a lizard) in Guaíba (Freire 1972).
Comments: this Neotropical tick species has also been generally observed as of "lagartos" (lizards) and "cobras" (snakes) and occasionally of "aves" (birds) and "gambás" (opossums) (Pinto 1945). It is also possible that these may include samples of *A. goeldii* (see *Amblyomma* sp. similar to *A. goeldii* Neumann, 1899; below).

Amblyomma tigrinum Koch, 1844

New material: 1 F, from *C. familiaris* in Eldorado do Sul, 27/01/79, RJ Laranja, (DEE203); 1 N (moulted to M in incubator), from "perdiz" (*Rynchotus rufescens*?) in Upamaroti, Santana do Livramento, 28/08/80, Federal Police/JA Simões Pires Neto, (DEE302); 1 M, 1 F, from *C. familiaris* in São Diago, S do Livramento, 31/08/80, O Bandeira, (DEE304); 3 FF, from *D. thous* in Guaíba, 28/08/82, RJ Laranja, (IPV02); 1 F from *C. familiaris* in Guaíba, 19/07/82, RJ Laranja, (IPV06); 2 FF from *C. familiaris* in Guaíba, 05/12/80, RJ Laranja, (IPV30); 1 F from *C. familiaris* in S do Livramento, 02/01/82, JR Martins, (IPV34); 1 M, 1 F, from *C. familiaris* in S do Livramento, 09/93, JR Martins, (IPV60); 5 MM from *C. familiaris* in Guaíba, 14/02/82, RJ Laranja, (IPV62); 1 M, from hu-

man (*Homo sapiens*) in Guaíba, 09/01/83, RJ Laranja, (IPV64); 1 F from *D. thous* in Vacaria, 01/09/83 (IPV72); 1 M from *C. familiaris* in S do Livramento, 02/01/82, JR Martins, (IPV76); 2 FF from *D. thous* in Guaíba, 28/08/82, RJ Laranja, (IPV118).
Previously reported material: from "cão doméstico" (*C. familiaris*) in Alegrete, Arroio Grande, Caçapava do Sul, Itaquí, Jaguarão, Lavras do Sul, Santana do Livramento, Pedro Osório, Rosário do Sul, São Francisco do Assis, São Gabriel, Uruguaiana (Freire 1972), Pelotas (Oliveira 1973) and Rio Grande do Sul (Silva & Gonzales 1972); from "graxaim" ("*Canis brasiliensis* ") (*D. thous*/*D gymnocercus*?) in Encruzilhada do Sul, Jaguarão and Pedro Osório (Freire 1972); from *F. catus* in Jaguarão (Freire 1972); and from *H. hydrochaeris* in Taim, Rio Grande (Sinkoc et al. 1995, 1997).
Comments: this Neotropical tick species has been confused with *A. maculatum* in some nearby regions (Guglielmone et al. 1982).

Amblyomma triste Koch, 1844

New material: none
Previously reported material: from "cão" (*C. familiaris*) in Jaguarão (Freire 1967b). This species has been described "as the first report in the literature" from *H. hydrochaeris* in Taim, Rio Grande (Sinkoc et al. 1995, 1997).
Comments: this Neotropical tick species has been reported from humans (*H. sapiens*) and dogs (*C. familiaris*) in Delta del Paraná, Provincia Bs As, Argentina (Ivancovich 1980). More material, especially on wild carnivores, would be more convincing as to the presence of this species in Rio Grande do Sul.

Amblyomma species, similar to *A goeldii* (Neumann, 1899)

New material: 3 MM, 2 FF, from "lagarto" (lizard) in Rio Grande, (DEE214/HH39,930), (1 M, 1 F to Dr JE Keirans, USA, but unable to confirm (DEE214/RML121973); 6MM, 4FF, from "lagarto" (lizard) in Rio Grande, (IPV100), (1M, 2FF to Dr J E Keirans, USA, but unable to confirm; IPV100/RML121974).
Previously reported material: none
Comments: if *A. goeldii*, it would be the first known report for this Neotropical tick species in Rio Grande do Sul and also its most southern known location.

Amblyomma species:

New material: none
Previously reported material: from *Rynchotus rufescens* in Itaquí and Porto Alegre (Freire 1972).
Comments: none.

