
Nicolas Gompel

Abstract: A revision is made of the species of the genus Mixaderus Collado & Alonso-Zarazaga, 1996 (Coleoptera: Aderidae) known from Madagascar and the Mascareignes archipelago. It includes the description of three new species and multiple new placements and synonymies, and is meant to provide a framework for future taxonomic studies of this widespread African genus.

Key words: Coleoptera, Aderidae, Mixaderus, Réunion Island, Republic of Mauritius, Madagascar, Mascareignes.

El género Mixaderus Collado & Alonso-Zarazaga, 1996 en Madagascar y el archipiélago de las Mascareñas, y descripción de tres especies nuevas (Coleoptera: Aderidae)

Resumen: Se hace una revisión de las especies del género Mixaderus Collado y Alonso-Zarazaga, 1996 (Coleoptera: Aderidae) conocidas de Madagascar y las islas Mascareñas. Incluye nuevas asignaciones y sinonimias y la descripción de tres nuevas especies, y se propone proporcionar un marco de referencia para futuros estudios taxonómicos de este abundante género africano.

Palabras clave: Coleoptera, Aderidae, Mixaderus, Isla de la Réunion, República de Mauricio, Madagascar, Mascareñas.


Introduction

The generic and suprageneric classification of the beetle family Aderidae (Coleoptera: Tenebrionoidea) is loose and confused and awaits much systematic work (Nardi, 2008; Lawrence and Śliwiński, 2010). Despite efforts of individual researchers to propose a suprageneric framework, even taking the shape of male genitalia into account (Werner, 1990) most species remain unplaced and still belong to the original and no longer available genera Hylophilus Berthold, 1827 and Xylophilus Curtis, 1830. This situation makes the revision of regional groups particularly difficult. Several African species were described by Pic and Bàguena-Corella, and parsed by the latter into various genera and subgenera (Bàguena-Corella, 1948; Bàguena-Corella, 1962). In the context of a survey of the Réunion Island beetles, my colleague Jacques Poussereau communicated to me a series of unidentified Aderidae, most of which looked superficially alike, but upon closer examination appear to belong to different species. A comparison to Bàguena-Corella’s type material led me to realize that they all belonged to the genus Mixaderus Collado & Alonso-Zarazaga, 1996. This prompted me to examine additional specimens from this island and to extend the survey to Mauritius and Madagascar. Pic and others have described several species from this region (Pic, 1903; Pic, 1909; Pic, 1921; Blair, 1935; Pic, 1937; Pic, 1948). Most of these species were described as Hylophilus or Xylophilus, two genera now invalid, and have not been genetically re-assigned since. I screened various museum and colleagues’ collections for species akin to those I had in hand, which led me to find a total of fourteen Mixaderus species for this region, three of which are new. This work also led me to propose several synonymies and new placements. Most species are known by a single, or a handful of specimens. I therefore expect that more Mixaderus species are present in these islands, and this work should be regarded as a preliminary step for future studies on the group.

The Mixaderus species from Madagascar and the Mascareignes islands make a fairly homogeneous group, and I have included the study of male genitalia to facilitate species separation. These genitalic character systems are both stable within species and distinct between species, providing reliable species identification criteria. Most specimens, though, can be separated using external morphology, in particular the pigmentation pattern of the elytra and the shape of the antennae.
Material and methods: specimens were obtained from colleagues or Museum collections. Most were dissected, cleaned and re-mounted. Entire beetles, or details, were photographed on a Leica M420 Makroskop equipped with a ProgRes C5 ccd camera (Jenoptik). Stacks of images were projected into single extended depth-of-field images using the Helicon Focus software (HeliconSoft). All Images were enhanced using Adobe Photoshop.

Measurements were made using a stage micrometer that was imaged under the same conditions, or directly on a Leica M26 stereoscope, using an eyepiece graticule.

Information relating to material examined is listed as follow: Country, State/Department: Locality, collection information (Collector), date of collection: number of specimens (Current host collection acronym).

Acronyms: Museo Nacional de Ciencias Naturales, Madrid (MNCNM); Muséum d’Histoire Naturelle de Paris (MNHN); Natural History Museum, London (NHM); Muséum d’Histoire Naturelle de Genève (MHNG); Jacques Poussereau’s collection (JPC, France: Dax); Nicolas Gomez’s collection (NGC, France: Marseille).

Results and Discussion

1) Genus diagnosis

Genus Mixaderus Collado & Alonso-Zarazaga, 1996

Mixaderus Bąguena-Corella, 1948 [nomen nudum].


Mixaderus (Perisia) Bąguena-Corella, 1948 [nomen nudum].


Mixaderus (Ginerostia) Bąguena-Corella, 1948 [nomen nudum].

PROPOSED DIAGNOSIS: small size (around 1.3-2.4 mm), stocky to moderately elongate. Head and thorax of similar width, generally much narrower than elytra. Head, thorax and elytra covered with double pubescence: recumbent hairs emerging from punctuation and interspersed very short, silvery or golden, pruinosity. Species convex, with disc of elytra depressed. Pronotum transverse to moderately elongate, characterized in most species by a dimple on each side of the dorsal midline, near the basal edge of the pronotum (Fig. 38). These depressions are oval, with their longer axis pointing toward the anterior angles of the pronotum. The pronotum is also characterized by the presence of a few longer hairs inserted near the posterior angles and pointing outward.

Eyes large, rounded, notched anteriorly near the insertion points of the antennae in most species, their posterior edge adjacent to the rear of the head only separated from it by a narrow stripe of cuticle.

Coloration of body and appendages variable, from yellow to dark, with several species harboring a complex pattern of stripes and spots on the pronotum and elytra, and variegated legs.

Antennae variable in color and conformation, sexually dimorphic in some species.

First segment of the foretarsi enlarged in the male of several species (e.g., Fig. 41). Male genitalia with a subarticulate base and a pointed apex, characterized in several species by paired appendages emerging from the sides, with 3-4 sensory setae at their tip. The length and shape of these appendages appears stable within species and provides a reliable criterion to separate taxa. Internal armature composed of two symmetric branches extending from the base to the apex, and often sticking out on the basal side.

