

Descriptions of *Anthrenus* (s. str.) *senegalensis*, *Anthrenus* (s. str.) *crypticus*, a new species from Togo, and *Anthrenus* (s. str.) *fosteri*, a new species from Algeria (Coleoptera: Dermestidae: Megatominae)

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Abstract - All specimens labelled *Anthrenus senegalensis* were borrowed from the Natural History Museum, London. *A. senegalensis* is a poorly known species, so the aim is to provide a good description of the species associated with habitus and genitalia images. Three species were noted in the sample: *A. senegalensis*, *A. crypticus* sp. nov., and *A. fosteri* sp. nov.. *A. crypticus* and *A. fosteri* are described along with *A. senegalensis*, the most likely confusion species. Habitus and genitalia images of all three species are provided.

Key words: aedeagus, distribution, median lobe, sternite IX, taxonomy.

Riassunto - Descrizioni di *Anthrenus* (s. str.) *senegalensis*, *Anthrenus* (s. str.) *crypticus*, nuova specie del Senegal, e *Anthrenus* (s. str.) *fosteri*, nuova specie dell'Algeria (Coleoptera: Dermestidae: Megatominae).

Tutti gli esemplari etichettati come *Anthrenus senegalensis* sono stati presi in prestito dal Museo di Storia Naturale di Londra. *Anthrenus senegalensis* è una specie poco conosciuta, quindi l'obiettivo era quello di fornire una buona descrizione delle specie associate all'habitus e alle immagini dei genitali. Nel campione sono state rilevate tre specie: *A. senegalensis*, *A. crypticus* sp. nov. e *A. fosteri* sp. nov. *Anthrenus crypticus* e *A. fosteri* sono descritti insieme ad *A. senegalensis*, la specie con cui più probabilmente possono essere confuse. Sono fornite immagini dell'habitus e dei genitali di tutte le tre specie.

Parole chiave: edeago, distribuzione, lobo mediano, sternite IX, tassonomia.

INTRODUCTION

The number of named species of Dermestidae Latreille 1804 exceeds 1900, and within this Coleoptera family, the number of species in the genus *Anthrenus* Geoffroy 1762 is just under 300 (Háva, 2024). *Anthrenus* is further split

into ten subgenera: *Anthrenodes* Chobaut 1898 (33 species), *Anthrenops* Reitter 1881 (30 species), *Anthrenus* (75 species), *Florilinus* Mulsant & Rey 1868 (38 species), *Helocerus* Mulsant & Rey 1868 (four species), *Nathrenus* Casey 1900 (80 species), *Peacockia* Menier & Villemant 1993 (one species), *Ranthenus* Mroczkowski 1962 (four species), *Setapeacockia* Háva 2008 (two species), and *Sol-skinus* Mroczkowski 1962 (17 species). The subgenera are split based largely on the number of antennal segments, except for the differentiation of *Anthrenus* from *Nathrenus* where additional characters are used, such as the presence or absence of a notch on the inner eye margin (Peacock, 1993; Háva, 2004, 2011).

Taxonomic studies of the subgenus *Anthrenus* now largely rely on dissection and inspection of male genitalia. This has not always been the case and was an approach introduced largely by Beal (1998) in his review of Nearctic *Anthrenus*. When dissection was first applied to the study of the Palaearctic *Anthrenus* (*Anthrenus*) *pimpinellae* (Fabricius 1775) complex (Kadej *et al.*, 2007), it was realized that many more species existed. Kadej *et al.* (2007), Kadej & Háva (2011), and Holloway (2019, 2020, 2021) added nine more species, almost doubling the number of known species in the complex whilst validating the taxonomy of others (Holloway *et al.*, 2020). Elsewhere, the examination of 'well-known' species, such as *A. A. festivus* Erichson 1846, has demonstrated the existence of more than one species that externally look similar but have considerably different genitalia (Holloway, 2023). Dissection to inspect genitalia structure will continue to be used as a technique in *Anthrenus* taxonomy.

Part of the problem behind the lack of understanding of the taxonomy of *Anthrenus* is the brevity of some of the original descriptions, restricting ability to differentiate among different species. This becomes a particular issue when the poorly described species is common in a region along with other similarly patterned species (e.g., Háva, 2022). Such is the case with *A. senegalensis* Pic 1927 (Mroczkowski, 1964), a species considered widely distributed and common across west Africa. Mroczkowski (1964) produced excellent illustrations of the holotype *A. senegalensis* including the aedeagus. In the current study, a more extensive description with images of *A. senegalensis* is provided, along with descriptions of two new species, one from Senegal, *Anthrenus* (s. str.) *crypticus*, and a second from Algeria, *Anthrenus* (s. str.) *fosteri*.