Genus *Haemaphysalis* Koch, 1844

Haemaphysalis juxtakochi Cooley, 1946

New material: none
Previously reported material: Reported as *H. kohlsi* Aragão & Fonseca, 1951, from "veado virá" or "veado pardo" (*Mazama* sp.) in Arroio Grande (Freire 1972)
Comments: more material of this Nearctic/Neotropical "deer" tick is needed to support the above isolated report.

Haemaphysalis leporispalustris (Packard, 1869)

New material: none
Previously reported material: *Mazama americana* in Três Passos (Freire 1972)
Comments: more material of this Nearctic/Neotropical "rabbit" tick would be preferable to support the above evidence of this species as present in Rio Grande do Sul, suggested by this unusual host record.

Genus *Anocentor* Schulze, 1937

Anocentor nitens (Neumann, 1897)

New material: 3 MM, possibly "imported" on *Equus caballus* in Viamão, —/05/99, L Ferreiro, identified by CM Barcellos (personal communication, Professor CM Barcellos, UFRGS, Porto Alegre, RS, to JRM, Eldorado do Sul, RS, 09/09/99) (confirmed, DEE & JRM, UFRGS, 01/03/00).
Comments: the widespread and extremely common, Nearctic/Neotropical tick, whose principal contemporary hosts are horses and other introduced equines (Evans 1978, Yunker et al. 1986), but whose known geographic distribution was, until the above report, considered to be limited north of Rio Grande do Sul in Brazil. It had previously been documented in the states of Brazil as far south as around the 26th latitude, in southern Paraná (Falce et al. 1983) and recently reported for the first time (Bellato et al. 1999) as present at least in the NE region of Santa Catarina, thus to around 26.30S, 48.30W. It has been found in the NW of Argentina, as far south as 23.05S, 64.25W (Mangold et al. 1983) and later to 23.50S, 64.47W (Mangold et al. 1986). The Argentinian workers were of the impression that *A. nitens* is still in the process of spreading southwards in their country. There is thus now increasing evidence that this is also occuring in Brazil. Its possible recent local introduction into Rio Grande do Sul merits close and urgent animal health attention, particularly with respect to its potential for permanent establishment, as a vector of equine babesiosis (*Babesia caballi*) and possibilities for dissemination especially through the more sensitive and mobile, commercially valuable of horse breeds.

This tick has been extensiviely cited as a synonym of *Dermacentor nitens*, its one-host life cycle in itself not being considered sufficient to grant it separate, monospecific, generic status. Unlike another species, *Dermacentor albipictus*, with a similar such habit, however, *Anocentor nitens* has further, unique morphological characteristics that warrant its taxonomic separation. Such generic status has again been recently argued by such as Borges et al. (1998). They have even proposed it as appearing to be more closely phylogenetically related to *Rhipicephalus sanguineus* (introduced from the Afrotropical Faunal Region) than to some more local *Dermacentor* species (Nearctic, and intruders into the Neotropics). Camicas et al. (1998) listed it as *A. nitens*, whereas it remained cited as *D. nitens* in the world checklist of valid tick species of Keirans (1992) and in the SEM atlas of New World *Dermacentor* species of Yunker et al. (1986).

Genus *Rhipicephalus* Koch, 1844

Rhipicephalus sanguineus (Latreille, 1806)