RATIONALE FOR SYNONYMY: Bąguena-Corella (1948) described three subgenera of Mixaderus: Mixaderus s.str., Perisia and Ginerostia (type species designated and genus names validated by Collado & Alonso-Zarazaga (1996)), based on the presence of elytral markings for the former, and dilated male foretarsi for the latter. These characters are extremely labile between species, some species carry both (e.g., M. emmerizei) and their subgeneric value is questionable. For this reason, I propose to consider them both synonomous of Mixaderus: Mixaderus Collado & Alonso-Zarazaga, 1996 = Mixaderus (Perisia) Collado & Alonso-Zarazaga, 1996, syn. nov. = Mixaderus (Ginerostia) Collado & Alonso-Zarazaga, 1996, syn. nov.

I have examined the type species of Mixaderus Collado & Alonso-Zarazaga, 1996, Hylophilus simplicis Escalera, 1941, which shares most of the morphological characters of the species from Madagascar and the Mascareignes islands that are described below. Figure 15 depicts the habitats of one of the two female syntypes of this species, preserved at the MNCNM.

GENUS PLACEMENT IN THE ADERIDAE CLASSIFICATION: when he first proposed a diagnosis for Mixaderus, Bąguena-Corella (1948) placed this genus in his tribe Aderini, in his subtribe Olotelina (currently known as Gompelina (Alonso-Zarazaga, 2010)). His definition of this subtribe is limited to the relative length of the second and third antennomeres, whereby the third would be longer than the second (Bąguena-Corella, 1948; Bąguena-Corella, 1962). Bąguena-Corella underscores the affinity between Olotelina and Aderina, both sharing a double elytral pubescence comprising normal setae along with pruinosity. While the Mixaderus species treated hereafter constitute a fairly homogeneous group at the morphological level, which I am inclined to consider monophyletic, the relative length of the second and third antennomeres is variable (Fig. 16-29). It is therefore difficult to decide whether they belong in the subtribe Olotelina or not, solely based on this criterion. Also, the species placed in the genus Olotelus Mulsant & Rey, 1866 sensu Bąguena-Corella (1948) (a genus comprising species today parsed between Cobossosia Collado & Alonso-Zarazaga, 1996 and Gompelina1 Alonso-Zarazaga, 2010) does not share much with Mixaderus species. For instance, the structure of the male genitalia differs markedly between both groups: Gompelina species have no subarticulated base, and while male genitalia of Cobossosia species, including its type species C. fulvicolor (Escalera, 1942) have a subarticulated base, they are devoid of lateral appendages often found in many Mixaderus (Figs. 32-37). On these bases, Bąguena-Corella’s work (1948) does not shed much light on the suprageneric placement of Mixaderus.

1 = Olotelus Mulsant & Rey but not Olotelus Solier, 1851)
The classification of North American species of Aderidae (Werner, 1990; Chandler, 2002) is more insightful in this respect. When applied to Mixaderus species, the key given in Chandler (2002) leads to the vicinity of the genus Ganascus Casey, 1895. From a morphological standpoint, the affinity of Chandler (2002) leads to the vicinity of the genus Mixaderus and Ganascus have a similar system of pigmentation of their thorax and elytra, with combined patterns of dark and pale markings. For these reasons, I provisionally place the genus Mixaderus near Ganascus, in the tribe Phytophagini Bâguena-Corella, 1948, sensu Chandler (2002).

**Distribution:** the genus Mixaderus is formally recorded only from Africa and Japan (Bâguena-Corella, 1948; Nardi, 2008).

2) **Species taxonomy**

- *Mixaderus emmerezi* (Pic, 1903)

  Fig. 1, 16, 30, 39.

  *Hyphilus emmerezi* Pic, 1903: Pic, 1903. Type: MNHN (examined).

  *Hyphilus emmerezi* Pic, 1903: Pic, 1910.

  **Mixaderus (Perisia) emmerezi** Champ. [sic]: Bâguena-Corella, 1948.

  *Xylophilus rodericensis* Blair, 1935: Blair, 1935, **new synonymy.**

  **Type:** NHM (examined).

  **Mixaderus (Perisia) rodericensis** Blair: Bâguena-Corella, 1948, **new synonymy.**

  **Redescription:** General. — Length: 1.3-1.8 mm, oval, very convex, overall morphology variable.

  **Head.** — Usually brown; eye large, adjacent or nearly adjacent to the rear of the head, notched, conspicuously larger in males; interocular space larger than eye diameter in female, narrower than eye diameter in male; maxillary palps orange; pruinosity is silvery, dense and woolly; punctuation fine and sparse.

  **Antennae.** — Slender; antennomere shape variable. 1-3 short and rounded; 4-6 elongate; 7-10 transverse and progressively wider, truncated at their extremities; 11 larger, asymetrically acuminate; color uniformly pale: yellow or orange; insertion near or in eye notch; antennae reach the base of pronotum when folded backward.

  **Pronotum.** — Usually transverse; anterior angles rounded in dorsal view; sides straight and parallel; dark; dimples around midline present; pubescence pale, white pruinosity forming a narrow band along the base and sides, in dimples, and in an anterior patch on dorsal midline; punctuation moderately dense, coarse.

  **Scutellum.** — Subquadrate, covered with white pruinosity.

  **Elytra.** — Very convex, depressed on disc; sides rounded in both sexes; width/length ratio: 0.64-0.74; dark with a pattern of yellow markings as follows: one large humeral spot on each side, a W-shaped antemedial stripe, an M-shaped postmedial stripe and a broad apical stripe. In some specimens from Mauritius the yellow color is dominant and gives the impression of dark stripes on a yellow background; pruinosity of woolly texture, silvery or white on the yellow bands, yellow or orange on the dark background; pubescence yellow; punctuation density moderate to dense, coarse.