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MATERIALS AND METHODS

A run of 34 specimens labelled *Anthrenus senegalensis* were borrowed from the Natural History Museum, London (NHML) for study. All specimens were macerated in a solution of 2% acetic acid for five days to allow removal from staging prior to dissection. Dissection was carried out under a Brunel BMSL zoom stereo LED microscope and involved detaching the abdomen from the rest of the insect using two entomological pins. The soft tergites were then peeled away from the harder ventrites to expose the genitalia. For males, the aedeagus was detached from the ring sclerite, and then sternite IX was detached from the ring sclerite and the aedeagus. Females were similarly dissected to confirm sex, but no further examination of female genitalia was carried out. Images of male and female habitus, both upper and under sides, were captured at $\times 20$ magnification using a Canon EOS 2000D camera mounted on the BMSL microscope. Images of aedeagi and (male) sternite IX were captured at $\times 200$ magnification for measurement using a Canon EOS 1300D camera mounted on a Brunel monocular SP28 microscope. After dissection, all body parts were mounted on card. The antennae were teased out and images were taken at $\times 200$ magnification through the SP28 microscope. All images were fed through Helicon Focus Pro version 8 focus-stacking software. All measurements were made using DsCap.Ink software version 3.90. Measurements taken:

- Body length (BL): distance from anterior margin of pronotum to the apex of the elytra.
- Body width (BW): maximum distance across the elytra.
- Antennal club length (AL): length of the last three antennomeres.
- Antennal club width (AW): maximum width across the terminal antennomere.
- Paramere length (PL): distance from the anterior end of the parameres to the apex of the parameres.

- Sternite IX length (SL): distance from the tip of one anterior horn to the tip of the posterior lobe.

The distribution map was generated using SimpleMapp (Shorthouse, 2010) using data labels on the specimens. Scale bars were added using ImageJ 1.53m (Schneider *et al.*, 2012).

TAXONOMY

Anthrenus (s. str.) *crypticus* sp. nov. (Figs. 1, 2)

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Type material

Holotype male NHML Togo, Fazao-Malfakasia NP, Mare aux Crocodiles Campsite, 8.750N 0.814E, Aristopharius, M., Geiser, M., Moretto, P., Sanbena, B. leg., 26 viii 2018 – 8 ix 2018. Sudanian savannah/gallery forest. ANHRT: 2018.31, BMNH(E): 2018-148, NHMUK014374284.

Diagnosis

Holotype *Anthrenus* (s. str.) *crypticus* (BL=2.23 mm, BW=1.54 mm) (Fig. 1A), with dark brown ocellus in centre of vertex, just below the level with top of eyes. Face covered in dark yellow and brown scales, the yellow scales mostly around the inner edges of the eyes, and the brown scales mostly on the vertex. Notch on the lower inner margin of the eye. Integument of the pronotum very dark brown, similar to colour on and around the small triangular scutellum and across the bases of the elytra. Posterior from scutellum, integument reddens slightly towards the elytral apices. Dorsal surface entirely covered in broad oval scales, each one of three colours: pale yellow, darker dirty coloured yellow, or very dark brown. The dark brown scales are concentrated mostly across the

