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A note on side-striped jackal *Lupulella adusta* diversity in North-East Africa

ABSTRACT

There is increasing evidence showing that basic taxonomic knowledge remains superficial even among better-known animals such as mammals, including members of the order Carnivora. Here, we examine photographic evidence collected in the Harennna Forest (Ethiopia) in 2012, integrated with a literature review of the taxonomy of *Lupulella adusta*, the side-striped jackal. Our results demonstrate that taxonomic diversity is seriously overlooked, as the geographic range of the *adusta* complex must include northeastern Sudan and Eritrea. Currently, the taxon *kaffensis* deserves recognition as a further Ethiopian montane endemic, but a complete taxonomic revision of the *adusta* complex is urgently needed.

Keywords: Canidae, Ethiopia, Harennna Forest, Integrative Zoology, *Lupulella*, Schaeffia, Taxonomy.

INTRODUCTION

In 2012 one of us (Alexander Coke Smith - ACS) photographed a unique-looking canid in the Harennna Forest, Bale Mountains National Park (South Ethiopia). Despite a lot of hypotheses at the time, and the interest of several canid experts, it appears that nothing on this individual canid appeared in the scientific literature (Figs. 1-2). Apparently the mtDNA collected from feces in the Harennna Forest confirmed the presence of *Lupulella adusta* (Sundevall, 1846) in the area (Atickem *et al.*, 2018). Therefore the Harennna record has apparently been assigned to *Lupulella adusta* without any further discussion regarding its peculiar external morphology.

Traditionally a sole species of side-striped jackal, formerly *Canis adustus*, has been recognised in Africa (Loveridge & MacDonald, 2013). However, as with many other species, formal taxonomic revisions are lacking for nearly a century. Allen listed seven subspecies (Allen, 1939) and Setzer (1969) described a new one, *Canis adustus namrui* from South Sudan that Coetzee overlooked in his account (Coetzee, 1971). It has not been recognised that Schwarz included in *Lupulella adusta* a further taxon, *Alopoden thoooides* Hilzheimer, 1906 from North-East Sudan. Schwarz stated that “Hilzheimer’s” species *thoooides* remains as a subspecies of *adustus*, as it is quite different from its eastern neighbor, *kaffensis* O. Neum., as well as from its western one, *centralis* Schwarz”

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(Schwarz, 1915). This arrangement, first advanced by Anderson (Anderson, 1902: 207), was confirmed by Koch (Yalden *et al.*, 1980: 181). Allen, in his checklist, instead considers *thooides* a synonym of *Canis anthus soudanicus* Thomas, 1903. Thus, if we agree with Schwarz, a total of nine putative subspecies of *adusta* may be recognized. In the already mentioned paper (Atickem *et al.*, 2018) a noteworthy finding is the deep divergence found between *adusta* of West Africa (Guinea, but not Benin) from those of East and South Africa. Incidentally, no name seems available for this putative West African taxon.

Therefore *adusta* seems characterized by both morphological and genetic variability that is ignored by the prevailing, monotypic taxonomy. With the present note, we discuss the *Haremma adusta* record and other sparse photographic evidence in the light of presently available taxonomic information. It is evident that *Lupulella adusta* diversity and geographic range has been grossly overlooked in north-eastern Africa, as is evident also with the so-called African golden wolf or *Canis anthus* complex (Gippoliti & Lupi, 2020). Historically, specimens belonging to *Lupulella adusta* from North-Eastern Democratic Republic of Congo were assigned to *Canis anthus soudanicus* Thomas (Allen, 1924). Sordelli (1902) assigned to *Canis variegatus* a specimen from Eritrea whose depicted skull belongs to the *Lupulella adusta* complex. It is not possible to attempt today even a preliminary revision of “*Lupulella adusta*”, yet we hope that our work may provoke more interest and research in the issue.