  **Legs.** — Mostly pale, hind femora sometimes dark; foretarsi with first segment strongly enlarged in males.

  **Genitalia.** — Figure 30. Appendages absent.


  **Type material:** Republic of Mauritius (d’Emmerez leg.), bearing the label "type" (Pic’s handwriting), presently designated as lectotype.

- *Mixaderus snelli* (Blair, 1935), new combination

  Fig. 14, 24.

  *Xylophilus snelli* Blair, 1935: Blair, 1935. Type: NHM (examined)

  **Aderus snelli** Blair: Bâguena-Corella, 1948.

  **Redescription:** General. — Length: 1.3 mm, oval, depressed; male unknown.

  **Head.** — Entirely yellow; eye of medium size, rounded (not notched), adjacent or nearly adjacent to the rear of the head; interocular space in female larger than eye diameter; maxillary palps orange; hairs short; pruinosity silvery; punctuation fine, rugose and confluent.

  **Antennae.** — Very slender; antennomere shape: 1-10 bead-shaped, about as long as wide; 11 slightly larger; color uniformly pale: yellow; insertion adjacent to the eyes; antennae reach the base of pronotum when folded backward.

  **Pronotum.** — Strongly transverse, anterior angles rounded in dorsal view, sides straight and parallel; yellow; dimples around midline absent; pubescence yellow, pruinosity white; punctuation moderately dense, coarse.
Scutellum. — Subquadrate, covered with white pruinosity. Elytra. — Weakly convex; sides rounded; width/length ratio 0.65; uniformly yellow, infuscated on disc; pubescence yellow; pruinosity silvery or white, silky; punctuation moderate to dense, coarse.

Legs. — Entirely yellow.

**MATERIAL EXAMINED:** **TYPE MATERIAL:** Republic of Mauritius: Rodrigues Island (H. J. Snell & H. P. Thomasset leg.), VIII-XI. 1918: female holotype (NHM).

- *Mixaderus mantillerii* n. sp.

Fig. 5, 20, 40.

**DERIVATIO NOMINIS:** the species is dedicated to my colleague Antoine Mantilleri (France, Paris) whose invaluable guidance through the MNHNP collection was decisive for this work.

**DESCRIPTION:**

*General.* — Length: 1.55 mm; oval, convex; male unknown. *Head.* — Brown, clypeus and labrum yellow; eye large, notched, adjacent to the rear of the head; interocular space larger than eye diameter; maxillary palps orange; hairs short; pruinosity woolly; punctuation moderately dense, coarse.

*Antennae.* — Slender; antennomere shape: 1-2 thick, rounded, slightly longer than large, subequal; 3-6 equally long, but narrower than 1-2; 7-10 transverse and progressively enlarged; 11 shortly acuminate; color: yellow; insertion near or in eye notch; antennae reach the base of pronotum when folded backward. *Pronotum.* — Transverse; anterior angles rounded in dorsal view; sides weakly rounded and convergent anteriorly; brown; dimples around midline present; a narrow band of white pruinosity along the base and sides and in dimples where it forms two spurs inward; pubescence pale; punctuation moderately dense, of intermediate size. *Scutellum.* — Rectangular, covered with white pruinosity. *Elytra.* — Depressed on disc; sides moderately rounded; width/length ratio 0.63-0.68; dark with a pattern of narrow yellow markings as follows: a weak humeral spot on each side, a W-shaped antemedial stripe and an M-shaped postmedial stripe; pubescence yellow; pruinosity woolly, silvery or white on the yellow bands, yellow or orange on the dark background; punctuation moderately dense, coarse.

*Legs.* — Mostly dark, except tarsi, foretibiae, and base of mid- and hind tibiae; foretarsi with first segment enlarged in males. *Genitalia.* — Figure 35. Appendages present.

**MATERIAL EXAMINED:** Republic of Mauritius, Chamarel (Vinson J. leg.), 23.IX.1934: 1 ex. (NHM); Macchabee Forest (Huston A.M. leg), 8.VI.1971: 2 ex. (NHM and NGC); Le Pouce (Huston A.M. leg), 10.VI.1971: 1 ex. (NHM).

**TYPE MATERIAL:** Republic of Mauritius, Chamarel (Vinson J. leg.), 23.IX.1934: inferred holotype, male specimen (MNHNP, Collection Maurice Pic), bearing the label "superbus v. nov. angustefasciatus" (Pic's handwriting), presently designated as lectotype.

● *Mixaderus pinatomorphus* (Pic, 1948), new combination

Fig. 9, 29.

_Hylophilus pinatomorphus*_ Pic, 1948: Pic, 1948. Type: MNHNP (examined).

**REDESCRIPTION:** General. — Length: 2.35 mm; moderately convex, elongate; male unknown.

**Head.** — Black; eye large, notched, adjacent or nearly adjacent to the rear of the head; interocular space in female narrower than eye diameter; maxillary palp orange; hairs short; pruinosity dense; punctuation moderately dense, fine.

**Antennae.** — Extremely thick and very hairy; antennomere shape: 1 large, rounded, longer than wide; 2 smaller, bead-shaped; 3 as long as 2, but conical; 4-10 very large and transverse; 11 as broad as 10, but much longer and asymmetrically acuminate; color 1-2 and 11 brown; 3-10 black; insertion near or in eye notch; antennae reach the base of pronotum when folded backward.

**Pronotum.** — As long as wide in dorsal view; anterior angles rounded; sides straight and parallel; dimples around midline present; dark; pruinosity silvery along base (including dimples) and sides; disc covered with golden pruinosity; pubescence pale; punctuation moderately dense, of intermediate size.

**Scutellum.** — Trapezoidal, covered with white pruinosity.

**Elytra.** — Depressed on disc; sides nearly straight and parallel; width/length ratio 0.67; dark with a pattern of yellow markings as follows: a weak humeral spot on each side, a broad and diffuse antemedial stripe extended posteriorly in a wide domain along the suture, and a broad post-medial stripe interrupted before the suture in a bifurcation; pruinosity woolly, white on the yellow bands, orange on the dark background; pubescence yellow; punctuation coarse.