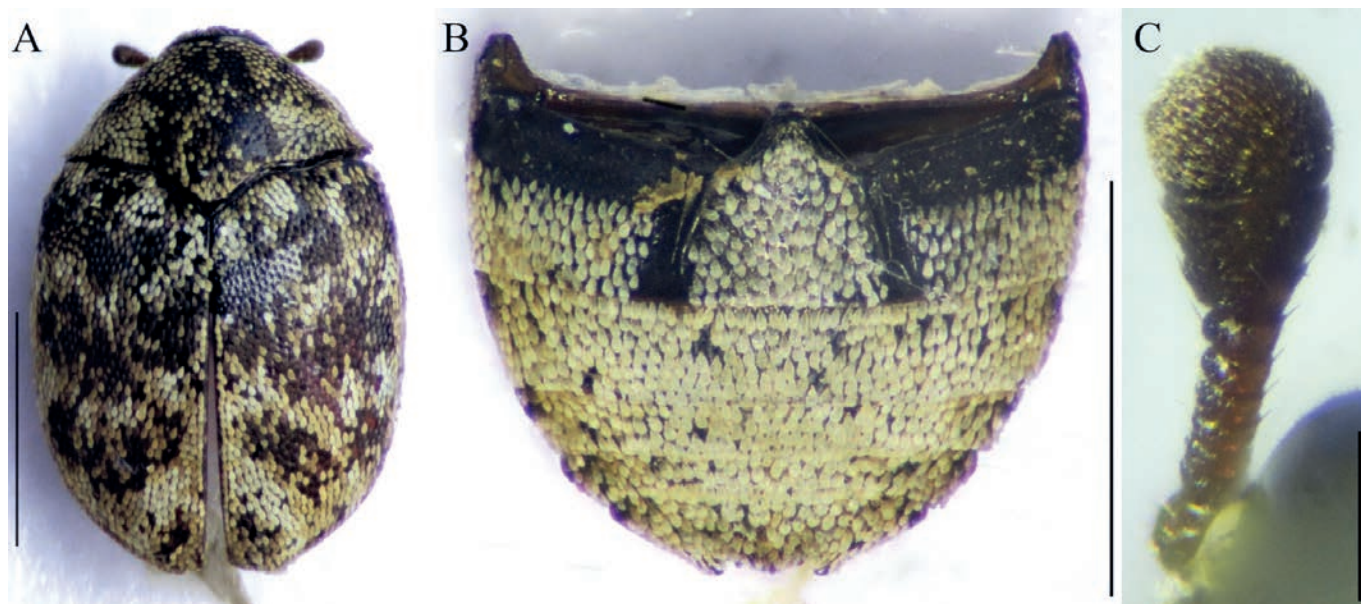


Fig. 1 – Holotype male *Anthrenus crypticus*. A) Habitus dorsal aspects (scale bar = 1 mm); B) ventrites (scale bar = 1 mm); C) antenna (scale bar = 100 μ m). / Olotipo maschio di *Anthrenus crypticus*. A) Vista dorsale dell'habitus (scala grafica = 1 mm); B) ventriti (scala grafica = 1 mm); C) antenna (scala grafica = 100 μ m).

basal half of the elytra, and the yellow scales commoner across the apical halves of the elytra, especially along the elytral suture and around a elytral apices. Integument of ventrites (Fig. 2B) very dark brown and covered with pale but dirty brownish-coloured scales that become a shade darker towards the ventrite margins and across ventrite 5. Small patches of brown and dark brown scales on the anterior edge of the margins of ventrites 2-5. No such patch of scales at the margins of ventrite 1. Eleven-segmented antenna (Fig. 1C) entirely dark red. Well-defined, three segmented club (AL=156 μ m, AW=111 μ m). Tibiae and tarsi red, femora a shade darker with pale yellow scales on the anterior side.

Internal characteristics

Parameres (PL = 339 μ m, Fig. 2A) rod-shaped for most of their length, curving outwards and round from base but then continuing parallel to each other to posterior tips. Parameres broad and almost the same width along entire length, expanding at the apices to form flat-topped, inward pointing, tilted down, spatulate tips. Paramere tips paler than the rest of the paramere, in particular a very pale window at very tips. Median lobe broad, straight, and parallel sided for most of length. Apex of median lobe narrows to pointed tip that falls short of tips of parameres. Sternite IX (SL = 403 μ m, Fig. 2B) poste-

rior lobe less than half length of sternite. Tip of posterior lobe carries stout black setae along posterior margin and submarginal which curve upwards and inwards towards centre of posterior margin. Small number of thinner, shorter setae running down lateral margins of posterior lobe. Sternite IX mostly dark yellow, slightly paler up lateral margins and around posterior margin. Margins of posterior lobe are mostly parallel to each other but kink inwards at base to form and slight neck. From the neck, margins sweep bow outwards and then back together to terminate at two narrow horns at anterior end of sternite IX (NB one horn missing).

Etymology

Specimens of *A. crypticus* were hidden amongst specimens of other species, hence a cryptic species.

Anthrenus (s. str.) *fosteri* sp. nov. (Figs. 3, 4)

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Type material

Holotype male (NHML). Biskra, Algeria (34.86N, 5.73E), donated to British Museum (Natural History) 1927, but collection date not recorded. Collector not recorded but held in G.C. Champion collection. Paratype: one female, Biskra, Algeria (34.86N, 5.73E). Paratype female NHML (diagnosis based on balance of probability since both specimens were staged on the same pin and collected at place).

Diagnosis

Holotype *Anthrenus* (s. str.) *fosteri* (BL=2.08 mm, BW=1.41 mm) (Fig. 3A), with pale amber ocellus in centre of vertex, approximately level with top of eyes. Face covered in concolorous, broadly oval, pale-yellow scales. Notch on the lower inner margin of the eye. Integument of the pronotum very dark brown, similar to the colour on and around the small triangular scutellum. Posterior from scutellum, integument reddens becoming pale orange towards the elytral apices. Dorsal surface entirely covered in broad oval yellow scales, with small patches of orange scales and numerous patches of white scales. *Sternites* (Fig. 3B). Integument dark reddish brown and covered with cream scales. Anterior lateral margin of each sternite with patch of very pale-yellow scales, yellow scales more extensive across sternite V. *Appendages*. Antenna (AL=134 μ m, AW=80 μ m, Fig. 3C) eleven-segmented antenna entirely red with no colour variation among the antennomeres. Well-defined, three segmented club. Legs similarly red, with pale-yellow scales on face of each femur.

Internal characteristics

Parameres (PL=360 μ m, Fig. 4A) rod-shaped for most of their length, curving outwards from base but then continuing parallel to each other to posterior tips. Parameres almost the same width along entire length, expanding slightly at the apices to form flattened, rounded spatulate tips. Paramere tips slightly paler than the rest of the paramere. Median lobe parallel-sided for most of

