A note on Hyalomma nitidum Schulze, 1919, its distribution and its hosts

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A note on *Hyalomma nitidum*, its distribution and its hosts

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Abstract. The paper summarises the morphological characteristics, the known geographical distribution and hosts of *Hyalomma nitidum*, a tick which has never been properly characterised. *H. nitidum* was first described in Cameroon in 1919, long considered as a synonym of *Hyalomma truncatum* and recognised as a separate and valid species only since the early 1970s. *H. nitidum* occurs from Senegal to the Central African Republic in more humid conditions than *H. truncatum*, roughly to the south of the isohyet of 900 mm. Adults are parasitic on various wild and domestic ungulates, on which immatures have not been found. Nymphs, identified after moulting to adults, have been found on a hare, and tentatively identified larvae and nymphs of this species have also been collected on hare as well as on a zebra mouse. The tick has been found infected with the virus of Crimean-Congo haemorrhagic fever, so far no other disease associations are known.

Introduction

The name *Hyalomma nitidum* Schulze (1919) has been considered for a long time as a synonym of *Hyalomma truncatum* Koch (1844), or its synonym *Hyalomma transiens* Schulze (1919) (see for instance Delpy 1949; Hoogstraal 1956; Elbl and Anastos 1966). It is only since its rediscovery in 1969 in the Central African Republic that the name of this African tick has reappeared in the literature, but even now it remains an abstraction to most tick workers, as it has never been convincingly characterised, except to a certain degree by Kratz (1940).

In 1969 and 1970, one of the authors (GU) while posted in Bouar, Central African Republic, noticed male ticks which in the keys to the species of *Hyalomma* of Hoogstraal (1956) keyed down to *H. truncatum*, but were atypical in some respects. These males were associated with females which had a genital aperture much like that of ticks of the *Hyalomma marginatum* group, quite

unlike the typical genital aperture of female *H. truncatum*. Specimens were sent to Drs. H. Hoogstraal and M.N. Kaiser at US NAMRU-3[1] in Egypt. At first they were dubious, because of the well-known variability in the genus *Hyalomma*, but after a voluminous correspondence and examination of many specimens they suggested that these ticks might correspond to what had been named *H. nitidum*, but insufficiently characterised, in the key of Schulze (1919), based on specimens from roughly the same area (Cameroon). Dr. M.N. Kaiser became quite convinced of the validity of *H. nitidum* after also examining the material in the Schulze collection deposited in the Rocky Mountain Laboratory[2]. Hoogstraal (1979) wrote that this species, 'long a lost taxon related to *H. truncatum*', is in the process of being redescribed, but for various reasons the intended characterisation and redescription never came about.

In this note we will briefly indicate the principal distinguishing features of adult *H. nitidum* ticks (without going to the length of presenting formal descriptions), its geographical distribution and its hosts. The nomenclature of the wild hosts is based on Wilson and Reeder (1993).

Material and methods

Most of the data presented here are based on specimens of *H. nitidum* and *H. truncatum* examined by the authors. The initial help of the late Drs. H. Hoogstraal and M.N. Kaiser was crucial as indicated above. The late Dr. P.C. Morel was briefed by one of us (GU), and offered his full collaboration. Examination of ticks that had been classified as *H. truncatum* in his tick collection at the IEMVT,[3] later CIRAD-EMVT,[4] first by one of us (GU) in Maisons-Alfort in 1970–1972, when the collection was still administered by him, later in 2000 in Montpellier by two of us (JLC and LT), made it possible to determine the approximate geographical distribution of *H. nitidum* (and *H. truncatum*) in many other countries. All specimens of both species in this collection were (re)identified by the authors. Specimens of *H. nitidum* and *H. impressum nitidum* collected on buffalo in Cameroon in 1913 of the Schulze collection housed in the Zoologische Museum in Berlin were also examined. Personal communications from Drs. H. Hoogstraal and M.N. Kaiser, based on their own collections and those of others, helped in establishing the distribution of both tick species, and Prof. J.E. Keirans has supplied us with details of the

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[2]Later, in 1971, he was inclined to consider both *H. nitidum* and *H. truncatum* as subspecies of *Hyalomma impressum* (which precedes *H. truncatum* in Koch's (1844) publication), and this would explain the occurrence of specimens which appear to be intermediate between these species/subspecies. This question has not been settled, as experimental crossings have never been carried out. It should be noted that Schulze and Schlottke (1930) presented both *nitidum* and *truncatum* as subspecies of *H. impressum*

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specimens of *H. nitidum* in the US. National Tick Collection at Georgia Southern University, Statesboro, which have practically all been identified by Dr. M.N. Kaiser.