**Legs.** — All legs similarly colored: orange-brown with femora and apical halves of tibiae dark.

**MATERIAL EXAMINED:** Type material: _Republic of Mauritius_, Montagne Ory, (Vinson J. leg.), 7.XI.1936: inferred holotype, female specimen (MNHNP, Collection Maurice Pic), bearing the labels "*Hylophilus pinatomorphus* [sic!] n sp" (Pic’s handwriting), presently designated as lectotype.

● *Mixaderus sinuatefasciatus* (Pic, 1937), new combination

Fig. 2, 17.


**REDESCRIPTION:** General. — Length: 1.45 mm; very convex, oval; male unknown.

**Head.** — Brown; eye large, notched, adjacent or nearly adjacent to the rear of the head; interocular space in female larger than eye diameter; maxillary palp orange; hairs short; pruinosity silvery, dense, woolly; punctuation moderately dense, coarse.

**Antennae.** — Slender; antennomere shape: 1 large and rounded; 2 shorter, as long as wide, bead-shaped; 3-7 filiform, longer than wide; 8-10 cylindrical, wider than long; 11 longer, asymmetrically acuminate; color: mostly yellow, antennomeres 1-2 brown; insertion near or in eye notch; antennae reach the base of pronotum when folded backward.

**Pronotum.** — Weakly transverse, anterior angles rounded in dorsal view; sides straight and parallel; dimples around midline present; dark; white pruinosity largely covering the pronotum, except for a large M-shaped marking resulting from golden pruinosity; pubescence pale; punctuation moderately dense, coarse.

_Scutellum._ — Subquadrate, covered with white pruinosity.

**Elytra.** — Very convex, depressed on disc; sides moderately rounded; width/length ratio 0.62-0.64; dark with a pattern of yellow markings as follows: a distinct humeral spot on each side, a broad antemedial stripe of unequal width, broadened in a large rectangle on each side on disc, interrupted at the suture, a post-medial M-shaped stripe whereby the arches of the M are made of deep loops, and an apical stripe; pruinosity woolly, silvery or white on the yellow bands, yellow or orange on the dark background; pubescence yellow; punctuation dense, coarse.

**Legs.** — Mostly pale, hind femora and apical halves of hind tibiae darker.

**REMARK:** this species is possibly a synonym of _M. emmerezi_ Pic. The shape of the posterior elytral stripe is very distinct, though, and I am reluctant to change its status before examining more material, in particular males.

**MATERIAL EXAMINED:** _Republic of Mauritius_, Roches noires (Vinson J. leg.), IX.1936: inferred holotype, female specimen (MNHNP, Collection Maurice Pic), bearing the labels "*Hylophilus pinatomorphus* n sp", "N°537"; "n sp. prê superbus" (Pic’s handwriting), presently designated as lectotype.

**TYPE MATERIAL:** _Republic of Mauritius_, Roches noires (Vinson J. leg.), IX.1936: lectotype (female), antennae and male genitalia.

 antennae (scale bar: 500 µm): 16. _M. emmerezi_ (Pic) female from La Réunion (Le Tampon, Plaine des Cafres); 17. _M. sinuatefasciatus_ (Pic) lectotype (female) from Mauritius; 18. _M. madecassus_ (Pic): type (female) from Madagascar; 19. _M. pousseraeui_ n. sp.: paratype (male) from La Réunion (Salazie, Rempart de Béoule); 20. _M. mantilleri_ n. sp.: holotype (female) from Madagascar; 21. _M. gomyi_ n. sp.: paratype (male) from Mauritius; 22. _M. superbus_ (Pic): (female) from La Réunion; 23. _M. simplex_ (Pic): type (female) from Madagascar; 24. _M. snelli_ (Blair): type (female) from Rodrigues island; 25. _M. cinereofasciatus_ (Pic): lectotype (male) from Mauritius; 26. _M. angustefasciatus_ (Pic): type (male) from Mauritius; 27. _M. hasi thorax_ (Pic): type (female) from Madagascar; 28. _M. perrieri_ (Pic): type (male) from Madagascar; 29. _M. pinatomorphus_ (Pic): type (female) from Mauritius. 30-37. _M. emmerezi_ (Pic): type from Mauritius; 31. _M. sinuatefasciatus_ (Pic): lectotype from Mauritius; 32. _M. gomyi_ n. sp.: paratype from La Réunion; 33. _M. perrieri_ (Pic) from Madagascar; 34. _M. superbus_ (Pic): from La Réunion; 35. _M. angustefasciatus_ (Pic) type from Mauritius; 36. _M. pousseraeui_ n. sp.: paratype from La Réunion; 37. _M. madecassus_ (Pic) type of _Hylophilus superbus v. trinitatus_ Pic, 1921) from Madagascar; 38. _M. madecassus_ (Pic) type of _Mixaderus_ (_Gionerosia_) _pinacotarsus_ Báguena-Corella, detail of prothorax showing the dimples around the midline (arrowhead) characteristic of the genus _Mixaderus_. 39-40. pronotum punctuation on disc; 39. _M. emmerezi_ (Pic) female from La Réunion; 40. _M. mantilleri_ n. sp.: type (female) from Madagascar; 41. foreleg with first tarsomere enlarged in a male of _M. superbus_ (Pic) from La Réunion; 42. genital segment of _M. perrieri_ (Pic) type: note the structure is characteristic of all species in the genus _Mixaderus_.