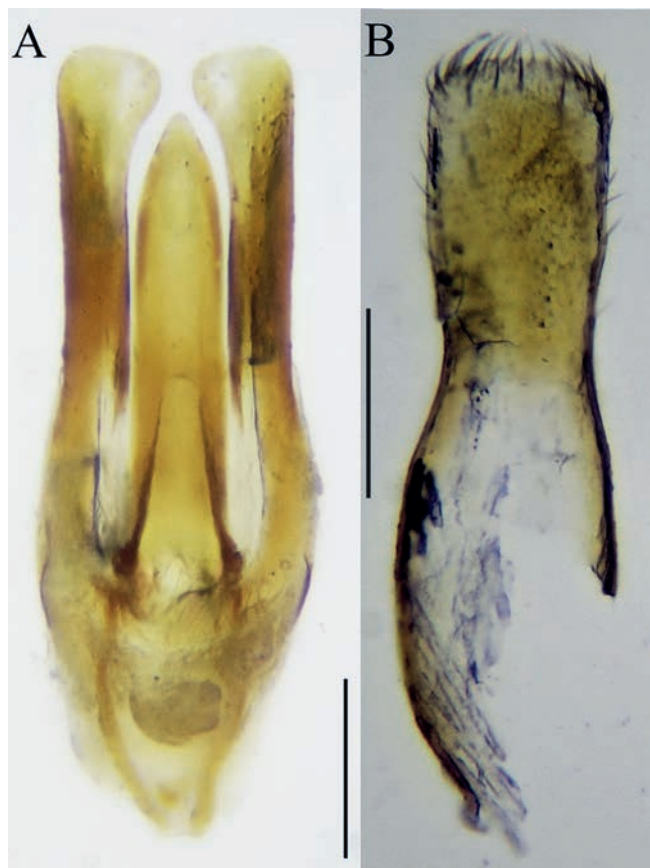


Fig. 2 – Holotype male *Anthrenus crypticus*. A) Aedeagus dorsal aspect; B) sternite IX. Scale bar = 100 μ m in both cases. / Olotipo maschio di *Anthrenus crypticus*. A) Vista dorsale dell'edeago; B) sternite IX. Scala grafica = 100 μ m in entrambi i casi.

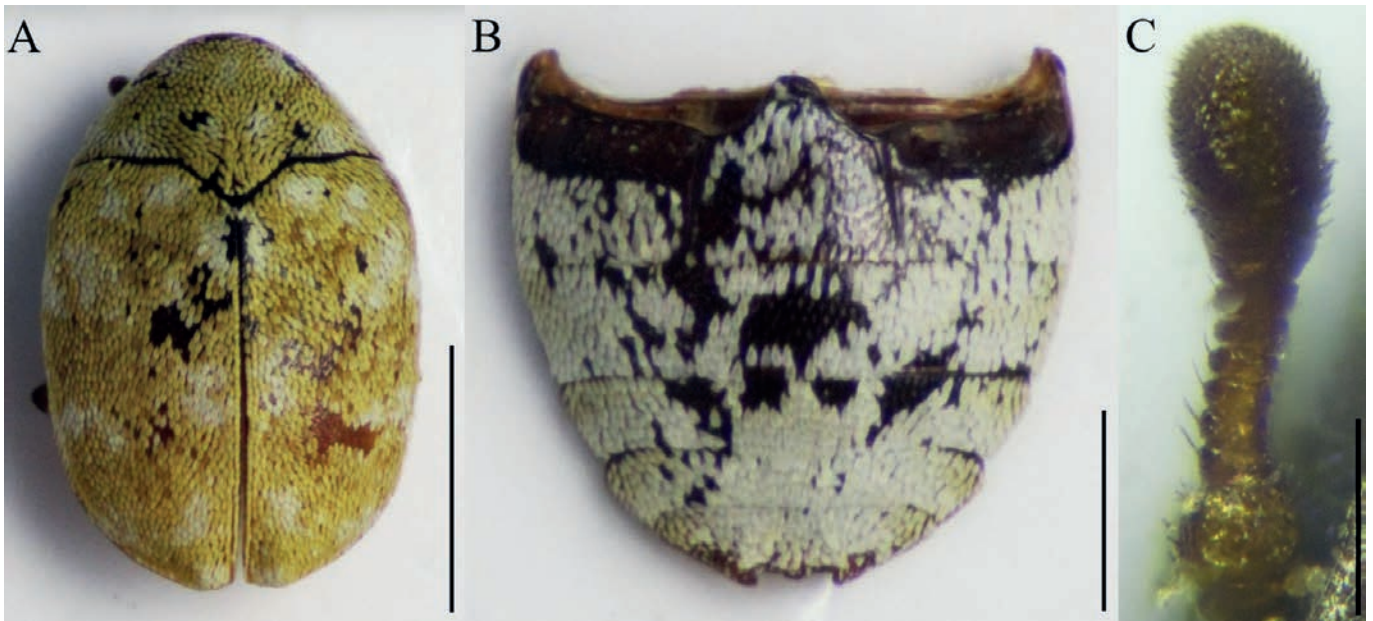


Fig. 3 – Holotype male *Anthrenus fosteri*. A) Habitus dorsal aspects (scale bar = 1 mm); B) ventrites (scale bar = 1 mm); C) antenna (scale bar = 100 μ m). / Olotipo maschio di *Anthrenus fosteri*. A) Vista dorsale dell'habitus (scala grafica = 1 mm); B) ventriti (scala grafica = 1 mm); C) antenna (scala grafica = 100 μ m).