The geographical distribution is based on specimens in the various collections[5] and on published data. Because of past and continuing confusion between *H. nitidum* and *H. truncatum*, published records of the latter species should be considered with caution, and only accepted when the authors distinguished between the two. That means unfortunately that the distribution of *H. truncatum* published in the thesis of Morel (1969) cannot be used, as the author did not yet distinguish between *H. truncatum* and *H. nitidum*.

Identification

Male (Figure 1(1–6))

In his 1919 key, Schulze included *H. nitidum* as a new species, from buffalo in Cameroon. Coxa I is typically deeply split (as opposed to that of *H. aegyptium* (called *H. syriacum* by Schulze, a synonym). There is no or a shallow median groove and the legs are of one colour or only with indications of lightening particularly on the first pair of legs; *H. nitidum* therefore does not belong in the category of species having clearly two-toned legs, brown and white, such as *H. truncatum* (Schulze's *H. transiens*). Finally, according to Schulze's key, the male of *H. nitidum* is smooth, deep-black, with a distinct caudal field and five glossy dorsally sharply delineated festoons. In the key by Schulze and Schlottke of 1930, one of the principal features they give of the males of what they call *H. impressum nitidum* is also the fact that the legs are mostly of one colour, red-brown; they also indicate a sharply defined and densely punctated caudal field with the rest of the scutum smooth and shiny.

Kratz (1940), who had access to Schulze's material, described the conscutum of the male of what he also called *H. impressum nitidum* as deep-black, smooth and shiny, apart from the densely punctated caudal field. The five distinctly delineated (dorsal) festoons of equal size are remarkably shiny.[6] The caudal

[5]UT – collection of the University of Turin (D. De Meneghi and L. Tomassone); JLC – collection of J.-L. Camicas (for IRD), or identified by him; GU – collection of G. Uilenberg, or identified by him; EMVT – collection of the late P.C. Morel in Maisons-Alfort, examined in 1970–1972 (GU), later in Montpellier, examined in 2000 (JLC and LT); HH – collection of the late H. Hoogstraal in Cairo; NTC – US National Tick Collection at Georgia Southern University; Parts of these collecting data overlap, as much of GU has ended up in EMVT and HH, and HH has been transferred into NTC.

[6]It is to be noted that Kratz described *H. impressum transiens*, now considered as a synonym of *H. truncatum*, as having seven dorsal festoons, as did Hoogstraal (1956) in his description of *H. truncatum*. But that distinction is not a clear one; Kratz wrote that the outer festoons of '*H. impressum transiens*' are the onset of the ridges which delimit the caudal field, and, as his figures 40b and 40c indicate, the situation is not fundamentally different in *H. nitidum*.