New material: 8 MM, 3FF, 39 NN, from *C. familiaris* in Porto Alegre, 10/12/79, S Lima (RJ Laranja) (DEE202a, 202b); 1 M, 1 F, from *C. familiaris* in Porto Alegre (?), 19/12/79, Dr Robinson (?) (DEE236); 2 MM, 1 F, 9 NN, in Santana do Livramento, 01/88, H Pedroso, (DEE243); 6 MM, 7 FF, 6 NN from *C. familiaris* in Guaíba, 01/04/82, RJ Laranja, (IPV03); 1 M from *C. familiaris* in Porto Alegre, 12/12/84, RJ Laranja, (IPV12); 1 F from *C. familiaris*, in Porto Alegre, 11/92 (IPV22); 2 MM, 2 FF from *C. familiaris* in Porto Alegre, 03/94 (IPV29); 2MM, 1F, 3NN from *C. familiaris* in Porto Alegre, 15/03/81, H Bruchmann, (IPV32); 4 FF from *C. familiaris* in S do Livramento, 19/09/85, JR Martins, (IPV43); 13 MM, 2 FF from *C. familiaris* in Eldorado do Sul, 11/93 (IPV83); 4 MM 2 FF from *C. familiaris* in Eldorado do Sul, 11/93 (IPV88); 15 MM, 1 F from *C. familiaris* in Porto Alegre, 03/12/92, I Santos, (IPV97); 3 MM from *C. familiaris* in Porto Alegre, 1983, C Pianta, (IPV99); 12 FF from *C. familiaris* in Eldorado do Sul, 10/08/94, JR Martins, (IPV102); 8 FF from *C. familiaris* in Eldorado do Sul, 08/94, JR Martins, (IPV105); 1 M, 2 FF from *C. familiaris* in Porto Alegre, 10/11/93 (IPV106); 20 MM from *C. familiaris* in Eldorado do Sul, 30/08/94, JR Martins, (IPV107); 1 M from *C. familiaris* in Eldorado do Sul, 12/12/94, D Borba, (IPV124); 11 FF from *C. familiaris* in Eldorado do Sul, (IPV111); 2 MM, 1 F from *C. familiaris* in Canoas, 08/09/95, VH Ceresér, (IPV130); 40 NN from *C. familiaris* in Porto Alegre, 02/12/95, BL Corrêa, (IPV132); 2MM, 2FF from *C. familiaris* in Porto Alegre, 28/03/96, M Pereira, (IPV134); 2 MM, 2FF from *C. familiaris* in Porto Alegre, 22/03/96, J Rosa, (IPV135); 17 FF from *C. familiaris* in Eldorado do Sul, 09/10/96, I Lopez, (IPV138); 16 MM from *C. familiaris* in Eldorado do Sul, 09/10/96, I Lopez, (IPV139); 14 NN from *C. familiaris* in Eldorado do Sul, 09/10/96, I Lopez, (IPV140); 1 M, 2FF, 1N from *C. familiaris* in Guaíba, 11/12/96, J Santos, (IPV143).

Previously reported material: from "cão" (*C. familiaris*) in the state (Freire 1943, Corrêa 1948) and from *C. familiaris* in São Francisco de Paula (Freire 1958, in 1967b, Corrêa 1954), in Porto Alegre (Aragão 1936, Freire 1972, Ribeiro et al. 1997) and São Francisco do Assis (Freire 1972); from *F. catus domesticus* (Freire 1943, in 1967b).

Comments: the cosmopolitan, introduced, Afrotropical Region tick that by 1907, according to Aragão (1936), had not been reported in Brazil south of São Paulo, being mainly present in the states of Rio de Janeiro and northwards. His 1936 summary, however, reported its presence in the more southern states of Brazil, including Porto Alegre, RS. It seems to have become more evident in recent times as a pest, chiefly on urban dogs, in Rio Grande do Sul; Corrêa (1948) reported only 1/77 (1.29%) of dogs examined in 1947 were infested with *R. sanguineus* and Freire (1972) was still refering to it as relatively rare following his own survey. Ribeiro et al. (1997), however, reported 52.44% of 450 dogs examined in Porto Alegre to be infested with *R. sanguineus* during 1993/94. Dr S Monteiro, Uruguaiana, RS, informed one of us (personal communication to DEE, 27/10/99, XI Seminário Brasileiro de Parasitologia Veterinária, Salvador, BA) that, within the last five years, this tick has changed from being an insignificant to a widespread pest of dogs in this city at the extreme west of Rio Grande do Sul. It is a known vector of canine babesiosis (*Babesia canis*) and ehrlichiosis (*Ehrlichia canis*).

Boophilus Curtice, 1891

Boophilus microplus (Canestrini, 1887)

New material: 1M, 2NN from *Equus caballus* in Guaíba, 01/05/85, (IPV53); 1F, 4NN from *E. caballus* in Eldorado do Sul, 11/11/93, (IPV55). [Observations and samples from cattle (*Bos taurus*, *B. indicus* and *B. taurus* x *B. indicus*) throughout Rio Grande do Sul (unlisted)].