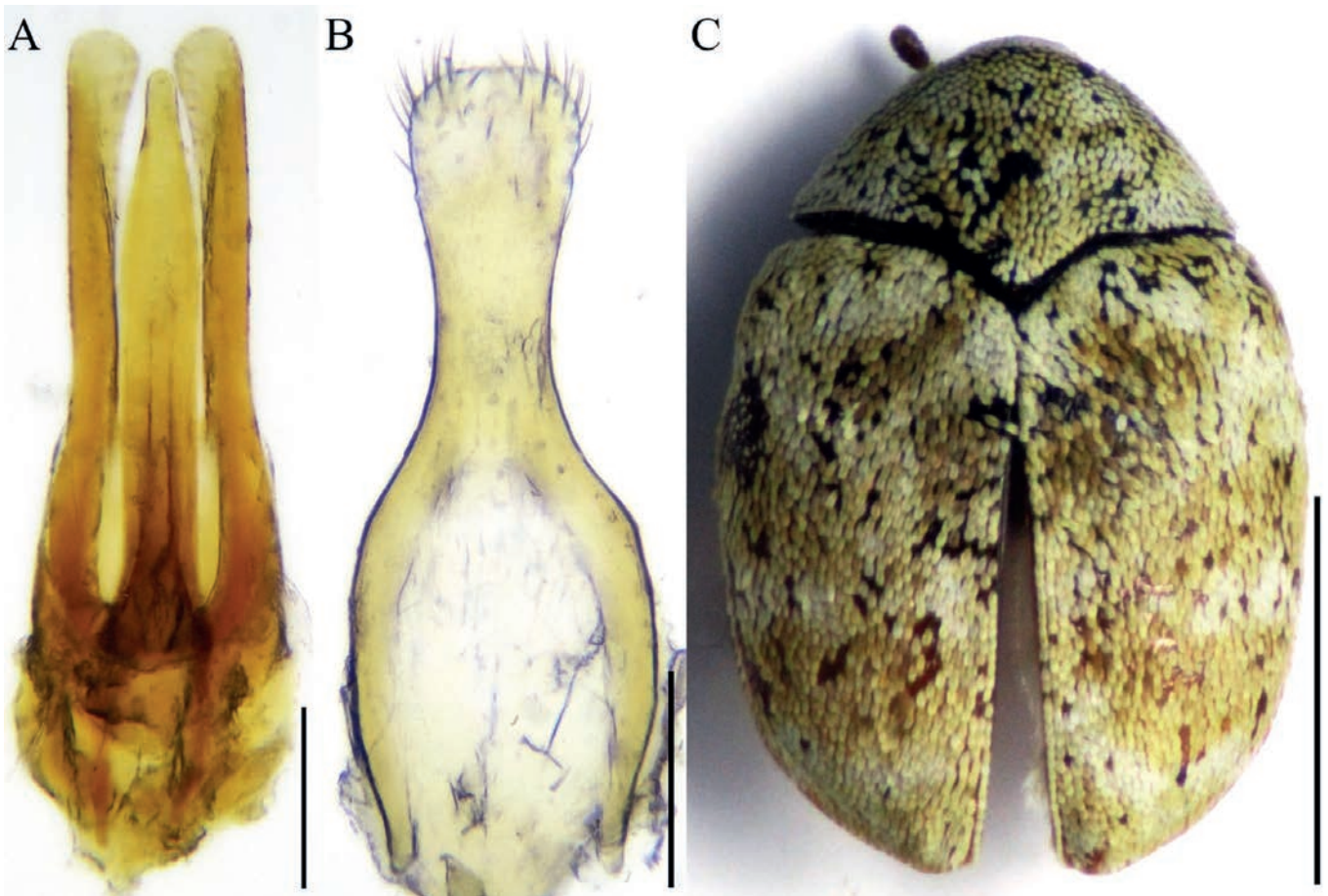


Fig. 4 – *Anthrenus fosteri*. A) Holotype aedeagus dorsal aspect (scale bar = 100 μ m); B) holotype male sternite IX (scale bar = 100 μ m); C) paratype female habitus dorsal aspect (scale bar = 1 mm). / *Anthrenus fosteri*. A) Vista dorsale dell'edeago dell'olotipo (scala grafica = 100 μ m); B) sternite IX dell'olotipo maschio (scala grafica = 1 mm); C) vista dorsale dell'habitus del paratipo femmina (scala grafica = 1 mm).

the length, with slight constriction towards the base. Tip of the median lobe a flattened, finger-like, evenly rounded extension lying almost completely along the same plane as the parameres, curving very slightly towards the posterior so that the tip extends just beyond the plane of parameres. Sternite IX (SL=385 μ m, Fig. 4B) posterior lobe less than half the length of sternite. Tip of the posterior lobe carries black setae, mostly towards the corners of the posterior lobe, some slightly in from lateral margins, few feeble setae on disc of posterior lobe. Some setae curve inwards slightly. Sternite IX mostly pale yellow with blotchy patches of white towards the tip of the posterior lobe. Margins of the posterior lobe converge to form a well-defined neck. From the neck, margins sweep outwards and bow round to terminate at two horns at the anterior end of sternite IX. Horns are broad, and the inner margins of each horn meet just anterior to neck of posterior lobe.