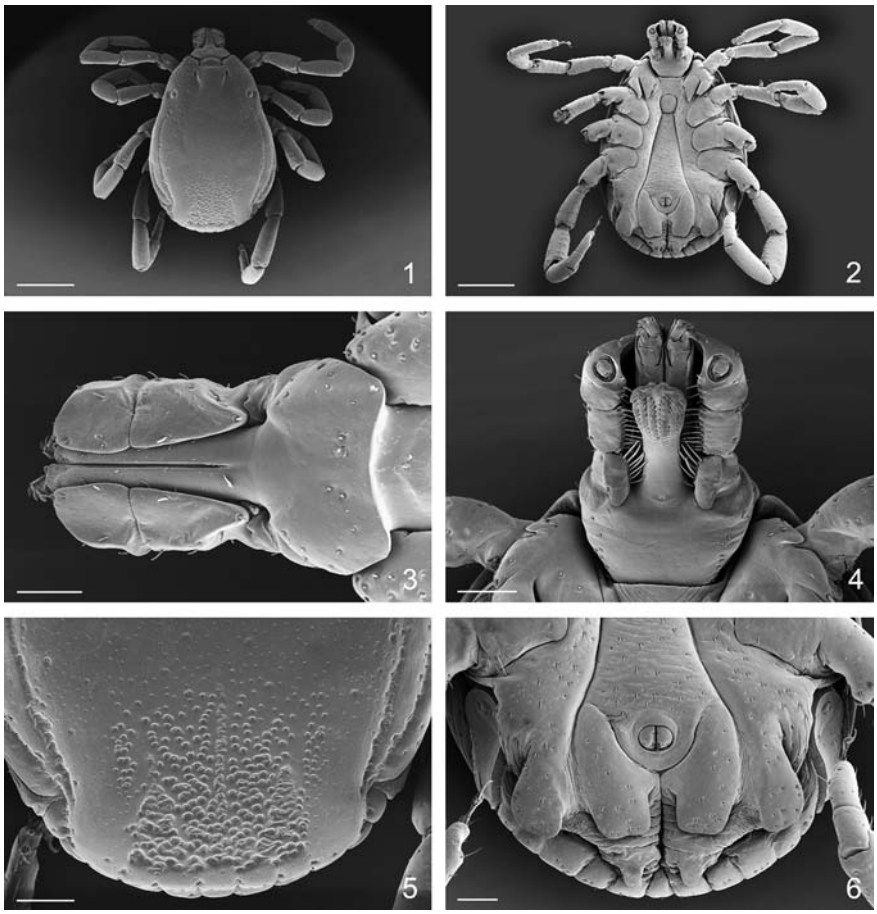

Figure 1. *H. nitidum* male: 1, general dorsal aspect (scale-bar = 1 mm); 2, general ventral aspect (scale-bar = 1 mm); 3, dorsal aspect of capitulum (scale-bar = 200 μ); 4, ventral aspect of capitulum (scale-bar = 200 μ); 5, posterodorsal aspect (scale-bar = 500 μ); 6, posteroventral aspect (scale-bar = 500 μ).

field is limited by two longitudinal ridges, the median groove is a flat line within the caudal field. There are 9–11 'peltae' (ventral festoons). The legs are red-brown, sometimes with pronounced lightening. In his key to male *Hyalomma* ticks the legs are simply described as mostly of one colour, red-brown.

In fact, the male of *H. nitidum* is much like that of *H. truncatum*, the most notable difference being that in most specimens the legs are all brown, lacking the pale rings, but sometimes with blotches of brownish white near the joints. Partly striped legs are not uncommon; white rings, if they occur, are usually limited to the area near the joints and are less contrasting than in *H. truncatum*. Some joints, particularly of femur I, have anterodistally a characteristic brownish spot within the white stripe, like an arm badge.

Female (Figure 2(7–12))

In Schulze's (1919) key *H. nitidum* is described as having red-brown legs, usually with only the first pair of legs ringed. A brown transversal stripe is present on the white rings. Tarsus I is very broad. According to Schulze and Schlottke (1930) the legs are brown, without rings, at most with faint lightening at the joints; they say moreover that the legs are remarkably long and thin. Kratz (1940) does not give a key to species for females, but describes the female *H. nitidum* as having remarkably long, and thin ('spiderlike') red-brown legs with lightening at the joints. The alloscutum is almost smooth, with sharply defined grooves.