Fig. 2. _Mixaderus_ species, antennae and male genitalia. 16-29, antennae (scale bar: 500 µm): 16. _M. emmerezi_ (Pic) female from La Réunion (Le Tampon, Plaine des Cafres); 17. _M. sinuatefasciatus_ (Pic) lectotype (female) from Mauritius; 18. _M. madecassus_ (Pic): type (female) from Madagascar; 19. _M. pousseraeui_ n. sp.: paratype (male) from La Réunion (Salazie, Rempart de Béoule); 20. _M. mantilleri_ n. sp.: holotype (female) from Madagascar; 21. _M. gomyi_ n. sp.: paratype (male) from Mauritius; 22. _M. superbus_ (Pic): (female) from La Réunion; 23. _M. simplex_ (Pic): type (female) from Madagascar; 24. _M. snelli_ (Blair): type (female) from Rodrigues island; 25. _M. cinereofasciatus_ (Pic): lectotype (male) from Mauritius; 26. _M. angustefasciatus_ (Pic): type (male) from Mauritius; 27. _M. hasi thorax_ (Pic): type (female) from Madagascar; 28. _M. perrieri_ (Pic): type (male) from Madagascar; 29. _M. pinatomorphus_ (Pic): type (female) from Mauritius. 30-37. _M. emmerezi_ (Pic): type from Mauritius; 31. _M. sinuatefasciatus_ (Pic): lectotype from Mauritius; 32. _M. gomyi_ n. sp.: paratype from La Réunion; 33. _M. perrieri_ (Pic) from Madagascar; 34. _M. superbus_ (Pic): from La Réunion; 35. _M. angustefasciatus_ (Pic) type from Mauritius; 36. _M. pousseraeui_ n. sp.: paratype from La Réunion; 37. _M. madecassus_ (Pic) type of _Hylophilus superbus v. trinitatus_ Pic, 1921) from Madagascar; 38. _M. madecassus_ (Pic) type of _Mixaderus_ (_Gionerosia_) _pinacotarsus_ Báguena-Corella, detail of prothorax showing the dimples around the midline (arrowhead) characteristic of the genus _Mixaderus_. 39-40. pronotum punctuation on disc; 39. _M. emmerezi_ (Pic) female from La Réunion; 40. _M. mantilleri_ n. sp.: type (female) from Madagascar; 41. foreleg with first tarsomere enlarged in a male of _M. superbus_ (Pic) from La Réunion; 42. genital segment of _M. perrieri_ (Pic) type: note the structure is characteristic of all species in the genus _Mixaderus_.
• **Mixaderus poussereauini** n. sp.
Fig. 4, 19, 36.

**DERIVATIO NOMINIS:** the species is named after my colleague Jacques Poussereau (France, Dax) who lead me to initiate this work.

**DESCRIPTION:**

**General.** — Length: 1.65-2.05 mm; moderately convex, elongate; variability limited.

**Head.** — Usually black; eye large, notched, adjacent or nearly adjacent to the rear of the head; interocular space narrower than eye diameter in both sexes; maxillary palp orange; hairs short; pruinosity silvery, dense, woolly; punctuation fine and confluent.

**Antennae.** — Filiform but robust; antennomere shape 1-10 about as long as wide; 1-3 bead-shaped; 4-10 cylindrical with sharp truncation at each end; 11 nearly twice as big as 10, asymmetrically acuminate; color variable, uniformly brown-orange in some specimens, bicolored with yellow base and brown apex; all femora dark.

**Legs.** — Dense, coarse. pubescence yellow; punctuation moderate to dense, white on the yellow bands, yellow or orange on the dark background; pruinosity woolly, silvery or white on the yellow bands, yellow or orange on the dark background; pubescence yellow; punctuation moderate to dense, coarse.

**Elytra.** — Moderately convex, depressed on disc; sides straight and weakly convergent; dimples around midline present; dark; a pattern of silvery and golden pruinosity making variable bands; dimples covered with silvery pruinosity; pubescence pale; punctuation moderately dense, coarse.

**Scutellum.** — Subquadrate, covered with white pruinosity.

**Pronotum.** — Usually as long as wide, anterior angles rounded in dorsal view; sides straight and weakly convergent; dimples around midline present; dark; a frame of white pruinosity bordering the thorax; pubescence pale; punctuation moderately dense, coarse.

**Punctuation:**

**Antennae.** — Slender; antennomere shape: 1 large and rounded; 2 shorter, as long as wide, bead-shaped; 3-6 filiform, longer than wide; 7-10 cylindrical, progressively more transverse; 11 larger, asymmetrically acuminate; color uniformly pale: yellow or orange; insertion near or in eye notch; antennae reach the base of pronotum when folded backward.

**Pronotum.** — Weakly transverse, anterior angles rounded in dorsal view; sides straight and parallel; dimples around midline present; dark; a frame of white pruinosity bordering the thorax; pubescence pale; punctuation moderately dense, coarse.

**Description:**

**General.** — Length: 1.35-2.0 mm; convex, elongate; morphological variability limited.

**Head.** — Black; eye large, strongly notched, adjacent or nearly adjacent to the rear of the head; interocular space narrower than eye diameter in both sexes; maxillary palp orange; hairs short; pruinosity silvery, dense, woolly; punctuation sparse, fine.

**Antennae.** — Filiform to progressively widened at apex, robust, with developed pubescence; antennomere variable in


**Type Material:** **France, La Réunion:** inferred holotype, female specimen (MNHN, Collection Maurice Pic), bearing the labels "I. Bourbon", "Hylophilus superbus Pic n.sp." (Pic’s handwriting), presently designated as lectotype. This specimen is heavily damaged, the head and half of the legs are missing.

• **Mixaderus gomyii** n. sp.
Fig. 6, 21, 32.

**DERIVATIO NOMINIS:** the species is named after my colleague Yves Gomy (France, Nevers) who has collected an important amount of Mixaderus specimens, including specimens of this new species.

**Description:**

**General.** — Length: 2.2-2.3 mm; moderately convex, elongate.

**Head.** — Black; eye large, strongly notched, adjacent or nearly adjacent to the rear of the head; interocular space narrower than eye diameter in both sexes; maxillary palp orange; hairs short; pruinosity silvery, dense, woolly; punctuation sparse, fine.