Phenotypic variation

Only two specimens of *A. fosteri* were found in NHML, holotype male and a paratype female (Fig. 4C). The female (BL=2.15 mm, BW=1.45 mm) was marginally larger than the male (BL=2.08 mm, BW=1.41 mm) and BW/BL values were 0.67 and 0.68, respectively. The female carries more dark brown scales than the male (Fig. 4C) indicating either sexual dimorphism or colour pattern variation across the species.

Etymology

Few British universities deliver courses on entomology. *Anthrenus fosteri* is named after Dr Chris W. Foster to recognise his efforts to deliver entomology teaching and research at both undergraduate and postgraduate level at the University of Reading, UK, and his work with the Royal Entomological Society.

Anthrenus senegalensis Pic 1927 (Figs 5-7)

Material examined

Bambey, Senegal (14.7N, -16.455E), 1940-1945, J. Risbec leg. Collected from carrot [sic.], J. Lancaster leg. 13/vi/1983, West Africa, Senegal, no name 16/iii/1999, Yaguiné-Banda, Mali, associated with ootheca of *Hieroglyphus daganensis* Krauss, 1877. All specimens in NHML.

Diagnosis

Anthrenus (s. str.) *senegalensis* (Fig. 5A) has a single dark amber ocellus on the vertex, just below the level of top of eyes and a notch on the lower inner margin of the eye. Face covered in pale yellow scales, which in some specimens are a shade darker on the vertex. The pronotal and basal elytral integument is very dark brown. Away from the base and towards the elytral apices the integument becomes redder. Elytra are covered in dark and light brown scales. The scales on either side of the small, dark, triangular scutellum are pale brown. The scales behind and below the humerus are pale brown and pale brown scales continue from the humerus along the outer margin. At about midway, pale brown scales leave the margin and form a downward curved, narrow fascia that crosses the elytra just beyond halfway. The fasciae on each elytron meet at the elytral suture, with more pale brown scales forming a vertical line on either side of the suture that extends towards but does not reach the elytral apices. Just before the apices the pale brown scales sweep left and right along the elytra to form a sub-apical fascia. Four small spots consisting of white scales sit in the mid-fascia accentuating the downward curve of the fascia. There are a few white scales in the sub-apical fascia and at the base of the elytra. All other scales are a darker brown. The pronotum is covered in brown scales

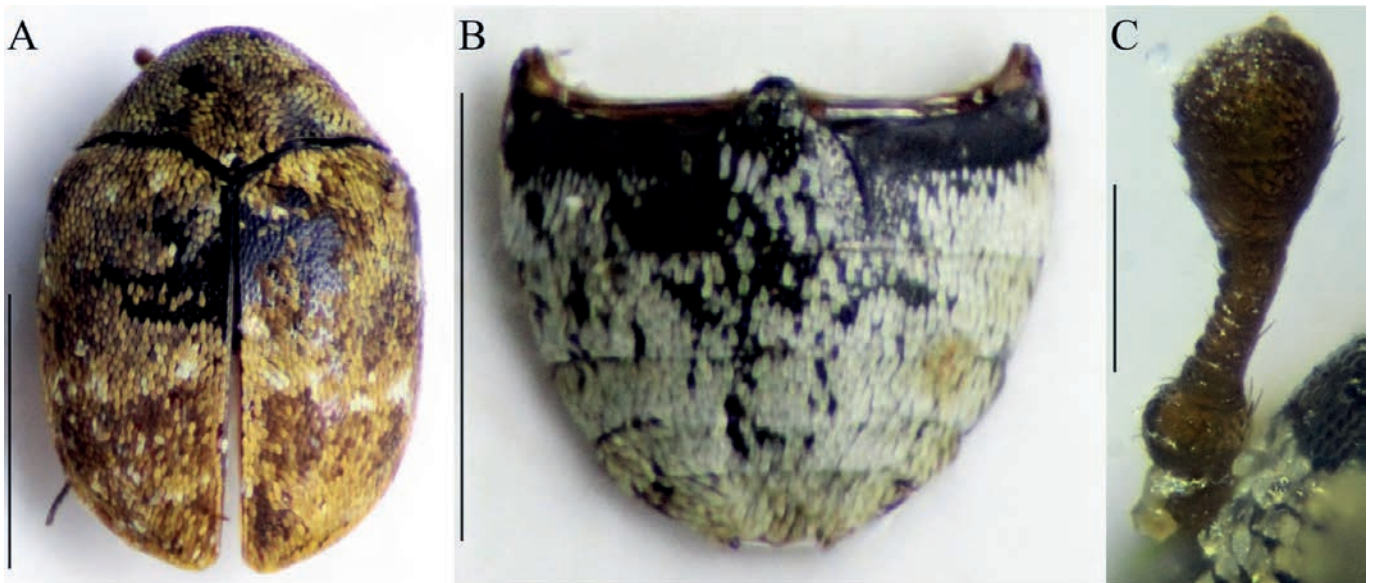


Fig. 5 – Male *Anthrenus senegalensis*. A) Habitus dorsal aspects (scale bar = 1 mm); B) ventrites (scale bar = 1 mm); C) antenna (scale bar = 100 μ m). / Maschio di *Anthrenus senegalensis*. A) Vista dorsale dell'habitus (scala grafica = 1 mm); B) ventriti (scala grafica = 1 mm); C) antenna (scala grafica = 100 μ m).

