

Article

# Description of Four New Species of the Afrotropical Weevil Genus *Afroryzophilus* (Coleoptera, Curculionidae)

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**Abstract:** Four new species belonging to the Afrotropical weevil genus *Afroryzophilus* Lyal, 1990 (Coleoptera, Curculionidae, Brachycerinae, Tanysphyrini) are described: *A. centrafricanus* n. sp. (Central African Republic), *A. congoanus* n. sp. (Democratic Republic of the Congo), *A. kuscheli* n. sp. (Senegal), and *A. somalicus* n. sp. (Somalia). Previously, this genus was monotypic, based only on *A. djibai* Lyal, 1990 from Senegal. The five species of this genus are very similar to each other in external morphology, varying only in the width of the forehead and that of the third tarsomere, the length of the fifth tarsomere and the pattern of dorsal seta-like scales. However, the male genitalia show clear interspecific differences.

**Keywords:** Coleoptera; Curculionidae; Brachycerinae; Tanysphyrini; *Afroryzophilus*; new species; Afrotropical region

## 1. Introduction

The genus *Afroryzophilus* was described by Lyal [1] from a single taxon, *A. djibai* Lyal, 1990, attacking rice in Senegal. Subsequently, no other species of this genus has been described and no other author dealt specifically with this genus. In recent years, we had an opportunity to study several African specimens of *Afroryzophilus* belonging to four closely related species. The comparison of six of the 69 paratypes of *A. djibai* revealed that they all belong to undescribed species.

The aim of this paper is to describe these new species and to redefine the genus in light of morphological characters of all its species.

## 2. Materials and Methods

### 2.1. Descriptions and Illustrations

For new species, holotypes were generally used for description whereas best-preserved paratypes were used for illustrations in some cases.

### 2.2. Measurements and Photographs

All measurements were made under a stereomicroscope (Wild, Heerbrugg, Switzerland) using an ocular micrometer. The body length is interpreted as the distance between the anterior eye margin and the elytral apex. Index  $RI/Rw$  is interpreted as the ratio of rostrum length from its base to the apex without mandibles to the medial length of pronotum, index  $Ew/Pw$  as the ratio of the maximum elytral width in the humeral region to the maximum pronotal width.

Whole body photos were made by a high-resolution camera (Canon EOS 50D, Canon Inc., Tokyo, Japan) and a macro zoom lens (Canon MP-E 65 mm, Canon Inc.). Male genital structures were dissected and treated for several days in 10% KOH. Male genitalia were photographed in glycerol with the

same camera under a laboratory microscope (Intraco Micro LMI T PC, Intraco Micro, Czech Republic). The multilayer pictures were processed using the software Combine ZP.

### 2.3. Diagnosis

A cluster of all characters were used to identify a particular species.

### 2.4. Terminology

We followed the online glossary of weevil characters proposed in the International Weevil Community Website (<http://weevil.info/glossary-weevil-characters>) (accessed on 18 March 2018).

### 2.5. Acronyms and Abbreviations

The materials studied are housed in various collections and are identified by the following acronyms:

BMNH	Department of Entomology, The Natural History Museum, London, UK
CA	Roberto Caldara, Milano, Italy
KO	Michael Košťál, Hradec Králové, Czech Republic
MSNM	Museo civico di Storia Naturale, Milano, Italy
RMCA	Musée Royal de l'Afrique Centrale, Tervuren, Belgium

The following abbreviations were used: E: Elytra; P: Pronotum; R: Rostrum; l: length; w: width.