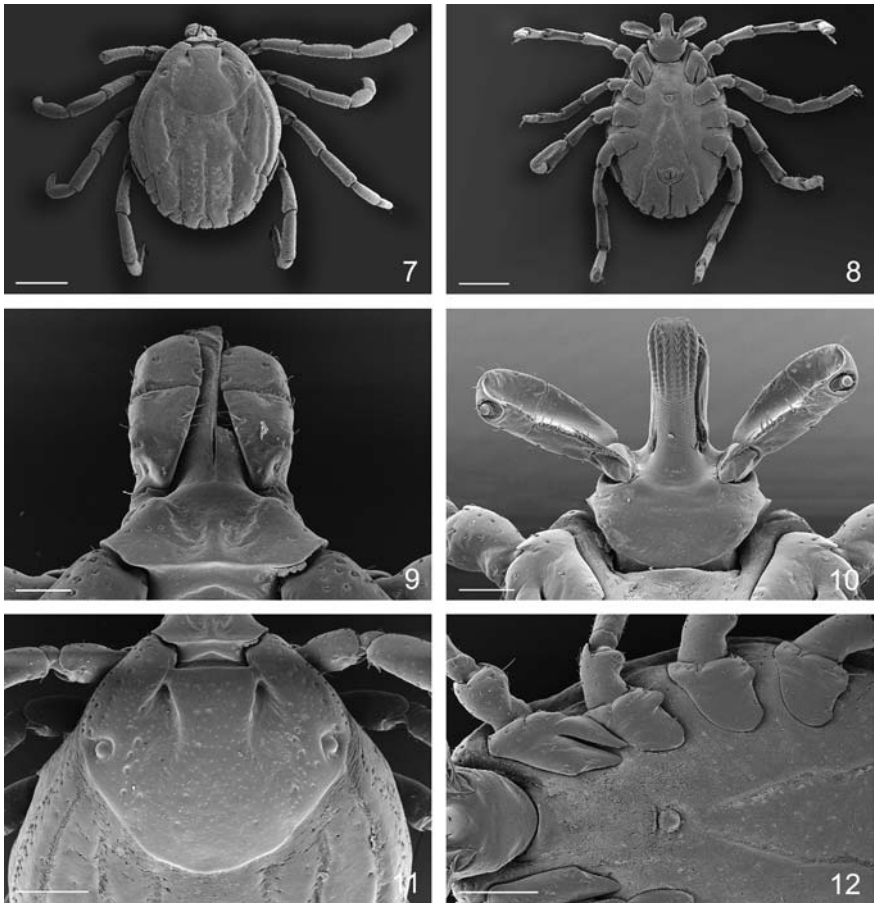

Figure 2. *H. nitidum* female: 7, general dorsal aspect (scale-bar = 1 mm); 8, general ventral aspect (scale-bar = 1 mm); 9, dorsal aspect of capitulum (scale-bar = 200 μ); 10, ventral aspect of capitulum (scale-bar = 200 μ); 11, scutum (scale-bar = 500 μ); 12, genital aperture and coxae (scale-bar = 500 μ) Figures 1 and 2 are SEM photographs by one of the authors (ADG)).

In fact, the overall aspect and scutal punctations of the female *H. nitidum* are very much like that of *H. truncatum*, but, as in the males, the legs lack the clear white rings of this species. [The statements by Schulze and Schlottke (1930) and Kratz (1940) that the legs are remarkably long and thin cannot be confirmed.] However, the shape of the genital aperture is quite different from that of *H. truncatum* (Figure 3). In *H. truncatum* the preatrial fold of the genital aperture is markedly concave with a narrow bulging transverse ridge on the upper part of the anterior lip, and a well-defined posterior lip forming a cup, while the anterior lip of the genital aperture of *H. nitidum* is strongly bulging, and the knob comes in close contact with the posterior lip defining the genital aperture as a slit under the knob, like the genital apertures of *H. marginatum marginatum* and *H. marginatum rufipes*. Another difference with *H. marginatum rufipes* is the absence of dense and long pilosity around the spiracular plate in *H. nitidum*.

Nymph and larva

These have not been described. In South-East Senegal one of us (JLC) collected six *Hyalomma* nymphs on hares (*Lepus victoriae*, as *L. crawshayi)*, which moulted to females identified by Dr. M.N. Kaiser as *H. nitidum*. These are the only immatures of *H. nitidum* collected in the field, identified with certainty. It is unlikely that the immatures can be identified as to species on morphological characters; we were unable to distinguish these nymphs from those of

