



## The taxonomic status of *Rhipicephalus sanguineus* (Latreille, 1806)



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### ABSTRACT

The brown dog tick, *Rhipicephalus sanguineus* sensu stricto, is a species with considerable public health and economic importance. However, the taxonomic status of this species is far from resolved. After more than 110 years of scientific work on *R. sanguineus* s.s., the situation is that there is no type, no solid description, nor is there a consensus about the range of morphological variability within the species. Recent findings based on laboratory crosses and molecular genetics strongly suggest that there are several entities grouped under the same name. Here we review the history of the taxon, and we point out the caveats behind any further work on this tick. The current taxonomic status of *R. sanguineus* s.s. thus lacks an informative original description, and is based on the existence of several morphological descriptions based on ticks originating from different populations, which show, in some cases, biological incompatibility and significant genetic divergence. We suggests that as a result it is not possible to assign the specific name *R. sanguineus* s.s. to any population. Further work is required based on the rules issued by the International Code of Zoological Nomenclature to clearly define the morphological range of the different populations.

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### 1. Introduction

The *Rhipicephalus sanguineus* complex (Acari: Ixodidae) includes 12 tick species, namely, *R. sanguineus* (Latreille, 1806), *Rhipicephalus sulcatus* Neumann, 1908, *Rhipicephalus rossicus* Yakimov and Kohl-Yakimov, 1911, *Rhipicephalus schulzei* Olenov, 1929, *Rhipicephalus pumilio*

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Schulze, 1935, *Rhipicephalus pusillus* Gil Collado, 1936, *Rhipicephalus turanicus* Pomerantzev, 1940, *Rhipicephalus leporis* Pomerantzev, 1946, *Rhipicephalus guilhoni* Morel and Vassiliades, 1963, *Rhipicephalus moucheti* Morel, 1965, *Rhipicephalus bergeoni* Morel and Balis, 1976 and *Rhipicephalus camicasi* Morel, Mouchet and Rodhain, 1976 (Pegram et al., 1987a)<sup>1</sup>. In terms of geographical distribution, public health relevance and economic impact, *R. sanguineus* (Latreille, 1806) (from now on, *R. sanguineus sensu stricto*) is the most important species of this group, however, the taxonomic status of this species is not clearly resolved. The original description of *R. sanguineus* s.s. was poor, not illustrated, and the type specimen has been lost. Thereafter, this name has been applied to *Rhipicephalus* populations worldwide. Recent studies focusing on morphological, genetic and biological differences among the different populations of what has been defined as *R. sanguineus* s.s. have demonstrated that, in some areas what may be more than one species is included under this name (Oliveira et al., 2005; Szabó et al., 2005; Burlini et al., 2010; Moraes-Filho et al., 2011; Levin et al., 2012; Nava et al., 2012; Dantas-Torres et al., 2013; Liu et al., 2013), whereas in others ticks designated as *R. sanguineus* or *R. turanicus* are genetically indistinguishable (Zahler et al., 1997; Beati and Keirans, 2001). Besides the biological meaning of this taxon, there are additional problems related to formal nomenclatural aspects of the usage of the name “*R. sanguineus* (Latreille, 1806)”. In light of this situation, the aim of this work is to present and discuss the taxonomic problems related to the name *R. sanguineus* s.s. and to propose potential solutions to this issue.

## 2. Historical review and taxonomic problems

*R. sanguineus* s.s. was originally described by Latreille (1806) as *Ixodes sanguineus* using a brief and vague description: “Sanguineus, punctatus, postice lineolis tribus impressis, dorso antico macula nulla thoracica, distincta. Habitat in Gallia; I. Ricino paulo minor: vide Acarum lipsiensem celeberrimi Fabricii” (“Blood-colored, punctate, with three linear depressions posteriorly, with no distinct spot on the anterior part of the dorsal surface. Lives in France; slightly smaller than *I. ricinus*: see *Acarus lipsiensis* [described] by the famous Fabricius”)<sup>2</sup>. The current taxonomic position of this species within the suborder Ixodida was determined by Koch (1844a) who transferred it to the genus *Rhipicephalus*. Although Koch (1847) presented a brief description of *R. sanguineus* s.s. from Portugal, the first comprehensive description of this species was given by Neumann (1897). The male, female and nymph of *R. sanguineus* s.s. were described by Neumann (1897) based on the types of *Rhipicephalus limbatu*s Koch, 1844 (male, type locality in Egypt), *Rhipicephalus sculus* Koch, 1844 (male and female, type locality in Italy), *Rhipicephalus*