## 3. Taxonomy

### 3.1. The Genus *Afroryzophilus* Lyal

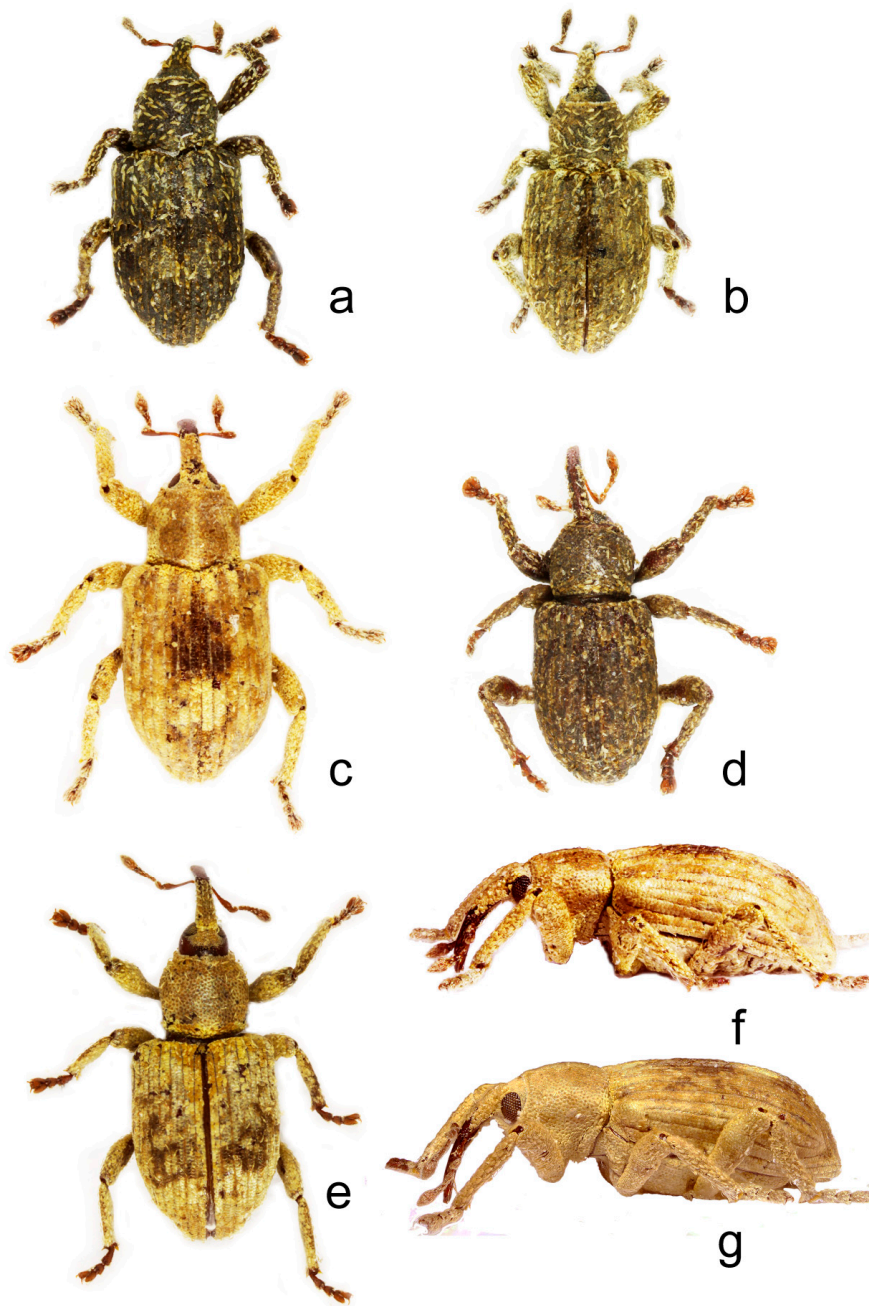
A very accurate description, and illustrations of this genus, including all structures of male and female genitalia, as we could ascertain by the study of six paratypes (BMNH) of *A. djibai*, were made by Lyal [1]. After the description of the following four new species, the original description remains almost unchanged. Therefore, we simply report a detailed diagnosis of the most important characters of *Afroryzophilus*.

With regard to genitalia, the new species show no substantial differences from those illustrated in detail by Lyal [1] except for the shape of the penis.

**Diagnosis.** Length 2.1–3.4 mm (rostrum excluded). Integument completely covered with appressed broad scales, almost rounded, mostly pitted on pronotum; and dorsally also with some recumbent to subrecumbent narrower seta-like scales. Rostrum long, in males slightly, in females more distinctly longer than pronotum, weakly curved in lateral view, tapering toward apex; densely squamose in basal half, almost glabrous in apical half (Figure 1f,g). Antennae densely squamose, inserted at middle of rostrum in males, just beyond middle of rostrum in females; scrobe parallel to rostrum length, not reaching eye. Scape not reaching eye, funicle longer than scape, 6-segmented. Mandibles with two exterior non-dehiscent teeth. Forehead (part of head between eyes) slightly narrower to distinctly broader than rostrum at base. Eyes large, not prominent.

Pronotum moderately wider than long, with slightly rounded sides, weakly convex. Prosternum with anterior margin concave, without longitudinal canal. Postocular lobes smoothly rounded. Scutellum small, oval. Elytra wider than pronotum, humeri prominent, sides parallel; interstriae broad, wider than striae, flat; striae with narrow deep punctures. Wings present. Metasternum anteriorly convex, posteriorly concave, especially in males. Femora clavate, unarmed. Tibiae weakly flexuose, mucronate, mucro stout, curved, abruptly directed ventrad. Tarsi with third tarsomere more or less large, distinctly bilobed, fifth tarsomere short, retracted to lobes of third tarsomere, claws small, separated from base.

Abdomen with ventrite 1 as long as ventrite 2, ventrites 3–5 shorter, not in the same plane as ventrites 1–2.