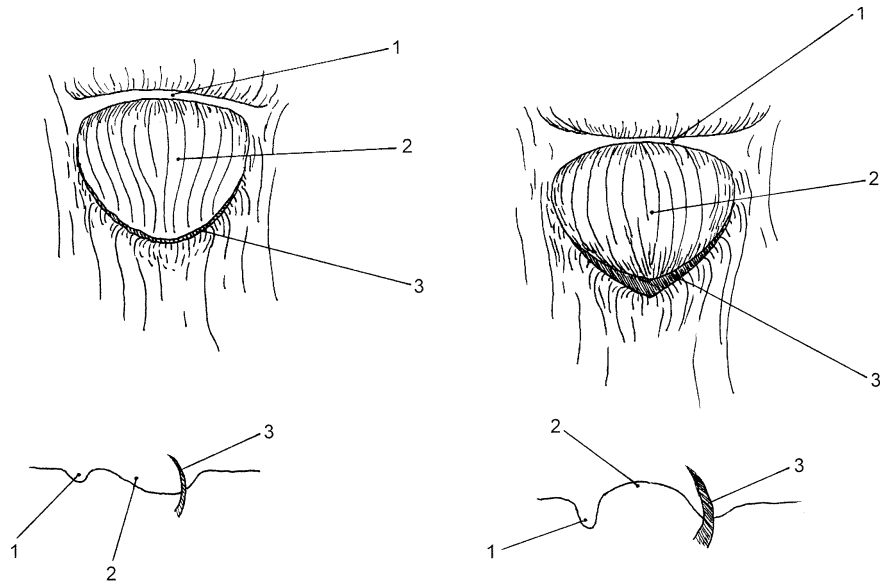

Figure 3. Genital apertures of female *H. nitidum* (on the right) and *H. truncatum* (on the left). 1 – anterior groove; 2 – preatrial fold (concave in *H. truncatum*, convex in *H. nitidum*); 3 – posterior lips.

H. impressum or *H. truncatum*. Molecular tools (comparing nucleotide sequences) might be useful in the future. The US National Tick Collection holds nymphs and larvae which were obtained by laboratory rearing at US NAMRU-3 in Cairo from engorged females collected by J. Bafort on cattle at the abattoir of Yaoundé (Cameroon). The females were apparently identified as *H. nitidum* at NAMRU-3. Cornet (1995) reported that nymphs and larvae have been found in the Central African Republic at Sarki (north-west of the country) on hare (*Lepus victoriae*, as *Lepus crawshayi*) and on *Lemniscomys striatus* (zebra mouse); these specimens have been seen by one of us (JLC) and their specific identification is only tentative.

Geographical distribution

Hyalomma nitidum is a sub-Saharan African tick, found so far from Senegal to the Central African Republic. It has been identified from the following countries:

Benin (EMVT, NTC, Morel 1978; Hoogstraal 1979, JLC, Vercruysse et al. 1982). It is widely spread in central and northern Benin, overlapping with *H. truncatum* in the North of the country.
Burkina Faso (EMVT, JLC, NTC, Morel 1978; Hoogstraal 1979). *H. nitidum* has only been collected in western Burkina Faso, where its distribution overlaps with that of *H. truncatum*.
Cameroon (Schulze 1919; Schultze and Schlottke 1930; Kratz 1940; GU, EMVT, HH, JLC, NTC, Hoogstraal 1979; Stachurski et al. 1993). *H. nitidum* was found in central and northern Cameroon, *H. truncatum* only in the North.
Central African Republic (GU, EMVT, JLC, NTC, Sureau et al. 1976a; Morel 1978; Hoogstraal 1979; Cornet 1995). *H. nitidum* is widely spread in most of the country, *H. truncatum* was found to overlap with it only in the extreme North-East.
Chad (GU, EMVT). *H. nitidum* was collected only in the extreme South, overlapping there with *H. truncatum*, which is common in central and northern Chad.
Equatorial Guinea (NTC). The fact that the annual rainfall is high[7]and the country has no livestock means that the tick may well have been collected on cattle imported from elsewhere. We think it is doubtful that it is established in the country.
Guinea (Conakry) (EMVT, UT, Hoogstraal 1979; De Meneghi et al. 2000; Tomassone et al. 2004). *H. nitidum* was commonly collected in central Guinea. Konstantinov et al. (1990) did not find this tick but reported *H. truncatum*; although they were aware of the existence of *H. nitidum*, the publication they quote would not have allowed them to recognise it.

[7]It should however be noted that we don't really know the maximum rainfall that *H. nitidum* will tolerate.

Ivory Coast (EMVT, NTC, Hoogstraal 1979). A few *H. nitidum* were found in the EMVT collection, from central Ivory Coast.
Mali (GU, EMVT, HH, NTC, Hoogstraal 1979; Teel et al. 1988). *H. nitidum* is common in southern Mali, where it overlaps with *H. truncatum*, which also occurs farther North.
Nigeria (Mohammed 1977). The only records are those of Mohammed from northern Nigeria, where *H. nitidum* was found together with *H. truncatum sensu stricto*.
Senegal (JLC, EMVT, NTC, Morel 1978; Hoogstraal 1979.) *H. nitidum* was found in southern Senegal; males were found on a horse near Dakar, but it is unlikely that the species is really established in that area, which should be too dry for it (the annual rainfall was about 600 mm in 1970). *H. truncatum* extends further North, into southern Mauritania.