Lupulella adusta in Ethiopia

Prior to the photographic record from the Haremma Forest, knowledge of Ethiopian mammals was summarized in a classic work (Yalden *et al.*, 1980). The first record of the species was made by Oskar Neumann, who, recognizing the significant differences between his specimen from Anderatscha (Kaffa) and those from other regions of Africa, established a new species, *Canis kaffensis*. This taxon was characterized by the absence of a white tail tip and a lateral flank stripe. Neumann also examined another specimen from Malo (middle Omo River Valley) and observed an individual from Addis Ababa sent to the Frankfurt Zoological Garden, noting seasonal variation in the flank stripe’s appearance (Neumann, 1902). He reported several cranial differences between *kaffensis* and other *adusta* but omitted comments on size. Neumann noted that the species appeared typical of montane forests. The leading canid expert at the time, Max Hilzheimer, accepted two species in the subgenus *Schaeffia* for the side-striped jackal: *C. kaffensis* and *C. adusta* (Heck & Hilzheimer, 1915: 195). Conversely, Ernst Schwarz (1915) described a new subspecies from Cameroon (*Canis adustus centralis*), distinguished by its very light coloration, and compared it with adjacent subspecies *kaffensis* and *thooides*.

Following the introduction of a polytypic concept of *L. adusta*, subspecies were largely ignored during much of the 20th century - a period termed “taxonomic inertia” (Gippoliti, 2019). Coetzee (1971) provided the last major checklist, recognizing five subspecies, including *kaffensis* in Ethiopia and Somalia (without details for the latter). Notably, Coetzee erroneously assigned *bweha* (Heller, 1914) to populations from Sudan to Tanzania, overlooking that Heller’s original description compared *bweha* (Mt. Elgon) to *kaffensis*, while *notatus* (Heller, 1914) represented the lowland form. This highlights a persistent issue in *adusta* taxonomy: Are there distinct montane and lowland taxa, or a single variable geographic cline?



Figs. 1–2: The unusual canid observed in the Hareenna Forest on 27 July 2012 (photographs by A. Coke Smith).

The Hareenna Forest expedition initially aimed to document the endemic montane monkey *Chlorocebus djamdamensis*. As narrated by ACS:

“While there, we noticed a very unusual canid crossing the road directly in front of our vehicle. I immediately recognized it as unique - not only unknown to the area but unfamiliar to me and our mammalogist guide. We documented the animal with photographs and GPS records of defecation sites and brush entries for potential hair sampling.”

This encounter occurred on 27 July 2012 at 17: 24.

The late mammalogist Colin Groves described the Ethiopian montane *Lupulella*’s external morphology: (1) Relatively short ears (reaching the eyes if folded forward), somewhat rounded; (2) Prominent white spots above the eyes; (3) White markings at mouth corners (not extending to chin/interramal region); (4) Strongly brindled black/white pelage (black dominant); (5) Limbs more ochre, without sharp contrast to the body; (6) Tail black except for a very short basal section (Groves, *in litt.* to SG, 2015).

After the 2012 record, Castello (2017) published a photographic guide to canids, recognizing three *adusta* subspecies (nominal, *lateralis* and *kaffensis*), though with weak justification. For example, *lateralis* was not documented in its type locality (Gabon), and the *kaffensis* individual depicted (from Uganda) lacked the typical dark dorsal coloration (Neumann, 1902; Schwarz, 1915). A recent photo from Mt. Elgon, Kenya (1.03605°N, 34.75774°E), strikingly resembles the Hareenna individual (Fig. 3), supporting Heller’s comparison of *bweha* and *kaffensis* - a link ignored for over a century.