**Figure 1.** Habitus of (a) *Afroryzophilus djibai* ♂; (b) *A. centrafricanus* ♂; (c) *A. kuscheli* ♂; (d) *A. congoanus* ♂; (e) *A. somalicus* ♀; (f) *A. kuscheli* ♂ in lateral view; (g) *A. kuscheli* ♀ in lateral view. (Not at the same scale).

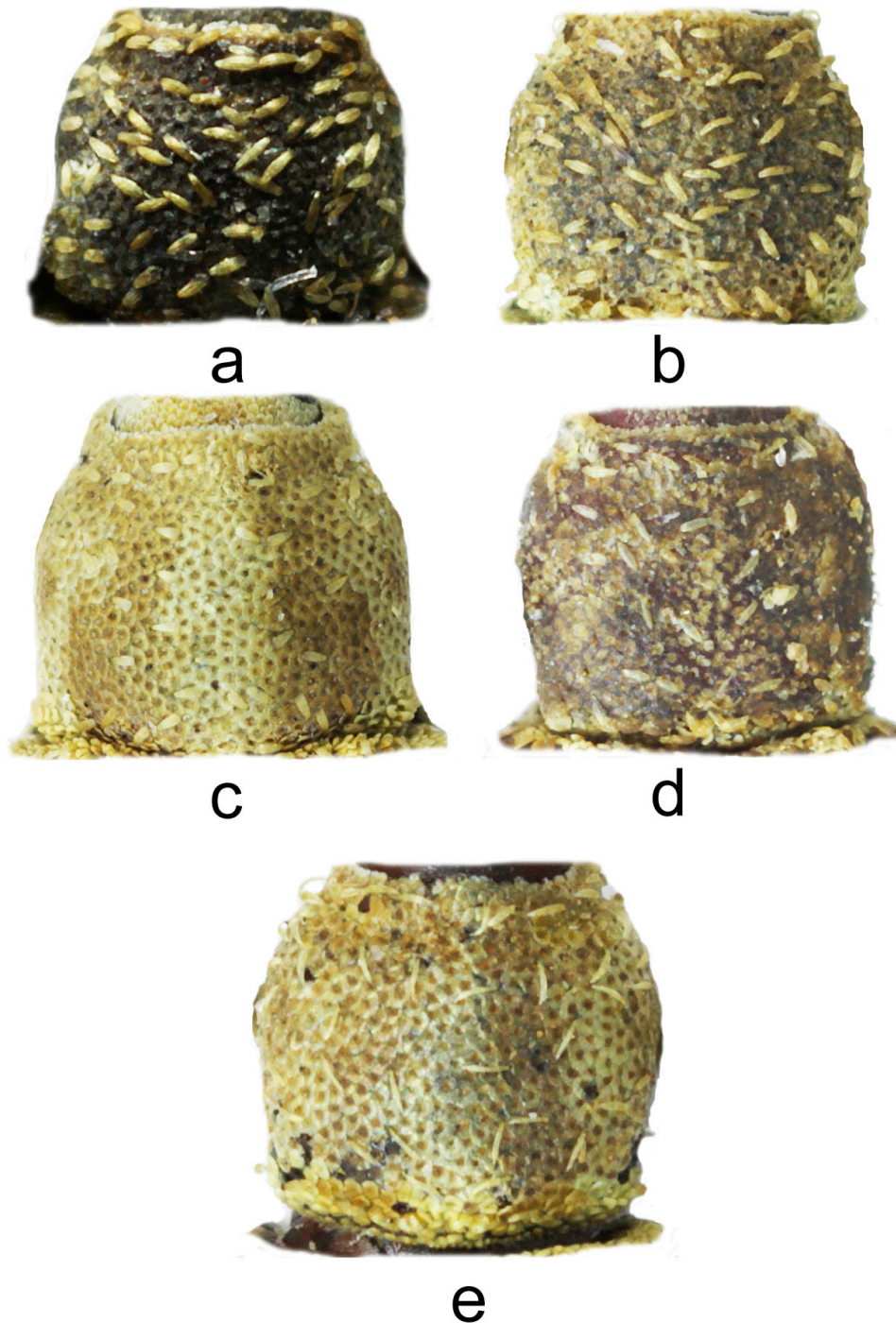
**Male genitalia.** Tergite VII with posterior margin medially emarginate. Tegmen with parameroid lobes weakly sclerotized, connate in their whole length, narrowed at base; then subparallel, tapered at apex, slightly shorter than body of penis. Body of penis more than half the length of apodemes. Tectum slender, united together with pedon with apodemes. Endophallus with small tooth-, comma- or crescent-like sclerite inside body of penis, with a flagellum more or less sclerotized, and as long as apodemes.

**Female genitalia.** Tergite VII quadrate. Tergite VIII quadrate, with posterior margin rounded, exposed at rest. Sternite VIII elongate, lateral sclerotizations of apical plate distinct for less than half the total length of sternite. Spermathecal duct arising part-way along bursa.