H. nitidum is likely to occur in other areas and other sub-Saharan countries with comparable climatic conditions, but either no tick collecting has been carried out or no distinction has been made between *H. nitidum* and *H. truncatum*. All specimens seen so far from Sudan as well as eastern and southern Africa are *H. truncatum sensu stricto*.

Note: the quotation by Doss et al. (1974) of Chodziesner (1924) having mentioned *H. nitidum* on the camel in Buchara [the capital of Uzbekistan in Asia], Egypt and 'Nubia' [= North Sudan] is presumably based on a misinterpretation of Chodziesner's paper. Chodziesner (1924) reported *Hyalomma dromedarii* on the camel in these places, but gives the host of *H. nitidum* as the buffalo in Cameroon.

Mohammed (1977) reported *H. nitidum* in low numbers from bait cattle in Nigeria in the Sudanese and northern-Guinean vegetational zones.

Morel (1978) reported it from Burkina Faso and described its general distribution as follows: *H. nitidum* parasitises domestic and wild ungulates in the Sudano-Guinean and Guinean savannas up to the North-East of the CAR. It is also known from Senegal and Benin. It occurs together with *H. truncatum* in the South of the distribution of the latter in western and central Africa.

Vercruysse et al. (1982) found *H. nitidum* in Benin in zones with over 1100 mm of rain per year, while *H. truncatum* was the most frequently encountered species of *Hyalomma* in regions with less than 1000 mm of rain annually.

Kolonin (1983), basing himself on the literature, gave distribution maps for *H. nitidum* and *H. truncatum*; although both maps are certainly inaccurate, the one for *H. nitidum* not extending sufficiently far to the East and the one for *H. truncatum* extending too far southward in West Africa, these maps are nevertheless a first approximation. He quoted reports on the occurrence of *H. nitidum* in Senegal, Guinea, Mali, Ivory Coast, Upper Volta (now Burkina Faso), Benin, Nigeria, Cameroon and the Central African Republic.

Teel et al. (1988) collected *H. nitidum* in South-western Mali, with few exceptions in localities confined to the North-Guinean forest and Sudano-Guinean zones. Its distribution was limited by the 900 mm isohyet.

Cornet (1995) stated that *H. nitidum* (in the CAR) occurs in the Congo-Guinean forest zone and the Guinea-Sudanese zone, even at the limit of the medial-Sudanese zone.

Figure 4 shows where *H. nitidum* has been collected, based on our data and those published by others. We have not included certain towns such as Yaoundé and Cotonou, where the species was collected on cattle at the abattoir, as cattle slaughtered there generally originate from other areas. Also we have not included the record from Equatorial Guinea, for the same reason. Geographical coordinates obtained by using the GPS system and those indicated in atlases and gazetteers are not always exactly the same, and sometimes only the general area in which the collection was made has been recorded. The sites indicated on the map should therefore be considered as approximate.

Hosts

Adult ticks

Cattle (GU, EMVT, HH, JLC, NTC, UT, Mohammed 1977; Hoogstraal 1979; Vercruysse et al. 1982; Teel et al. 1988; Cornet 1995; De Meneghi et al. 2000; Tomassone et al. 2004) ♂♂, ♀♀
Horse (EMVT, NTC, Hoogstraal 1979) ♂♂