of varying hue, paler towards the lateral margins and darker on the pronotal disk, with two spots of dark brown on the posterior margin on either side of the scutellum. Ventrite (Fig. 5B) integument is dark red and covered in yellow-tinted scales on the disk, fading to a broad margin of yellow ochre scales. The scales on the outer, anterior corners of each sternite are marginally darker.

The 11-segmented antenna (Fig. 5C) is entirely red, with little to no variation in hue among the various antennomeres. All components of the legs are similarly red. The antero-ventral faces of the femora are covered in pale brown scales.

Internal characteristics

Fig. 6A shows the ventral surface of the aedeagus. The parameres are rod-shaped for most of their length. The parameres bow out from the base before curving towards each other, approaching midway, and then slowly diverging towards the posterior tips. The outer margin of each paramere is strongly concave. The parameres are almost the same width for most of their length but expand to form rounded spatulate tips. The tips are paler than the rest of the parameres, suggesting they are either thinner or consist of less sclerotized material and carry no visible setae. The median lobe is narrow at the base and

gradually expands for $\frac{3}{4}$ of its length. At this point, the margins converge towards an evenly rounded, blunt tip. The tip is marginally paler than the rest of the median lobe. The tip of the median lobe is very flat (dorso-ventrally) and curves dorsally beyond the line of the parameres.

Sternite IX (Fig. 6B) has a small posterior lobe tipped with a tight mass of setae at the tip, many of which bend inwards. The setae extend a short way down the margins and the face of the posterior lobe. The area of the posterior lobe carrying setae is very pale, almost white. The posterior lobe terminates at a neck and anterior to the neck the margins sweep outwards and then curve back towards each other forming two long, bowed anterior horns. The length of the horns (to the neck) is about twice that of the length of the posterior lobe (from the neck).

Phenotypic variation

Twelve male *A. senegalensis* were found in NHML (mean BL = 1.974 ± 0.103 (standard deviation) mm, mean BW/BL = 0.686 ± 0.01). 95% of specimens of male *A. senegalensis* would be expected to fall between 1.747mm and 2.2mm, with a BW/BL between 0.666 and 0.706. The dorsal colour pattern was variable (Fig. 7), in particular the extent and clarity of the patches of white scales, the hue and extent of the pale brown/yellow scales, and the extent of the darker brown scales.

Geographical distribution

The locations where the study species were collected are shown in Fig. 8.

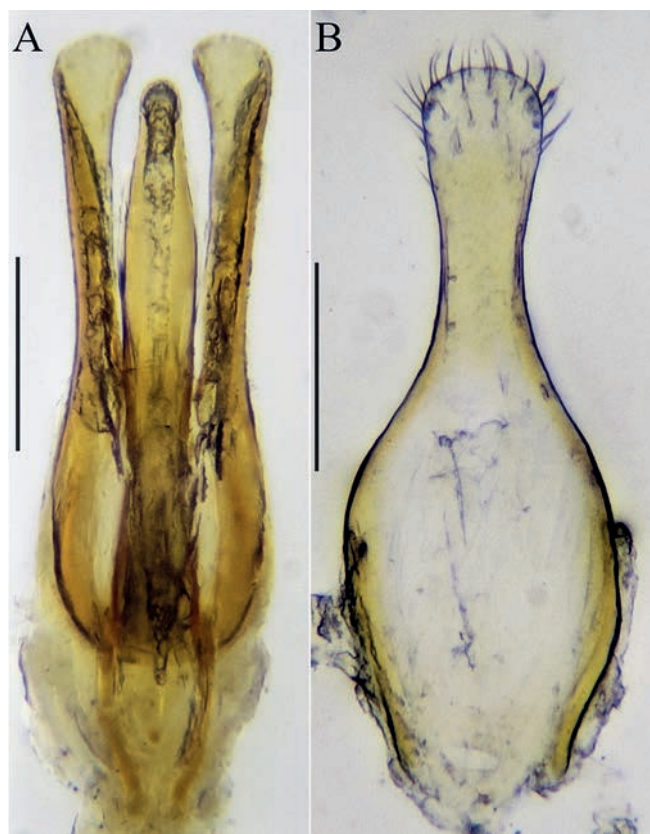


Fig. 6 – Male *Anthrenus senegalensis*. A) Aedeagus dorsal aspect; B) sternite IX. Scale bar = 100 μ m in both cases. / Maschio di *Anthrenus senegalensis*. A) Vista dorsale dell'edeago; B) sternite IX. Scala grafica = 100 μ m in entrambi i casi.