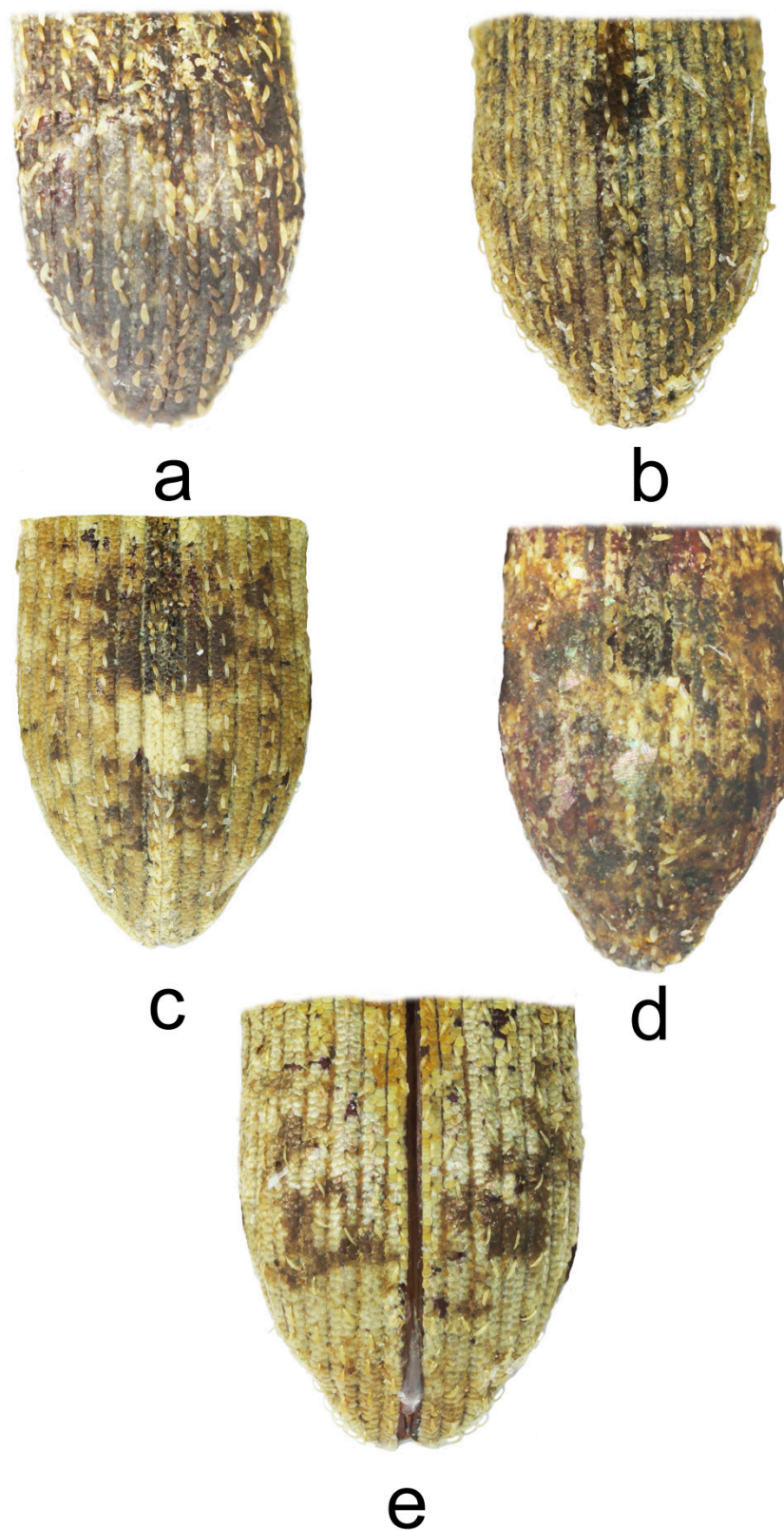
### 3.2. Treatment of the New Species

*Afroryzophilus centrafricanus* n. sp. (Figures 1b, 2b, 3b, 4b and 5b)