**Antennae.** — Filiform to progressively widened at apex, robust, with developed pubescence; antennomere variable in...
shape: 1-7 longer or as long as wide; 4-10 conical and truncated at each end; 8-10 transverse and progressively wider; 11 larger, asymetrically acuminate; color variable; usually with first few antennomeres yellow, and the remaining ones orange-brown; insertion near or in eye notch; antennae reach the base of pronotum when folded backward.

**Pronotum.** — Subquadrate to weakly transverse, anterior angles rounded in dorsal view; sides straight and parallel; dimples around midline present; dark; a pattern of silvery and golden pruinosity making variable bands; dimples and base covered with silvery pruinosity; pubescence pale; punctuation moderately dense, coarse.

**Scutellum.** — Trapezoidal, covered with white pruinosity.

**Elytra.** — Convex, depressed on disc; sides rounded in both sexes; width/length ratio 0.58-0.68; dark with a pattern of yellow markings as follows: a narrow humeral spot on each side, often reduced or absent, a broad antemedial stripe with the shape of a flat W, and a broad post-medial stripe, with the shape of a flat M. Both stripes are generally interrupted at the suture; pruinosity silvery or white on the yellow bands, yellow or orange on the dark background; pruinosity woolly; pubescence yellow; punctuation moderate to dense, coarse; female elytra slightly wider.

**Legs.** — All tarsi and foretibiae yellow; mid- and hind tibiae bicolored with yellow base and brown apex; all femora dark with yellowish apex; foretarsi with first segment enlarged in males.

**Genitalia.** — Figure 32. Appendages present.

**Material Examined:** Type material: France, La Réunion, Le Tampon, PK 14° (823 m.), 21°14’ S 55°30’ E, Beating Ligustrum robustum, (Poussereau J. leg.), 20.XII.2010: 1 male type (NGC); Saint-Denis, La Grande Chaloupe (Poussereau J. leg.), 28.I.2009: 1 male paratype (JPC); Saint-Joseph, Manapany, Kiosque, light (Poussereau J. leg.), 16.I.2009: 1 male paratype (JPC) and 1 female paratype (NGC); Sainte-Suzanne (Gomy Y. leg.), 23.IV.1967: 1 female paratype; Saint-Paul (Gomy Y. leg.), 20.II.1965: 1 female paratype; Saint-Denis, Rampe Saint-François (Gomy Y. leg.), 7.I.1967: 1 male paratype; Republic of Mauritius, Rose Hill (Mamet R. leg.), 8.VII.1933: 1 male paratype (MNHNP); Curepipe (Carrié P.), 10.VI.1904: 1 female paratype (MNHNP).

• *Mixaderus cinereofasciatus* (Blair, 1935)

Fig. 11, 25, 31.

**Xylophilus cinereofasciatus** Blair, 1935: Blair, 1935. Type series: NHM (examined).

**Mixaderus (Perisia) cinereofasciatus** Blair: Bâguena-Corella, 1948.

**Redescription:**

**General.** — Length: 1.3-1.75 mm; convex, elongate.

**Head.** — Black; eye large, notched, adjacent or nearly adjacent to the rear of the head; interocular space narrower than eye diameter in both sexes; maxillary palp orange; hairs short; pruinosity hardly visible; punctuation moderately dense, fine.

**Antennae.** — Slender; antennomere shape: 1-5 slightly longer than wide; 6-10 progressively wider, truncated on each end; 11 larger, asymmetrical, straight on inner edge, largely rounded on outer edge; color entirely dark orange; insertion near or in eye notch; antennae reach the base of pronotum when folded backward.

**Pronotum.** — Slightly transverse, anterior angles rounded in dorsal view; sides straight and parallel; dimples around midline present; uniformly dark brown; pruinosity white; pubescence pale; punctuation moderately dense, medium.

**Scutellum.** — Trapezoidal, covered with white pruinosity.

**Elytra.** — Depressed on disc; sides moderately rounded in both sexes; width/length ratio 0.62-0.65; dark with a single broad posthumeral stripe; pruinosity white, sparse; pubescence yellow; punctuation moderately dense, coarse.

**Legs.** — Forelegs entirely orange; mid- and hind legs orange with femora and distal half of tibia brown; foretarsi with first segment weakly enlarged in males.

**Genitalia.** — Figure 31. Appendages present.

**Material Examined:** Two type specimens kept in the NHM collection obviously correspond to the specimens described by Blair as *X. cinereofasciatus*. However, one (a male) is labelled *X. flavicornis* and the other (a female) is unlabelled. It is likely that Blair was going to name the species *flavicornis* but discovered this name was pre-occupied by *X. flavicornis* Champion, 1890. I consider these specimens to be two of the three syntypes of *X. cinereofasciatus* Blair, 1935. The specimen represented on Fig. 11, (a male) becomes the lectotype and the other (the female) becomes a paralectotype. I have added labels to these specimens accordingly. The third type specimen, referred to in Blair’s original description could not be located.

**Type Material:** Republic of Mauritius: Rodrigues Island (H. J. Snell & H. P. Thomasett leg.), VIII-XI. 1918: one male (lectotype, present designation) and one female (paralectotype, present designation) (NHM).

• *Mixaderus perrieri* (Pic, 1909)

Fig. 12, 28, 33, 42

**Hylophilus perrieri** Pic, 1909: Pic, 1909. Type: MNHNP (examined).

**Hylophilus perrieri** Pic, 1909: Pic, 1910.

**Mixaderus (Ginerosia) perrieri** Pic, 1911 [sic!]: Bâguena-Corella, 1948.

**Redescription:**

**General.** — Length: 1.6-1.85 mm; mean length: 1.71 mm; convex, oval.

**Head.** — Black; eye large, notched, adjacent or nearly adjacent to the rear of the head; interocular space narrower than eye diameter in both sexes; maxillary palp orange; hairs short; pruinosity woolly; punctuation moderately dense, fine.

**Antennae.** — Filiform; antennomere shape: 1-3 short, 2 shorter than wide; 4-7 longer than wide, conical. 8-10 variable, hardly longer than wide. 11 much larger, asymetrically acuminate; entirely orange; insertion near or in eye notch; antennae reach the base of pronotum when folded backward.