The skull of *L. adusta* differs from *Canis anthus* and *L. mesomelas* in its narrower braincase, flatter forehead, elongated snout, *Vulpes*-like canines, and smaller premolars. No notable intraspecific variation has been documented except in a Kenyan series (Nandi and Ravine Station), where some skulls exhibited arched profiles with rounded foreheads - a trait attributed to individual variation (de Winton, 1899: 542–543). Recorded weights averaged 7 kg for males and 6.3 kg for females (de Winton, 1899), much less than those from Zimbabwe (8–10 kg.; Smithers, 1983). Neumann (1902) noted the skull of *kaffensis* is narrower, while Lönnberg (1910) observed shorter nasals. A detailed comparative study of montane vs. lowland skulls is needed.

CONCLUSIONS

Given the current inadequate state of knowledge, we support Schwarz’s suggestion that a species belonging to the *Lupulella adusta* complex is present in north-eastern Sudan, thereby extending the range of the species northwards. The description of ssp. *namrui* from the Upper Nile Region of South Sudan (Setzer, 1969), as well as scattered photographic evidence of *adusta*-like individuals to the east and west of the Nile, highlights the need for improved research in Sudan, South Sudan and neighbouring regions. Notably, mislabelled specimens from South Sudan (collected by Hoogstraal in 1961) have fuelled recent taxonomic confusion (Machado & Teta, 2020; Kitchener *et al.*, 2020).

The side-striped jackal is another example of a large mammal in need of a taxonomic revision, which is crucial for both biological research and the development of

effective conservation strategies (Gippoliti *et al.*, 2024). A greater awareness of its diversity should also help to establish the true value of the proposed generic name *Schaeffia* for *Lupulella adusta*, a taxonomic move that is strongly supported by mitochondrial DNA results (Atickem *et al.*, 2018). It should be noted that the phylogenetic analysis by Atickem *et al.* is based on a relatively short region of mitochondrial DNA and, as the authors also note, the topological structure of the tree could be improved with a more extensive mitochondrial dataset (Atickem *et al.*, 2018). It is also important to note that, while mitochondrial DNA is often the genetic system of choice for phylogenetic investigation, it is only one of many loci that can be analysed, and different loci can capture different aspects of the evolutionary history of a given species/population (Després, 2019).



Fig. 3. Another unusual side-striped observed on Mt. Elgon on 23rd July 2024 (photograph by courtesy of R. Watson). Hemmer in 1914 described the Elgon side-striped jackal, *Thos adustus bweha* with type locality “Kitavi”.

More specifically, differences in topology are often highlighted when mitochondrial and nuclear DNA loci are compared. This is the result of gene flow, incomplete lineage sorting, or, more simply, female-specific dynamics (as mitochondrial DNA is usually inherited from the mother) (Roos *et al.*, 2011; Toews & Breslford, 2012). An extensive analysis of the genomic variation of the relevant species and populations is expected to shed light on the complexity of the evolutionary history of African jackals and its implications for the taxonomy of the genus. We also propose limiting the taxon *kaffensis* to montane Ethiopia and using *notatus* for the form found on the East African plains. Among the intriguing questions posed by the side-striped jackal in East Africa is whether the morphological affinities between *kaffensis* and *bweha* are due to a phyletic relationship or convergent evolution in montane environments.

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RIASSUNTO

Esistono sempre più prove che dimostrano come la conoscenza tassonomica di base rimanga superficiale anche per animali ben conosciuti come i mammiferi, inclusi i membri dell'ordine Carnivora. In questo studio, esaminiamo prove fotografiche raccolte nella Foresta di Harennà (Etiopia) nel 2012, integrate con una revisione della letteratura sulla tassonomia di *Lupulella adusta*, lo sciacallo striato. I nostri risultati dimostrano che la diversità tassonomica è gravemente sottovalutata, poiché l'areale geografico del complesso *adusta* deve includere il Sudan nordorientale e l'Eritrea. Attualmente, il taxon *kaffensis* merita di essere riconosciuto come un ulteriore endemismo montano etiopico, ma è urgente una revisione tassonomica completa del complesso *adusta*.

Parole chiave: Canidae, Etiopia, Foresta di Harennà, Zoologia Integrativa, *Lupulella*, *Schaeffia*, Tassonomia.

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