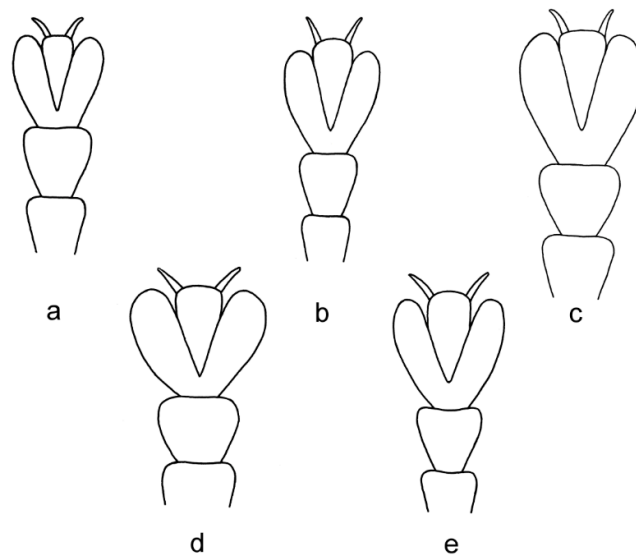
Type series. Holotype, male “Central African Rep., Bamingui-Bangoran Pr. [Prefecture] 75 km SSW Ndele, 8–12 July 2011, 450 m, A. Kudrna Jr. Lgt”. (MSNM). Paratypes: Same data as holotype (1 male and 4 females, RC, MK).



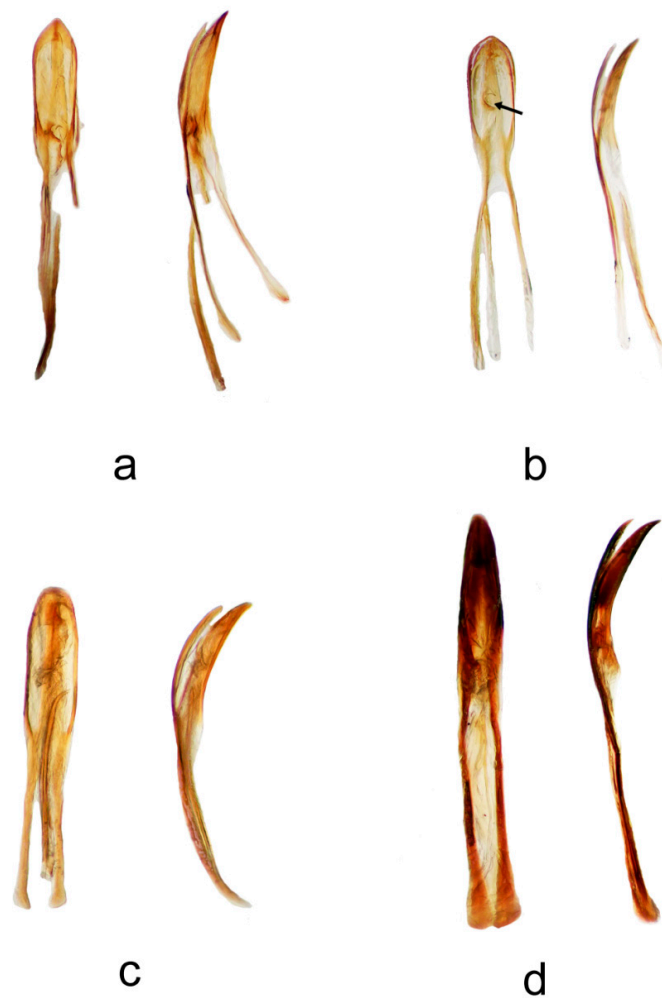
**Figure 2.** Scales on pronotum of (a) *Afroryzophilus djibai*; (b) *A. centrafricanus*; (c) *A. kuscheli*; (d) *A. congoanus*; (e) *A. somalicus*. (Not at the same scale).



**Figure 3.** Scales on elytra of (a) *Afroryzophilus djibai*; (b) *A. centrafricanus*; (c) *A. kuscheli*; (d) *A. congoanus*; (e) *A. somalicus*. (Not at the same scale).



**Figure 4.** Protarsi of (a) *Afrozophilus djibai*; (b) *A. centrafricanus*; (c) *A. kuscheli*; (d) *A. congoanus*; (e) *A. somalicus*. (Not at the same scale).



**Figure 5.** Penis in ventrodorsal (left) and lateral (right) view of (a) *Afrozophilus djibai*; (b) *A. centrafricanus*; (c) *A. kuscheli*; (d) *A. congoanus*. Black arrow indicates a sclerite inside the endophallus. (Not at the same scale).