Previously reported material (on non-bovine hosts): from "cavalo" and "eqüinos" (*Equus caballus*) from Rio Grande do Sul (Corrêa 1948, 1955); from *E. caballus* in Jaguarão, Rio Pardo, Alegrete and Caçapava do Sul; from *C. familiaris* in Guaíba, Quaraí and Alegrete (in Freire 1967b); from *Ovis aires* in Tupanciretã and Alegrete, (Freire 1967a, 1972), in

Arroio Grande, Itaqui, Jaguarão, São Jeronimo and Uruguaiana, from *E. caballus* in Alegrete, Arroio Grande, Cendelária, Encruzilhada do Sul, Itaqui, Jaguarão, Lavras do Sul, Livramento, Pedro Osório, Porto Alegre, Rio Pardo, São Francisco de Assis, São Gabriel and Uruguaiana, from *C. familiaris* in Alegrete, Arroio Grande, Braga, Guaíba and Quaraí, from "lebre" ("*Sylvilagus minensis*") (*Lepus capensis*?) in Uruguaiana, and from "veado virá" or "veado pardo" (*Mazama* sp.) in Arroio Grande, Herval do Sul and Encruzilhada do Sul, from "veado galheiro" (*Hippocamelus = Blastocercus dichotomus*) in Sapucaia (do Sul) (Freire 1972) and "veado" in the state of Rio Grande do Sul (Silva & Gonzales 1972); from *O. aires* in Eldorado do Sul and Santana do Livramento (Evans 1984) and from *E. caballus* in Eldorado do Sul (Evans 1984, and unpublished observations 1983/84).

Comments: despite the documented reports of *B. microplus* on non-bovine hosts, including indigenous wildlife species, throughout Rio Grande do Sul, nothing suggests that these be considered as anything but occasional, non-typical contemporary hosts. Sheep have been observed to become relatively heavily "infested" with larval *B. microplus*, grazing in the presence or absence of cattle, but very few of these ticks reached the nymph or adult stages; horses, in pastures infested with the larvae of *B. microplus*, in the absence of bovines, have been observed to present only very low infestations with any stages of these ticks (Evans 1984, and unpublished observations 1983/84). *B. microplus* is thus considered to have retained its effectively high degree of specificity to its contemporary, bovine host since the introduction of this pan-tropical, Oriental region origin tick species into Rio Grande do Sul, as to become a significant "exotic" pest to the local cattle industry.

Host parasite list for the ticks reported from Rio Grande do Sul, southern Brazil

"New/confirmed material"	**M/MM male/males; F/FF female/females; N/NN nymph/nymphs; L/LL larva/larvae**
"Previously reported material"	(?) presence must remain doubtful or unlikely (??) presence considered erroneous (!) validity of tick species in doubt
Class AMPHIBIA	
none	
Class REPTILIA	
Order SAURIA	
"lagarto" (*Tupinambis teguixim*)	*Amblyomma scutatum* (?)
"lagarto" (lizard)	*Amblyomma fuscum* (!) ***Amblyomma nr goeldii* (?) MM, FF** *Amblyomma scutatum* (?)
Order SERPENTES	
"jibóia" (boa constrictor)	*Amblyomma rotundatum* (?)
Class AVES	
Order TINAMIFORMES	
Family Tinamidae	
Rhynchotus rufescens (Red-Winged Tinamou)	*Amblyomma* species
"perdiz" (partridge)	***Amblyomma tigrinum* N**
Order GALLIFORMES	
Family Phasianidae	
"galinha", *Gallus gallus*	*Argas miniatus*
chicken houses	***Argas miniatus* MM, FF, NN, LL**
Order PASSERIFORMES	
Family Formicariidae	
Thamnophilus ruficapillus	*Ixodes auritulus* F