**Pronotum.** — As long as wide, anterior angles rounded in dorsal view; sides rounded; dimples around midline present; black; pruinosity white; pubescence white; punctuation dense, fine.

**Scutellum.** — Subquadrate, covered with yellow pruinosity.

**Elytra.** — Convex, weakly rounded in both sexes; width/length ratio 0.64-0.70; uniformly black; pruinosity white, woolly; pubescence white; punctuation dense, coarse.

**Legs.** — Entirely orange; foretarsi with first segment enlarged in males, but variable in length.

**Genitalia.** — Figure 33. Appendages present.

**Material Examined:** Madagascar (Perrier H. leg.): 2 ex. (MNHNP and MNCNM).
TYPE MATERIAL: Madagascar (Perrier H. leg.): inferred holotype, male specimen (MNHNP, Collection Maurice Pic), bearing the labels "type", "Hylophilus Perrieri Pic", "désirée" [=desiderata]; “Fig. 8, 3, 37, 38. designated as lectotype.

- Mixaderus madecassus (Pic, 1909)
  Fig. 8, 3, 37, 38.
  Mixaderus (s.str.) madecassus Pic, 1911 [sic!]: Bágüena-Corella, 1948.
  Mixaderus (Ginerosia) pinacotarsus Bágüena-Corella, 1948; Bágüena-Corella, 1948, new synonymy. Type: MNHNP (examined).
  Hylophilus superbus v. trinitatus Pic, 1921; Pic, 1921, new synonymy. Type: MNHNP (examined) nec Xylophilus trinotatus Champion, 1916.

REDESCRIPTION:
General. — Length: 1.45-1.75 mm; mean length: 1.55 mm; convex, oval; overall morphology variable, especially pigmentation.
Head. — Brown to black; eye large, weakly notched, adjacent or nearly adjacent to the rear of the head; interocular space larger than eye diameter in both sexes; maxillary palp orange; hairs relatively long; pruinosity silvery, dense, woolly; punctuation moderately dense, fine.
Antennae. — Slender; antennomere variable in shape: 1-2 short and rounded; 4-6 slender but their width/length ratio variable; 7-10 progressively wider, truncated at their extremities; 11 larger, asymetrically acuminate; generally orange, antennomeres 7-11 sometimes brown or dark; insertion near or in eye notch; antennae reach the base of pronotum when folded backward; antennae longer in males than females.
Pronotum. — As long as wide, anterior angles rounded in dorsal view; sides rounded; dimes around midline present; pigmentation yellowish; pruinosity silvery; pubescence pale; punctuation moderately dense, coarse.
Scutellum. — Subquadrate, covered with white pruinosity.
Elytra. — Moderately convex; sides weakly rounded in both sexes; width/length ratio 0.57-0.65; yellow with 3 stripes of brown to dark pigmentation, one basal, one medial and one pre-apical. These 3 components are variable in size, shape and intensity, from pale forms where they form discrete spots and hardly reach the elytral suture, to darker forms where they are broader and continuous, yet they remain narrower than the yellow interstripes; pruinosity white, woolly; pubescence pale; punctuation moderately dense, coarse.
Legs. — Orange; hind femora sometimes darker; foretarsi with first segment strongly enlarged in males.
Genitalia. — Figure 37. Appendages present.

MATERIAL EXAMINED: Madagascar (Decary R. leg.): 1 male (MNHNP, lectotype of Mixaderus (Ginerosia) pinacotarsus Bágüena-Corella, 1948, present designation); Anta-
nanarivo, 1921 (Decary R. leg.): 2 ex. (MNHNP); Soanierana (Mathiaux A. leg.), 1905: 1 ex. (MNHNP); Pays Androy (Alluaud Ch. leg.), 1900: 3 syntypes of Hylophilus superbus v. trinitatus Pic, 1921 (1 male, 1 female, 1 unsexed, MNHNP, Collection M. Pic); Ambovombe, Amboasary, 1956: 1 male (MNHNP).

TYPE MATERIAL: Madagascar (Perrier H. leg.): female holotype (MNHNP, Collection M. Pic).

- Mixaderus basithorax (Pic, 1909)
  Fig. 10, 27.
  Hylophilus basithorax Pic, 1909. Type: MNHNP (examined).
  Hylophilus basithorax Pic, 1909; Pic, 1910.
  Mixaderus (s.str.) basithorax Pic, 1911 [sic!]: Bágüena-Corella, 1948.

REDESCRIPTION:
General. — Length: 2.1 mm; moderately convex, elongate; male unknown.
Head. — Brown; eye large, notched, adjacent or nearly adjacent to the rear of the head; interocular space in female larger than eye diameter; maxillary palp orange at base with last article darker; hairs short; pruinosity dense; punctuation moderately dense, fine.
Antennae. — Slender; antennomere shape: 1-2 globose, 1 larger; 3-7 conical, longer than large; 8-10 conical transverse; 11 nearly 3 times longer, asymetrically acuminate; antennomeres 1-5 pale orange; 6-10 brown; 11 dark orange; insertion near or in eye notch; antennae reach the base of pronotum when folded backward.
Pronotum. — Slightly transverse, anterior angles rounded in dorsal view; sides weakly rounded and convergent anteriorly; dimes around midline large and shallow, barely visible; dark-brown; pruinosity silvery; pubescence pale; punctuation moderately dense, medium.
Scutellum. — Rectangular, covered with white pruinosity.
Elytra. — Largely depressed on disc; sides moderately rounded; width/length ratio 0.55; dark with a two large posthumeral triangular-shaped yellow spots; yellow markings hardly reaching the elytral suture; pruinosity silvery; pubescence yellow; punctuation moderately dense, coarse.
Legs. — Orange, posterior femora darker.

MATERIAL EXAMINED: Type material: Madagascar: inferred holotype, female specimen (MNHNP, Collection Maurice Pic), bearing the label "Hylophilus basithorax Pic n sp" (Pic's handwriting). presently designated as lectotype.