**Description.** Holotype. Male. Length 2.3 mm. Habitus as in Figure 1b. Integument completely, densely covered with decumbent and appressed scales, these are oval to polygonal, on pronotum moderately pitted at sides, mainly light brown; on basal half of interstria 1 also dark brown, and whitish on base of pronotum along middle and at side, base of odd elytral interstriae and third quarter of interstria 1, and with robust, subrecumbent, posteriorly distinctly recurved, lanceolate brown seta-like scales, these distinct and unevenly sparsely distributed on pronotum, arranged in single regular rows on each elytral interstria and numerous on rostrum, femora and tibiae. Rostrum slightly longer than pronotum (RI/PI 1.05), in lateral view distinctly, evenly curved, markedly tapered from base to apex; in dorsal view slightly narrowing from base to antennal insertion, then parallel-sided. Forehead 1.4 times broader than rostrum at base. Pronotum slightly wider than long (Pw/Pl 1.15), with weakly rounded sides, widest at middle, weakly convex. Elytra distinctly longer than wide (El/Ew 1.48), distinctly wider than pronotum (Ew/Pw 1.52), with parallel sides, weakly convex. Tarsi with second and third tarsomere moderately transverse, only slightly wider than long, fifth tarsomere slightly projecting beyond lobes of third tarsomere. Penis (Figure 5b) with body short (l/w 2.6), parallel-sided in dorsal view, distinctly thin in lateral view, with apodemes twice as long as body, only slightly enlarged at their extremities; endophallus with weakly sclerotised flagellum.

**Variability.** Length 2.2–2.6 mm. Females as male, except for rostrum distinctly longer (RI/Rw 5.65) and in lateral view almost subparallel-sided from base to apex; in dorsal view moderately narrowing from base to antennal insertion, then parallel-sided to apex. Apart from sexual characters no significant differences between the holotype and the paratypes.

**Etymology.** This species name is a Latin adjective that refers to the country in which the type locality is situated.

**Remarks.** This species is the most closely related to *A. dijbai*, from which it differs externally only by slightly thinner seta-like scales of the elytral interstriae and the fifth tarsomere in dorsal view, slightly protruding from the third tarsomere (not protruding in *A. dijbai*) (see Figure 4b vs. Figure 4a). On the contrary, the shape of the body of the penis is distinctly different in these two species, being shorter and distinctly thinner in lateral view in *A. centrafricanus* (see Figure 5b vs. Figure 5a).

**Distribution.** Central African Republic.

*Afroryzophilus kuscheli* n.sp. (Figure 1c,f–g, Figures 2c, 3c, 4c and 5c)

Type series. Holotype, male “Senegal-Kaolack, Norio du Rip, 24 July 2009, Moretto” (MSNM). Paratypes: Same data as holotype (1 male and 3 females, RC, MK).

**Description.** Holotype. Length 3.0 mm. Habitus as in Figure 1c. Integument completely, densely covered with decumbent and appressed scales, these are oval to polygonal, on pronotum moderately pitted at sides, light brown, with large macula at middle of first three elytral interstriae, also dark brown and with longitudinal vittae at midline and sides of pronotum, large macula at apical third of first three elytral interstriae and short whitish vittae on odd elytral interstriae, and with robust subrecumbent, posteriorly distinctly recurved, robust lanceolate brown seta-like scales, being distinct and unevenly sparsely distributed on pronotum, arranged in single regular rows on each elytral interstria and numerous on rostrum, femora and tibiae. Integument with vestiture as in *A. centrafricanus* with regard to colour and pattern, except for very sparse seta-like scales on pronotum; and thinner and sparse (except for on interstria 1) on elytra, especially on even interstriae, almost indistinct since completely flattened. Rostrum moderately long, slightly longer than pronotum (RI/Rw 4.17, RI/PI 1.13); in lateral view distinctly and evenly curved, distinctly tapered from base to apex; in dorsal view slightly narrowing from base to antennal insertion, then parallel-sided. Forehead 1.3 times broader than rostrum at base. Pronotum slightly wider than long (Pw/Pl 1.10), with weakly rounded sides, widest at middle, weakly convex. Elytra distinctly longer than wide (El/Ew 1.39), markedly wider than pronotum (Ew/Pw 1.59), with parallel sides, weakly convex. Tarsi with second and third tarsomere moderately transverse, only slightly wider than long, fifth tarsomere not projecting beyond lobes of third tarsomere. Penis (Figure 5c) with body moderately long (l/w 3.2), parallel-sided in dorsal view,

moderately robust in lateral view, with apodemes only slightly longer than body, somewhat enlarged at their extremities; endophallus with distinctly sclerotized flagellum.

**Variability.** Length 2.7–3.4 mm. Females as males, except for rostrum distinctly longer (Rl/Rw 5.67) and in lateral view almost subparallel-sided from base to apex; in dorsal view moderately narrowing from base to antennal insertion, then slightly widened to apex. Apart from sexual characters no significant differences between the holotype and the paratypes.

**Etymology.** This species is named in the memory of Willy Kuschel, one of the greatest experts on weevils, who particularly studied the erirrhinines and gave them a completely new taxonomic arrangement.

**Remarks.** To date, this is the largest species in this genus. Apart from the shape of the penis (see Figure 5c vs. Figure 5a vs. Figure 5b), *A. kuscheli* differs from *A. djibai* and *A. centrafricanus* by smaller seta-like scales, which are very sparse on the pronotum and the elytra, and indistinct on the even interstriae, being completely flattened and not curved in the middle. Moreover, the dorsal pattern seems to be characterised by more contrasting colours, with distinct large dark brown and white maculae on the disc, and white vittae on the pronotum, and less distinctly on the odd elytral interstriae.