Class MAMMALIA	
Order MARSUPIALIA	
Family Didelphidae	
"gambá" (*Didelphis* sp.)	*Ixodes loricatus*
Didelphis marsupialis	***Ixodes loricatus* M, FF**
Order PRIMATES	
Family Hominidae	
Homo sapiens	*Ornithodoros brasiliensis*
	***Amblyomma tigrinum* M**
Order EDENTATA	
Family Dasypodidae	
"tatú" (armadillo)	*Amblyomma albopictum* (?)
	Amblyomma auricularium (?)
	Amblyomma fuscum (!)
	Amblyomma parvum (?)
"mulita", "*Dasypus septemcinctus*" (*D. novemcinctus*?)	*Amblyomma brasiliense* (?)
Family Mymecophagidae	
"Tamanduá mirim", *Tamandua tetradactyla*	*Amblyomma calcaratum* MM, FF
	Amblyomma nodosum
Order LAGOMORPHA	
Family Leporidae	
"lebre" ("*Sylvilagus minensis*") (*Lepus capensis*?)	*Boophilus microplus*
Order RODENTIA	
Family Hydrochoeridae	
"capybara", *Hydrochoerus hydrochaeris*	*Amblyomma cajennense* (?)
	***Amblyomma cooperi* MM, FF, NN, L**
	Amblyomma cooperi (*A. lutzi*)
	Amblyomma tigrinum
	Amblyomma triste (?)
Family Cavidae	
laboratory guinea pigs (*Cavia porcellus*)	*Ornithodoros brasiliensis*
"preás silvestres" (wild guinea pigs) (*Cavia* sp.)	*Ixodes loricatus*
Family Muridae	
"ratos" (rats; *Rattus rattus*?)	*Ixodes loricatus*
Order CARNIVORA	
Family Canidae	
"cão", "cão doméstico"; (*Canis familiaris*)	*Ornithodoros rostratus* (?)
	Amblyomma cajennense (?)
	Amblyomma fuscum (!)
	Amblyomma humerale (?)
	Amblyomma incisum (?)
	Amblyomma maculatum (??)
	Amblyomma ovale (?)
	***Amblyomma aureolatum* MM, FF**
	***Amblyomma tigrinum* MM, FF**
	Amblyomma triste (?)
	***Rhipicephalus sanguineus*, MM, FF, NN**
	Boophilus microplus
Dusicyon thous	***Amblyomma aureolatum* MM, FF**
	***Amblyomma tigrinum* FF**
"graxaim" ("*Canis brasiliensis*") (*Dusicyon thous*/*D. gymnocercus)*	*Amblyomma ovale* (?)
	Amblyomma aureolatum
	Amblyomma tigrinum

"grachaim" *Pseudolopex* (= *Dusicyon*) *gymnocercus*?	*Amblyomma ovale* (?)
"guarachaim" (*Chrysocyon brachyurus*?)	*Amblyomma maculatum* (??)
"guaxinim/mão pelada" (*Procyon cancrivorus*)	*Amblyomma aureolatum*
Family Felidae	
"gato", "gato doméstico", *Felis catus*	*Ixodes loricatus*
	Amblyomma maculatum (??)
	***Amblyomma aureolatum* M, F**
	Amblyomma tigrinum
	Rhipicephalus sanguineus
Family Mustelidae	
Conepatus sp.	*Ornithodoros brasiliensis*
"zorrilho" (*Conepatus chinga*)	*Ornithodoros brasiliensis*
Order PERISSODACTYLA	
Family Equidae	
"equino", *Equus caballus*	***Boophilus microplus* MM, FF, NN, LL**
	***Anocentor nitens* MM**
Order ARTIODACTYLA	
Family Cervidae	
Mazama gouazubira	*Ixodes affinis* F
"veado pardo" (*Mazama americana*)	*Haemaphysalis leporispalustris* (?)
"veado virá" or "veado pardo" (*Mazama* sp.)	*Haemaphysalis juxtakochi* (?)
	Boophilus microplus
"veado galheiro" ("*Hippocamelus* (= *Blastocercus*) *dichotomus*")	*Boophilus microplus*
Family Bovidae	
"ovino", *Ovis aires*	***Boophilus microplus* MM, FF, NN, LL**
Family Suidae	
"suino", "porco"; (*Sus scrofa*)	*Amblyomma cajennense* (?)
Family Tayassuidae	
"porco do mato" (*Tayassu tajacu*)	*Ornithodoros brasiliensis*

The tick fauna of Rio Grande do Sul as understood at the present time, with predominant host/host group encountered

Tick species (10) confirmed to be present:
- Neotropical tick species (7)
- *Argas miniatus* (poultry)
- *Ixodes loricatus* (opossums)
- *Amblyomma calcaratum* (anteater), *A. cooperi* (capybaras), *A nodosum* (anteater), *A. aureolatum* (synonym; *A. striatum*) (dogs), *A. tigrinum* (dogs)
- Locally introduced (?), Nearctic/Neotropical tick species (1)
- *Anocentor nitens* (synonym; *Dermacentor nitens*) (horses)
- Introduced tick species (2)
- *Rhipicephalus sanguineus* (dogs) (Afrotropical)
- *Boophilus microplus* (cattle) (Oriental)