- Mixaderus simplex (Pic, 1921), new combination
  Fig. 13, 23.
  Hylophilus simplex Pic, 1921. Type: MNHNP (examined).

REDESCRIPTION: General. — Length: 1.95 mm; moderately convex, elongate; male unknown.
Head. — Yellow; eye small, moderately notched, adjacent or nearly adjacent to the rear of the head; interocular space in female larger than eye diameter; maxillary palp orange; hairs short; pruinosity silvery, dense, short; punctuation absent.
Antennae. — Clubbed; antennomere shape: 1 large and rounded; 2 shorter, as long as wide, bead-shaped; 3-5 filiform, longer than wide; 6-11 progressively wider, forming a club; 8-10 transverse and 11 longer, asymetrically acuminate; entirely yellow; insertion near or in eye notch; short, do not reach base of pronotum when folded backward.
**Scutellum.** — Trapezoidal, covered with white pruinosity.  
**Pronotum.** — Longer than wide, anterior angles rounded in dorsal view; sides straight and weakly divergent; dimples around midline present, but shallow; yellow; pruinosity silvery; pubescence pale; punctuation moderately dense, coarse.  
**Elytra.** — Moderately convex; sides rounded; width/length ratio 0.62; uniformly yellow; pruinosity white, wooly; pubescence pale; punctuation moderately dense, coarse.  
**Legs.** — Entirely yellow.

**MATERIAL EXAMINED:** Type material: **Madagascar,** Forêt d’Anamala-zoatra, Forêt de la côte Est (C. Alluaud leg.), 1901: inferred holotype, female specimen (MNHN, Collection Maurice Pic), bearing the label “Hylophilus simplex Pic” (Pic’s handwriting), presently designated as lectotype.

### 3) Remarks and notes

A few species described by Pic from the Mascareignes archipelago currently have an ambiguous status, and call for discussion:

- **Hylophilus cariei** Pic, 1932. Type: Mauritius (MNHN). I have examined and remounted the holotype of this species treated by Báguena-Corellla (1948) as Mixaderus, and consigned by Pic a close relative to *H. alluaudi* Pic, 1898. The shape of its thorax and antennae place this species unambiguously in the genus *Aderus* Stephens, 1829: *Aderus cariei* (Pic, 1932), new combination.

- the following species are recorded from Madagascar or Mauritius, but I could not locate their type material. They were collected by Ch. Alluaud, and are possibly kept in his own collection, as I could not find them in Pic’s collection; yet I was not able to find an Aderidae drawer in Alluaud’s collection at the MNHN. For now, I am unable to place them with certainty based on their original descriptions. While all three likely belong to the genus *Mixaderus*, they are provisionally considered *incertae sedis*:

  - **Hylophilus fasciatipennis** Pic, 1903. Type: Madagascar: Forêt Tanala. Likely a *Mixaderus*, based on Pic’s original description.
  - **Xylophilus** (? *Pseudeuglenes*) *Alluaudi* Pic, 1898. Type: Mauritius
  - **Xylophilus** (? *Pseudeuglenes*) *mauritiensis* Pic, 1898. Type: Mauritius

### 4) Key to species

<table>
<thead>
<tr>
<th>1</th>
<th>Elytra uniformly colored, legs entirely pale</th>
<th>2</th>
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<tr>
<td>2</td>
<td>Elytra bicolor: brown or black, with patterns of pale stripes and spots</td>
<td>4</td>
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<tr>
<td>3</td>
<td>Head, thorax and abdomen entirely black</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Antennae thick, hairy and dark</td>
<td>5</td>
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<tr>
<td>5</td>
<td>Antennomeres 4-10 transverse</td>
<td>7</td>
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<tr>
<td>6</td>
<td>Elytra dark with a single transverse yellow stripe, located in their anterior half</td>
<td>8</td>
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<tr>
<td>7</td>
<td>Elytra with a complex coloration involving at least two stripes, transverse and sinuated</td>
<td>9</td>
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<tr>
<td>8</td>
<td>Anterior elytral stripe strongly sinuated</td>
<td>10</td>
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<tr>
<td>9</td>
<td>Anterior elytral stripe, with weak or no sinuation (sometimes reduced to discrete blotches)</td>
<td>11</td>
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<tr>
<td>10</td>
<td>Thorax as long as wide</td>
<td>12</td>
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<tr>
<td>11</td>
<td>Posterior stripe with a deep, loop-shaped sinuation</td>
<td>13</td>
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<td>12</td>
<td>Apex of elytra yellow</td>
<td>14</td>
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<tr>
<td>13</td>
<td>Yellow humeral spot barely visible. Elytra less than 3.5 longer than pronotum</td>
<td>15</td>
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<td>14</td>
<td>Antennomeres 4-10 transverse (fig. 2)</td>
<td>16</td>
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<td>15</td>
<td>Antennomeres 4-10 sinuated (fig. 3)</td>
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<td>16</td>
<td>Thorax as long as wide</td>
<td>18</td>
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<td>17</td>
<td>Head, thorax and abdomen entirely pale</td>
<td>19</td>
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<td>18</td>
<td>Antennae thinner, not entirely dark</td>
<td>20</td>
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<tr>
<td>19</td>
<td>Antennae as long as wide</td>
<td>21</td>
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<td>20</td>
<td>Thorax transverse</td>
<td>22</td>
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<tr>
<td>21</td>
<td>Thorax transverse</td>
<td>23</td>
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<tr>
<td>22</td>
<td>Anterior stripe not extended along suture</td>
<td>24</td>
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<tr>
<td>23</td>
<td>Anterior stripe not extended along suture</td>
<td>25</td>
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<tr>
<td>24</td>
<td>Posterior stripe with milder sinuation (fig. 2)</td>
<td>26</td>
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<tr>
<td>25</td>
<td>Yellow humeral spot distinct. Elytra 3.5 to 4 times longer than pronotum</td>
<td>27</td>
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