**Distribution.** Western Senegal.

*Afroryzophilus congoanus* n. sp. (Figures 1d, 2d, 3d, 4d and 5d)

Type series. Holotype, male “Congo Belge: P.N.A. [Parc National Albert, currently Parc National des Virunga], 14-15-VIII-1952, P. Vanschuytbroeck & J. Kekenbosch, 767-70/Massif Ruwenzori, Kalonge, 2.210 m” (RMCA). Paratype: “Congo belge: P.N.A., Kanyabayongo (Kabasha), 1760 m, 6-xii-1934, G.F. de Witte: 870/R. Dét. uu 4470/Erirrhinide ou Tychiide” (1 female, RMCA).

**Description.** Holotype. Length 2.1 mm. Habitus as in Figure 1d. Integument with regards to colour and pattern as in *A. djibai*, vestiture with scales on pronotum and more robust elytra, more numerous and darker in colour. Rostrum moderately long, slightly longer than pronotum (Rl/Rw 4.10, Rl/Pl 1.15), in lateral view distinctly and evenly curved, distinctly tapered from base to apex; in dorsal view slightly narrowed from base to antennal insertion, then parallel-sided. Forehead slightly narrower than rostrum at base. Pronotum moderately wider than long (Pw/Pl 1.20), with weakly rounded sides, widest at middle, weakly convex. Elytra distinctly longer than wide (El/Ew 1.40), distinctly wider than pronotum at base (Ew/Pw 1.37), with parallel sides, weakly convex. Tarsi with second and third tarsomere distinctly transverse, with fifth tarsomere not projecting beyond lobes of third tarsomere. Penis (Figure 5d) with body long (l/w 4.3), gradually narrowed from base to apex in dorsal view, moderately robust in lateral view, with apodemes moderately longer than body and distinctly enlarged at their extremities; endophallus with distinctly sclerotized flagellum.

**Variability.** Female as male, except for rostrum distinctly longer and in lateral view almost subparallel-sided from base to apex; in dorsal view slightly narrowed from base to antennal insertion, then parallel-sided to apex; length 2.4 mm.

**Etymology.** The name is a Latin adjective that refers to the country in which the type locality is situated.

**Remarks.** Due to the forehead being only slightly narrower than the rostrum at base, this species seems to be close to *A. somalicus*. However, it differs from this species by the third tarsomere being broader and distinctly wider than the second tarsomere, and by the seta-like scales on pronotum and elytra being more robust, shorter and more numerous.

**Distribution.** Democratic Republic of the Congo (Eastern provinces).

*Afroryzophilus somalicus* n. sp. (Figures 1e, 2e, 3e and 4e)

Type series. Holotype, female “Coll. Mus. Tervuren, Somalie: Afgoi [Afgooye], August 1977, Leg. Olmi” (RMCA).

**Description.** Female. Length 2.8 mm. Integument completely, densely covered with decumbent and appressed, oval to polygonal scales; scales on pronotum distinctly and deeply pitted, mainly



light brown; on basal half of elytra, especially on perisutural interstriae, light brown scales intermixed with light and slightly darker scales, with distinct micaceous reflections; lanceolate, seta-like scales apically distinctly recurved, almost transparent with silvery reflections, recumbent to semi-erect on pronotum and elytra, moderately thin on rostrum, femora and tibiae, very sparse on pronotum, a little more numerous and barely visible on elytra, more numerous on basal half of rostrum and legs. Rostrum long (RI/Rw 5.02, RI/PI 1.16), in lateral view almost subparallel-sided from base to apex; in dorsal view slightly narrowed from base to antennal insertion, then parallel-sided to apex. Forehead slightly narrower than rostrum at base. Pronotum moderately wider than long (Pw/PI 1.17), with weakly rounded sides, widest at middle, weakly convex. Elytra distinctly longer than wide (El/Ew 1.46), markedly wider than pronotum at base (Ew/Pw 1.52), with parallel sides, weakly convex. Tarsi with second and third tarsomere moderately broad, almost as long as wide, fifth tarsomere slightly projecting beyond lobes of third tarsomere.

**Etymology.** The name is a Latin adjective that refers to the country in which the type locality is situated.

**Remarks.** This species differs from the others by the more deeply pitted scales on the pronotum. Moreover, the scales of the dorsal vestiture are light brown with distinct micaceous reflections. Probably also the pattern of the elytral vestiture is different from that of the other species; however, this difference needs to be confirmed by examination of further specimens. The seta-like scales are thinner and longer both on pronotum and elytra and more raised on the tibiae.