Further tick species (3) reported to be present
- Neotropical tick species (1)
- *Ornithodoros brasiliensis* (humans)
- Nearctic/Neotropical tick species (1)
- *Ixodes affinis* (deer)
- Nearctic/Neotropical/Afrotropical/Australasian tick species (1)
- *Ixodes auritulus* (birds)

Further tick species (13) reported to be present, but whose presence should remain in some doubt
- Neotropical tick species (9)

Ornithodoros rostratus
Amblyomma albopictum, A. auricularium, A. brasiliense, A. humerale, A. incisum, A. ovale (synonym; *A. fossum*), *A. parvum, A. triste*

Nearctic/Neotropical tick species (4)
Amblyomma cajennense, A. rotundatum
Haemaphysalis juxtakochi (synonym; *H. kohlsi*), *H. leporispalustris*

Tick species (1) reported to be present, but considered erroneous

Nearctic/Neotropical tick species
Amblyomma maculatum

Tick species (1) reported to be present, but taxonomic validity in doubt
Amblyomma fuscum

Rio Grande do Sul as part of a transitional zone from tropical to sub-tropical tick species in Brazil - It is considered that at least several species of ticks are at or nearing their natural biogeographical distribution limits in or near Rio Grande do Sul. As four of these are commonly encountered and at least their adult stages are easily identifiable by the non-specialist, they provide excellent material for "climate-matching" exercises either by using traditional methods or more modern, computer programmes (eg. Climex; Sutherst & Maywald 1985). Their distribution limits are likely to be determined predominantly by climatic conditions rather than host availability. Each of the species either has highly catholic host "preferences" (*A. cajennense*) or utilises hosts that are widely available and highly mobile (*B. microplus, A. nitens, Ixodes pararicinus*) up to and beyond the ticks' geographic limits apparent in this study.

B. microplus, although considered a tropical species, extends over the majority of the state (Evans 1984, 1989, 1992b, Laranja et al. 1986, Gonzales 1992) and south into Uruguay (Nari et al. 1979, Cardozo et al. 1984, Nari 1989, 1990) according to locally suitable climate. The general impression (Evans 1992b) is that its ecological responses to specific climatic factors, especially temperature, seem in-keeping with those expressed in its other southern limit territories of the world (McCulloch & Lewis 1968, Wilkinson 1970, Sutherst & Moorhouse 1972, Sutherst 1983). The vivid reports (Pinto & Di Primio 1931) of finding this now "pan-tropical tick" in such locations as São Francisco de Paula, RS, (long-term average annual mean temperature, 14.4^{o}C), however, should alert us to the importance of less severe conditions frequently existing within the heterogeneity of their local climates. Such infiltration, into apparently unsuitable ecotypes, would provide an intriguing local comparison with the impressive ecological capabilities of "this exceptionally adaptable tick", so wondered at by Hoogstraal (1973b), as apparently "even found on yaks high in the Himalayas and on the Tibetan high plateau"! A recent visit to São Francisco de Paula by two of the authors (DEE & JRM), 04/11/99, and interviews with local field veterinarians confirmed that the tick is considered a significant pest of mixed breed (*Bos taurus* x *B. indicus*) cattle throughout this region; sufficient to warrant the use of around 250 immersion tanks and four acaricide treatments annually for cattle throughout the municipal administrative district around this town. The possible existence of slightly "cold-adapted" tick strains in such locations and/or improved local temperature conditions due to such as "global warming" effects, however, cannot be ruled out definitively without specific such investigations.

It appeared doubtful that *A. cajennense* is currently present in Rio Grande do Sul. There are also no records of this tick from the state in the extensive unpublished records associated with the tick collection held at the Butantan Institute, São Paulo, Brazil (personal verification by DEE and Dr DM Barros-Battetsi, São Paulo, SP, 07/11/99). Climatically, however, the state appears to present some locations within the tick's temperature requirements. *A. cajennense* has been documented as present as far south as 27.46^{o} in Argentina (Mangold et al. 1990). Such a latitude would be equivalent to around mid-Santa Catarina, Brazil. No examples of *A. cajennense* were reported in the survey of horse ticks there (Bellato et al. 1999) and have not so far been found by local specialists on any other hosts examined (Souza, Bellato & Sartor, CAV-Udesc, Lages, SC, Brazil, personal communication, 30 April 1999). However, a very recent single collection (—/09/99, M Lenzi) of adults (17 MM, 1 F) of this tick, from horses, cattle and as free-living stages, from a property in the coastal Itajaí, SC, (26.54^{o}S, 48.40^{o}W, 5 m alt.) has just been identified and reported to one of us (Souza, Bellato & Sartor, CAV-Udesc, Lages, SC, Brazil, personal communication to DEE, 29 September 1999). They also stated that more of such material has been collected (by M Lenzi) and that

the property owner has reported having problems, apparently with this tick, for more than four years. The previous most southerly records of *A. cajennense* on equine hosts in Brazil seem to be those from Paraná (Falce et al. 1983), to around 26ºS.

