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Additions to the "Annotated Checklist of the Ticks of Germany": *Ixodes acuminatus* and *Ixodes inopinatus*

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Abstract

Since the publication of "An annotated checklist of the ticks of Germany" in 2012, the list now includes two additional ixodid species. *Ixodes acuminatus* is endemic in several countries bordering Germany. Sufficient specimens have now been found in southwestern Germany to show that this species is also native there. The other species, *Ixodes inopinatus*, has its main area of distribution in the western Mediterranean, and it is not yet clear whether the two females and one male found in Rhineland-Palatinate were accidental introductions or are part of a viable population.

Although it is only two years since our checklist of the ticks of Germany was published (Petney *et al.* 2012), two species have now been recorded that were not identified previously in this country; one is already known for other Central European countries, while the other is newly described (Estrada-Peña *et al.* 2014).

***Ixodes acuminatus* Neumann, 1901**

There is some debate about whether the eastern Palearctic species *Ixodes redikorzevi* Olenev, 1927, is a synonym of *I. acuminatus*. Along with Guglielmone *et al.* (2014) we consider that this is not the case until a comparison of types has been carried out. However, should the synonymy be confirmed, then the range of this species would be extended to include parts of Eastern Europe, China, the eastern Mediterranean and the Middle East.

Small mammals hosted numerous larvae and nymphs of this species over three years of collection so that *I. acuminatus* is now confirmed as endemic to Germany.

Distribution: This species is widely distributed in temperate and western Mediterranean Europe, occurring in Belgium, France, Italy, Hungary, Portugal, Spain and southern England (Durio *et al.* 1982, Marquez *et al.* 1987, Martyn 1988, Gilot *et al.* 1992, Manilla, 1998, Caeiro 1999, Barandika *et al.* 2007, Földvári *et al.* 2011, Jameson & Medlock 2011, Santos-Silva *et al.* 2011, Tomassone *et al.* 2013).

The current records for Germany come from Baden-Württemberg (Littwin *et al.* unpublished data).

Hosts: Ixodes acuminatus has predominantly been found on small mammals, such as insectivores (Soricidae, Talpidae) and rodents (Arvicolidae, Cricetidae, Gliridae and Muridae), including the house mouse (*Mus musculus*) and the common rat (*Rattus norvegicus*). It also occurs on medium-sized mammals including hedgehogs (*Erinaceus europaeus* and *Erinaceus roumanicus*) (Gilot *et al.* 1992, Manilla 1998, Boyard *et al.* 2008, Gyuranecz *et al.* 2010, Földvári *et al.* 2011). Carnivores (Canidae, Felidae, Mustelidae and Viverridae) including martens, badger, red fox, gray wolf (*Canis lupus*) and domestic dogs and cats are occasionally infested (Manilla 1998, Földvari *et al.* 2007, Lorusso *et al.* 2011, Santos-Silva *et al.* 2011, Tomassone *et al.* 2013). Manilla (1998) also reports a nymph from a common buzzard (*Buteo buteo*), as well as from a human, while Tomassone *et al.* (2013) found one adult tick on a red partridge (*Alectoris rufa*) and Norte *et al.* (2012) recorded a single specimen (stage not indicated) from a common blackbird (*Turdus merula*). Both adults and immature stages occur on most of the host families listed.

In Baden-Württemberg both larvae and nymphs have been found on the bank vole (*Myodes glareolus*) and the yellow-necked mouse (*Apodemus flavicollis*), and rarely by flagging (Littwin *et al.* unpublished data).

Ecology: This is chiefly a nest-dwelling species, although we have collected a few immatures by flagging. *Ixodes acuminatus* is widespread in France, though it is rare or even missing in regions where the average temperature in January is below 0°C (eastern France, the northern Alps, high altitudes of the central Pyrenees) (Gilot *et al.* 1992). Ticks occur throughout the year on small mammals, although adult activity seems to peak from the end of February to the end of April. Nymphs seem to have a spring peak and larvae a summer peak (Gilot *et al.* 1992).