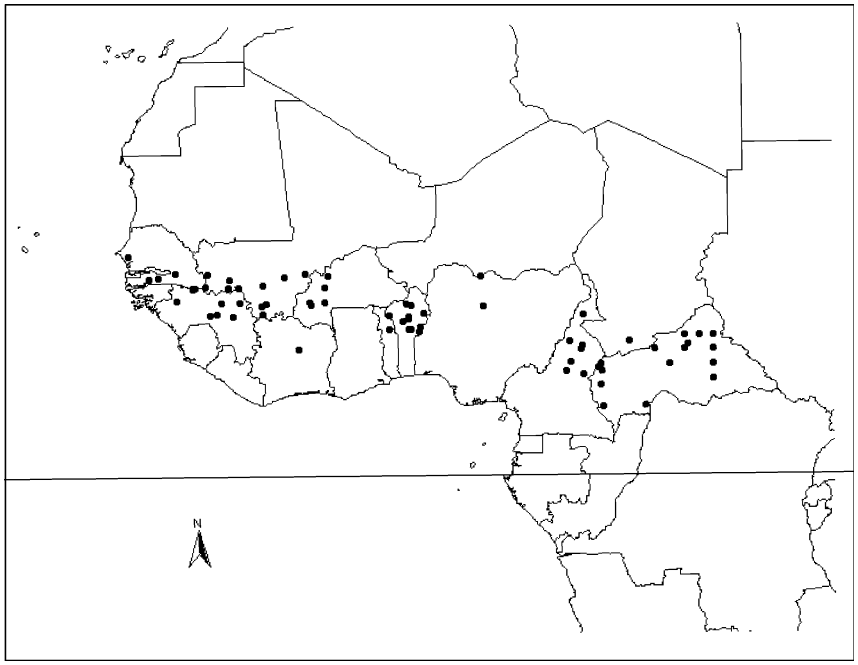

Figure 4. Approximate collection sites of *H. nitidum*. These line drawings (Figure 3) and the map (Figure 4) were prepared by one of the authors (LT).

Goat (GU, Hoogstraal 1979) ♂♂
Man (GU, now in NTC) 1 ♂, not attached
Buffalo (*Syncerus caffer*) (Schulze 1919; Schulze and Schlottke 1930; GU, EMVT, HH, NTC, Morel 1978; Hoogstraal 1979) ♂♂, ♀♀
Warthog (*Phacochoerus africanus)* [GU, EMVT, JLC, Morel 1978; Teel et al. 1988 (according to their Table II, not according to the text)] ♂♂, ♀♀
Bushpig (*Potamochoerus porcus*) (Hoogstraal 1979)[8]
Roan antelope (*Hippotragus equinus*) (GU, JLC, Morel 1978; Hoogstraal 1979; NTC) ♂♂, ♀♀
Defassa waterbuck (*Kobus ellipsiprymnus*) (GU, Hoogstraal 1979). ♂♂
Buffon's Kob (*Kobus kob*) (Morel 1978)
Jackal (*Canis aureus*) (JLC) ♂
Hare (*Lepus victoriae*) (NTC) ♀♀. (These may well be the females moulted from nymphs collected on hare by one of us, see above and below, and in that case these females were not collected on hare)

(The **camel** was quoted as a host by Doss et al. (1974), but this is presumably based on a misinterpretation of the paper by Chodziesner (1924), see above.)

Nymphs

Hare (*Lepus victoriae*) (JLC, Hoogstraal 1979,[9] NTC; these nymphs were identified after moulting to females. Other nymphs were identified tentatively: JLC, Cornet 1995)
Zebra mouse (*Lemniscomys striatus*) (Cornet 1995; JLC)[10]

Larvae

Hare (*Lepus victoriae*) (JLC, Cornet 1995)[10]
Rodent (*Lemniscomys striatus*) (Cornet 1995; JLC)[10]

Kolonin (1983), quoting from the literature, reported farm animals (cattle, horse, goats), and wild ungulates (warthog, bushpig, buffalo, roan antelope and waterbuck) as hosts for adult ticks.

Seasonal dynamics and predilection sites

According to most authors, the adults (the only stage reported) appear to be mainly present on cattle during, and shortly after, the rainy season.

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[8]There are no specimens from the bushpig in any of the collections, and Hoogstraal (1979) does not mention the warthog as a host, although he had seen several *H. nitidum* ticks collected on the latter; we suspect that the warthog was meant.

[9]Hoogstraal (1979) mentions immatures in general.

[10]Tentative identification.

However, both in the CAR and in the Republic of Guinea, they were commonly collected during the dry season; while in the CAR this may mainly be due to the fact that collecting on wild hosts was preferably carried out when travelling was easiest, it shows at least that the adults (and not only males) can be parasitic throughout the year.

Table 1 shows the *H. nitidum* ticks collected on known dates in 1969–1971 on buffalo, cattle and warthogs in the Central African Republic. No valid conclusions as to the seasonal occurrence can be drawn from these data, as collecting was not done systematically over the year. The table also indicates the ticks collected on cattle in the Republic of Guinea, in 12 consecutive months in 1994 and 1995. It shows in both countries that some females may be encountered even in the midst of the dry season.

Mohammed (1977) collected the species on cattle in May and August. Teel et al. (1988) found the tick on cattle from May to January, with the largest numbers in May. Bayemi (1991) who examined cattle in Yaoundé (southern Cameroon), originating from further North, found males throughout the year, except in May, and females only from July to January. Adult numbers peaked in September. Stachurski et al. (1993) found it on cattle on the Adamaoua plateau in Cameroon also mainly in the rainy season, although there was a second peak at the beginning of the dry season.