Anocentor nitens was also encountered on equines in this study in Paraná, as a problem on horses in at least the NE of the Santa Catarina survey (26.30º S) (Bellato et al. 1999). The very recent, single report of Professor CM Barcellos and colleagues, from Viamão, RS, if subsequently found to represent anything more than an apparently locally imported few male specimens, would put it as far south as as 30.05º S, in Brazil. More detailed analysis of the biogeographic distribution and new field surveys for *A. cajennense* and *A. nitens* in Paraná, Santa Catarina and Rio Grande do Sul would be highly illustrative in determining their climatic ecological requirements and very important in practical terms. This is especially to monitor the apparently still increasing spread of such indigenous ticks, associated with their contemporary, introduced equine hosts, thoughout the Neotropical Faunal region, such as seems to be suggested in northern Argentina and now in the south of Brazil. The reports of *A. cajennense* on capybaras in Uruguay (Vogelsang & Cordero 1939) may have been, in reality, infestations by *A. cooperi*.

Ixodes pararicinus Keirans & Clifford, 1985 (Neotropical) (cattle) (Keirans et al. 1985), formerly frequently confused as an introduced *I. ricinus* (Linnaeus, 1758) (Palearctic) (catholic), has been reported from neighbouring regions of Argentina and Uruguay. We are aware of no evidence that *I. pararicinus*, known as the temperate/subtropical "South American cattle tick", is extending its distribution into the extreme of southern Brazil, but vigilance would seem prudent. The presence of *Ixodes affinis* and *I. auritulus* was based only on a single previously reported specimen in each case. They had been found, however, on their typical host types and that are relatively or highly mobile. They have also been reported from the regions surrounding the state. Such data lend credence to the probability that their usual distribution has included or includes Rio Grande do Sul. Being species of the genus *Ixodes*, there are additional important bio-medical justifications to investigate the extent of their establishment in or passage through the state. This genus has been that mainly incriminated in the transmission and dissemination of the emergent Lyme disease within wildlife species reservoirs and to man, caused by the spirochaete, *Borrelia burgdorferi* (*sensu latu*) (Oliver Jr 1996). It is feasible that the other, more well established tick species, already involved to varying degrees at local wildlife/pet/human ecological interfaces, might become involved in the perpetuation of such a pathogen, once introduced by a more typical vector tick. The importance of actively seeking corroborative such material and its examination for potential pathogens is stressed.

More distribution data on *Argas miniatus* and *R. sanguineus* would be highly instructive to attempt to establish their current or absolute southern climatic limits on poultry and domestic dogs, respectively, that are clearly available as hosts beyond Rio Grande do Sul. Rodriguez Gonzalez and Lazaro (1954) have reported *R. sanguineus* from Uruguay. It was also found in Punta Alta, Province of Buenos Aires (38º 53' S) (Guglielmone et al. 1989). The situation is complicated and "masked" in such cases due to these ticks, in part, inhabiting poultry houses and kennels, respectively. These protect them to some extent from the more rigorous general macroclimate, especially low, and potentially limiting, southern winter temperatures. The occurrence of *Ornithodoros brasiliensis* is apparently unique to the cooler, higher altitude regions of Rio Grande do Sul and merits further attention, including its reevaluation as a public health risk (Davis 1952).

The state of Rio Grande do Sul, southern Brazil, has relatively long established, introduced ("exotic"), Old World tick species (*B. microplus*, *R. sanguineus*) that continue to represent significant pests and disease vectors to their traditional, introduced domestic animal hosts; cattle and urban dogs. There are also indigenous, New World ticks (*A. miniatus*, *O. brasiliensis*, *A. aureolatum*, *A. nitens*), as both long established and possibly newly locally introduced species in the state, that should be considered as potential and emergent pests and pathogen vectors to humans and their more recently acquired, introduced domestic animal hosts; rural poultry, dogs and horses.

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