Medical and veterinary significance: Although *Borrelia burgdorferi* sensu lato has been isolated from *I. acuminatus* feeding on small mammals in eastern France (Doby *et al.* 1990), this tick is not currently considered a competent vector. Tomassone *et al.* (2013) collected four *I. acuminatus* from wild and domestic cats (3) and red partridge (1); these carried *Borrelia spielmanii* (cats and partridge), *B. valaisiana* (cats) and *Rickettsia helvetica* (both host species). Obsomer *et al.* (2013) list Bhanja virus, *Francisella tularensis*, the causative agent of tularemia, and *Coxiella burnetii*, the causative agent of Q-fever, as being associated with *I. acuminatus*.

Hillyard (1996) also lists Uukuniemi viruses. Unfortunately, we were unable to locate the primary literature describing these associations.

***Ixodes* (*Ixodes*) *inopinatus* Estrada-Peña, Nava and Petney, 2014**

This species was recently described (Estrada-Peña *et al.* 2014). Whether it is a permanent resident in Germany is currently unknown. Two females attached to sheep and one male crawling on a sheep were found south of the village of Kapsweyer at the margin of the Bienwald forest in southern Rhineland-Palatinate. Neither farm nor companion animals from outside Germany had been introduced to the farm for at least 12 months prior to tick collection. To date, no sampling has been carried out on either foxes, which are common hosts in Spain (Estrada-Peña *et al.* 2014), or cattle, which may be potential hosts in Algeria (Noureddine *et al.* 2011).

Identification: Estrada-Peña *et al.* (2014) indicate that females of *I. inopinatus* can be separated from those of *Ixodes ricinus* (Linnaeus, 1758) by the relative dimensions and punctations on the scutum, the length of the idiosomal setae, the size of the auriculae, the aspect of the porose areas, and a 2/2+3/3 hypostomal formula. Separation of *I. inopinatus* and *I. ricinus* nymphs is possible by comparing scutal dimensions, the relative size of the scutal and idiosomal setae, and the relative size of the spurs on coxa I. In larvae of the new species, the scutum is broader than long and idiosomal setae Md1 to Md3 are unusually long.

Distribution: *Ixodes inopinatus* is largely confined to the western Mediterranean: Spain, Portugal, Morocco, Algeria and Tunisia. In Spain, its northern limit is the province of Guadalajara. In Spain and Portugal, close monitoring of *I. inopinatus* populations shows that there is no overlap of this species with *I. ricinus*. This is not the case with specimens from Rhineland-Palatinate, where both species occurred on the same individual host.

Hosts: Immatures of *I. inopinatus* have been found on *Psammodromus algirus*, a lizard belonging to the family Lacertidae, and adults parasitize red fox (*Vulpes vulpes*) (Estrada-Peña *et al.* 2014). Noureddine *et al.* (2011) found genetically identical specimens, then classified as *I. ricinus*, on cattle in Algeria.

Ecology: *Ixodes inopinatus* occurs in Mediterranean habitats in which cork oak (*Quercus suber*) predominates with limited areas characterized by pine (*Pinus* spp.). The climate is dry and warm with minimum temperatures above 6-7 ºC and a total rainfall of 700-800 mm/year. In North Africa, *I. inopinatus* (previously identified as *I. ricinus*) is active during the winter months (Yousfi-Monod & Aeschlimann, 1986), with adults occurring on cattle from November to March. This is in contrast to *I. ricinus* from most of continental Europe, where this species usually has two activity peaks, one in spring and another in autumn (Kurtenbach *et al.* 2006).

Medical and veterinary significance: The medical significance of *I. inopinatus* is currently unknown, but "*I. ricinus*" from North Africa has been recorded as carrying *Borrelia burgdorferi* sensu lato (Dsouli *et al.* 2006), *Borrelia lusitaniae* (Younsi *et al.* 2001, 2005), *Rickettsia helvetica* and *R. monacensis* (Sfar *et al.* 2008, Kernif *et al.* 2012), *Anaplasma* spp. and *Ehrlichia* sp. (Sarih *et al.* 2005). Clearly, this calls for urgent clarification of the status of *I. inopinatus* and *I. ricinus* in North Africa.

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