Differential diagnosis

All three species considered here were confused in the NHML and considering the variable colour patterns (Figs. 1A, 3A, 4C, 7), it is easy to see how this could happen. Both *A. fosteri* and *A. senegalensis* are paler on average than *A. crypticus*, although only one specimen of *A. crypticus* was found. *Anthrenus crypticus* aedeagus differed greatly from *A. fosteri* and *A. senegalensis* in that the median lobe and parameres were thicker giving the aedeagus a broader, squatter appearance. The *A. crypticus* sternite IX had a much broader, square-topped posterior lobe with barely any constriction at the base of the posterior lobe. *Anthrenus fosteri* and *A. senegalensis* are more similar, although geographical separation might offer easy identification. There is a lot of overlap in the colour patterns. The tip of *A. fosteri* median lobe is extended into a narrow, parallel-sided finger, whereas the *A. senegalensis* median lobe tapers gradually to a broad, bluntly rounded tip. The posterior apices of *A. fosteri* parameres only slightly expand to broad, rounded tips that tilt inwards slightly towards the tip of the median lobe. *Anthrenus senegalensis* parameres tips are broader, especially on the inner margin where the tips expand towards the median lobe, and the parameres tips are angled slightly upwards away from the tip of the median lobe. The sternite IX posterior lobe of *A. fosteri* occupies a greater proportion of the length of the sternite than *A. senegalensis*, and the curved anterior horns are much thicker in *A. fosteri* than *A. senegalensis*.



Fig. 7 – *Anthrenus senegalensis*. A-H) Habitus dorsal aspect. Scale bars = 1 mm in all cases. / *Anthrenus senegalensis*. A-H) Vista dorsale dell'habitus. Scala grafica = 1 mm in tutti i casi.

DISCUSSION AND CONCLUSIONS

The current study was initiated when 34 specimens labelled *Anthrenus senegalensis* were discovered in the NHML. *Anthrenus senegalensis* is not a well-known species, not unusual for Dermestidae, so the original intention was to generate a thorough description of the species. After the first few dissections had been carried out, it was evident that similar-looking species had been mixed. The study, once again, demonstrates the importance of dissecting *Anthrenus* to be certain of identifica-

tion and in many cases, it is very difficult to identify species with an acceptable level of certainty from habitus features alone. *Anthrenus senegalensis* has a highly variable colour pattern (Fig. 7). All specimens shown in Fig. 7 were dissected to confirm identification. There is no indication that the colour patterns of *A. senegalensis* found in the current study fall into two discrete categories. It is much more likely that the colour pattern shown in Fig. 7 is a manifestation of colour pattern plasticity, something that has been demonstrated in other *Anthrenus* species (Holloway *et al.* 2022).

The collection locations of the specimens considered here are shown in Fig. 8. Háva (2024) describes *A. senegalensis* as occurring in Benin, Gambia, Guinea Bissau, Senegal, Sierra Leone, and Togo. As a result of confusion between *A. senegalensis* and *A. crypticus* (Háva 2022), we now do not know the true distributions of the two species, other than that shown in Fig. 8.

Discovery of new species relies on the availability of good descriptions of existing species which is not always the case. Inspection of the images on Herrmann's (2023) site and wider literature reveals images or illustrations of genitalia for most *Anthrenus* (s. str.) species. For 10 *Anthrenus* (s. str.) species, *A. ethiopicus* Háva 2004, *A. kaliki* Pic 1952, *A. lindbergi* Mroczkowski 1959, *A. lopatini* Zhantiev 1976, *A. pacificus* Fairmaire 1850. *A. pulaskii*

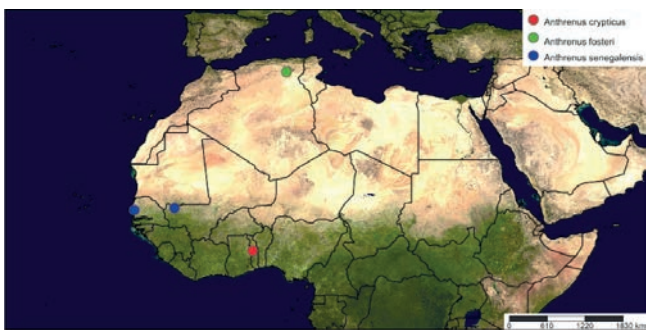


Fig. 8 – Collection locations of study insects. / Località di raccolta degli insetti studiati.

Kadej 2011, *A. rautebergi* Reitter 1908, *A. rotundulus* Reitter 1889, *A. seminulum* Arrow 1915, *A. sparsutus* Fairmaire 1850, no published illustrations of aedeagal (and sternite IX) structure could be found. Most of these species were described a long time ago accounting for the lack of images (NB *A. ethiopicus* and *A. pulaskii* holotypes are female), but efforts should be made to plug these gaps to facilitate species discovery and further taxonomic studies. The discovery of *A. crypticus* and *A. fosteri* brings the number of *Anthrenus* (s. str.) species to 77.

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