No systematic study of the predilection sites was carried out in the CAR. Many of our ticks were found in the tail switch. Mohammed (1977) found *H. nitidum* on cattle in Nigeria mainly in the anal region. According to Bayemi (1991) predilection sites on cattle were scrotum or udder, tail switch, and legs and axillae, but not the anal region.

Table 1. Seasonal collections of adult *H. nitidum* on selected hosts in the Central African Republic and the Republic of Guinea

Central African Republic		Republic of Guinea (only on cattle)
Month (hosts)	Number (♂/♀)	Number (♂/♀)
January (B)	5 (5/0)	4 (3/1)
February (W)	4 (1/3)	6 (4/2)
March (B, W)	13 (8/5)	7 (6/1)
April (B, W)	35 (26/9)	3 (3/0)
May (B, C, W)	104 (85/19)	9 (8/1)
June (B, C, W)	77 (57/20)	9 (6/3)
July (W)	4 (1/3)	9 (7/2)
August	–	10 (9/1)
September (C)	11 (7/4)	13 (9/4)
October (C)	9 (7/2)	31 (26/5)
November	–	9 (6/3)
December (W)	7 (2/5)	2 (2/0)

B = buffalo, C = cattle, W = warthog

Disease associations

Disease associations are as yet unknown as far as livestock is concerned. Because no immatures have been found on livestock,[11] *H. nitidum* is unlikely to play a role in the ecology of *Theileria* species which are transmitted transstadially by other *Hyalomma* sp. (*Theileria annulata*, *T. lestoquardi*, *T. equi*). Crimean-Congo Haemorrhagic Fever virus has been isolated from it in the Central African Republic (Sureau et al. 1976a). The impact of *H. nitidum* on liveweight gain in cattle appeared to be negligeable in a Cameroon study by Stachurski et al. (1993).

Discussion and conclusions

As stated above, *H. nitidum* is not a new, but a resurrected species. The comparison of our material with that in the Schulze collection by Drs. M.N. Kaiser and H. Hoogstraal and by one of us (LT) was convincing. The name has reappeared in the literature, but most tick workers have no idea of what it means and what the tick looks like. Apart from the literature quoted above, *H. nitidum* has been mentioned in other publications, such as: Sénevet 1922; Morel 1976, 1980; Sureau et al. 1976b; Camicas 1978; Doss et al. 1978; Dégallier et al. 1985; Camicas et al. 1986, 1990, 1998; Cornet 1987; Matthysse and Colbo 1987; Keirans 1992; Awa 1997; Chartier et al. 2000; Tomassone et al. 2002; Horak et al. 2003; Walker et al. 2003, and the list is probably not comprehensive. Whether it is a species or a subspecies of *H. impressum* has not been settled (see above).

Hyalomma nitidum is a West and Central African tick, extending from Senegal to at least as far as the eastern CAR. It has not been reported from neighbouring areas in the Sudan, and Matthysse and Colbo (1987) stated: 'It is unlikely that the West African *H. nitidum* occurs in Uganda'. There were no ticks of this species from Niger in the Morel collection (EMVT), while the species *H. truncatum* was well represented. But a negative result is of course not conclusive.

The tick occurs on cattle and other ungulates in West and Central Africa, in more humid conditions than *H. truncatum* (and therefore to the South of the latter), with some overlap (the distribution of *H. truncatum* is not shown). The northern limit appears to follow roughly the isohyet of 900 mm. Its present distribution may not correspond exactly to that reported above, as isohyets in West Africa have considerably migrated southwards in the past decades (see for example Milich 1997). Its morphology is close to that of *H. truncatum*, but

[11]A larva of *Hyalomma* sp. has been collected on a cow at Samandéni (Burkina Faso) by G. Duvallet on 17th November 1973, and been seen by one of the authors (JLC). Although it could not be identified as to species, it has to be *H. nitidum*, *H. truncatum* or *H. impressum*, which occur all three in the area. Other species can be excluded, either because of morphological differences or because they do not exist in the region.

clearcut differences are the absence of pale rings on the legs (faint rings may sometimes be present) and the shape of the female genital aperture, as described above.

This note was also prepared in the hope that someone will be stimulated to undertake a study of the biology and possible pathological importance of this widespread tick.

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