*stigmaticus* Gerstäcker, 1873 (male, type locality in Kenya) and *Phauloixodes rufus* (Koch, 1844) (nymph)<sup>3</sup>, all of them considered by Neumann to be synonyms of *R. sanguineus* s.s. There is also an informative description of *R. sanguineus* s.s. (male and female) by Canestrini (1890). Although this author does not indicate clearly the origin of the ticks he used for the description, he mentions having seen many specimens of this species from southern Italy. Afterwards, several morphological descriptions of *R. sanguineus* s.s. were published during the 20th century, and these represented landmarks for the taxonomic determination of this taxon. Neumann (1911) differentiates three subspecies (*R. sanguineus sanguineus* (Latreille, 1806), *R. sanguineus punctatissimus* Gerstäcker, 1873 and *R. sanguineus brevicollis* Neumann, 1897) based on scutal punctuations, the marginal and cervical grooves, the length of the scutum and position of the eyes. Neumann (1911) indicated that *R. s. sanguineus* was found in Africa (Algeria, Tunisia, Egypt, Ethiopia, Somalia, Tanzania, Madagascar, Angola, “Congo” (sic), Senegal, South Africa, Togo), southern Europe (France, Italy, Greece, Romania, Turkey), America (Brazil, Panama, French Guiana, Dominican Republic) and Asia (India, “Oriental China” (sic), Iran), while *R. s. punctatissimus* and *R. s. brevicollis* were described only from specimens from Africa. Currently, *R. s. punctatissimus* is considered a synonym of *R. sulcatus* in Camicas et al. (1998) and a synonym of *R. sanguineus* s.s. in Walker et al. (2000), and *R. s. brevicollis* is regarded as synonym of *R. sanguineus* s.s. in Camicas et al. (1998) and Walker et al. (2000). After carrying out a comparative morphological analysis with ticks from the Ukraine, Russia, Armenia, Azerbaijan, Uzbekistan, Tajikistan and Kazakhstan, Zumpt (1939) diagnosed a group of subspecies formed by *R. s. sanguineus* and *R. sanguineus rossicus* Yakimov and Kohl-Yakimov, 1911<sup>4</sup>, based principally on differences in size, shape and scutal punctations, adanal plates, spiracles and palpal article II. In subsequent works, this author added *R. sanguineus schulzei* Olenev, 1929 to this group (Zumpt, 1940, 1950) and presented a detailed morphological characterization of male and female specimens which he considered to be *R. sanguineus* s.s. (Zumpt, 1946). The scheme proposed by Zumpt (1939, 1940, 1950) was substantially modified by Russian workers (Pomerantzev et al., 1940; Pomerantzev, 1946, 1950; Filippova and Panova, 1983; Filippova, 1997), who stated that *R. rossicus* and *R. schulzei* are valid species and not subspecies of *R. sanguineus* s.s. They also included another three species which are morphologically closely related to this group: *R. turanicus*, *R. pumilio* and *R. leporis*. According to Pomerantzev (1950), the principal morphological characters which are useful for achieving accurate species

<sup>1</sup> The authorities and years of publication of *R. turanicus*, *R. rossicus* and *R. moucheti* were modified from those published in Pegram et al. (1987a) and Walker et al. (2000) following Guglielmo and Nava (2014).

<sup>2</sup> It is likely that when Latreille saw Fabricius' *Acarus lipsiensis*, he already knew that *A. lipsiensis* was a synonym of *Ixodes ricinus*. The type specimen of *A. lipsiensis* is also lost (N. Scharff, personal communication).

<sup>3</sup> *Phauloixodes rufus* (Koch, 1844), renamed *Ixodes rufus* by Koch in 1847, is a synonym of *Ixodes ricinus* (Linnaeus, 1758) as stated by Neumann (1901, 1911). However, the name *Phauloixodes rufus* was used by Berlese (1889) for ticks that Neumann in 1897 considered to be *R. sanguineus*. The specimen described by Koch (1844b) is undoubtedly an *Ixodes* (see fig. 39–7), but the *P. rufus* nymph used by Neumann (1897) to describe the nymph of *R. sanguineus* s.s. corresponds to the specimen of Berlese (1889).

<sup>4</sup> The authority and year of publication *R. sanguineus rossicus* were modified from those published in Zumpt (1940, 1950) following Guglielmo and Nava (2014).

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