**Distribution.** South-western Somalia (Lower Shebelle Region).

#### Key to the species

1. Forehead 1.3–1.4 times broader than rostrum at base. .... 2
  - Forehead slightly narrower than rostrum at base. .... 4
2. Seta-like scales of dorsal vestiture subrecumbent, more distinct, more numerous both on pronotum and all elytral interstriae (Figure 2a,b and Figure 3a,b). Elytral vestiture on disc at most with poorly distinct large dark brown macula (Figure 3a,b). .... 3
  - Seta-like scales of dorsal vestiture recumbent, less visible, sparser especially on even elytral interstriae (Figures 2c and 3c). Elytral vestiture on disc with two distinct large maculae, one dark brown and one white (Figure 3c) ..... *kuscheli* n. sp.
3. Fifth tarsomere in dorsal view not projecting beyond lobes of third tarsomere (Figure 4a). Seta-like scales of elytral interstriae robust. .... *dijbai* Lyal
  - Fifth tarsomere in dorsal view slightly projecting beyond lobes of third tarsomere (Figure 4b). Seta-like scales of elytral interstriae slightly thinner. .... *centrafricanus* n. sp.
4. Tarsi shorter, second and third tarsomere wider than long (w/l 1.50 and 1.25 respectively) (Figure 4d). Broad scales of dorsal vestiture opaque, those covering pronotum shallowly pitted (Figure 2d,e); seta-like scales more robust and more numerous (Figures 2d and 3d). .... *congoanus* n.sp.
  - Tarsi longer, second and third tarsomere as wide as long (Figure 4e). Broad scales of dorsal vestiture with distinct micaceous reflections, those covering pronotum deeply pitted (Figures 2e and 3e). Seta-like scales thinner and sparser, especially on pronotum (Figure 2e). .... *somalicus* n. sp.

#### 4. Discussion

At the time of description, due to the structure of the genitalia, particularly the presence of a pedo-tergal penis, this genus was placed by Lyal [1] in Eirrhiniinae, however, without specifying a tribe. Subsequently, Alonso-Zarazaga and Lyal [2] placed *Afroryzophilus* in Eirrhiniinae, Eirrhiniini. Very recently, this genus was transferred by Oberprieler [3] to Tanysphyrini, which were considered a tribe of the Brachycerinae, this subfamily included all Eirrhiniinae sensu Alonso-Zarazaga and Lyal [2].

We agree with this placement, as *Afroryzophilus* possesses all the main characters distinctive for this tribe [3]: Rostrum moderately long, without apico-lateral setiferous grooves but usually with one or a few long setae in the same position; dorsum of rostrum usually densely squamose from base to antennal insertion but conspicuously glabrous in front of it; funicle six-segmented, with basal segment enlarged and apically densely fringed with setae or tuft hairs, tibiae mucronate, without spurs, bevels or corbels (though sometimes with false corbels); tarsi usually flattened with short onychium and barely or not markedly, to completely withdrawn into lobes of segment 3, claws simple, divaricate; ventrite 5 usually with a pair of thin setal tufts or single long setae; tegmen laterally fused (not hinged), usually with complete but weakly sclerotized dorsal plate.

Lyal [1] already discussed the differences between *Afroryzophilus* and the other erirhinine genera, pointing out the characteristic shape of the mandibles, which are toothed externally in this genus, and between *Afroryzophilus* and other genera of Brachycerinae feeding on rice, i.e., *Echinocnemus* Schoenherr, 1843 (Erirhinini) and *Lissorhoptrus* LeConte, 1876 (Tanysphyrini), both with the onychium distinctly longer than the third tarsomere. However, only the former genus is distributed in Africa. In fact, the only other genus of Tanysphyrini known from the Afrotropical region is *Araxus* Marshall, 1955, whose biology is unknown although it was hypothesised that it might feed on mosses [3]. This genus, which is distributed in western and central Africa but also in Madagascar [4,5], clearly differs from *Afroryzophilus* by the seven-segmented funicle, the stout rostrum, poor sexual dimorphism, the very stout tibiae and the lack of pitted scales on the pronotum.

Concerning the five species of this genus, they differ from each other externally only by a few characters, mainly by the shape of the tarsi and the width of the forehead, the shape of the seta-like scales on pronotum and elytra and, to a less extent, by the pattern of the dorsal vestiture. Other characters, such as the shape of pronotum and elytra, are almost identical in all species. In contrast, the male genitalia are clearly different in each of the four species of which the male is known.

It was reported that *A. djibai* is a potential pest of rice in Senegal [1,6]. Unfortunately, we have no data on the host plants of the new species and do not know whether they might also affect rice cultivation. However, *A. centrafricanus*, *A. kuscheli*, and *A. somalicus* were collected in a plain, the latter two near the coast, and all near a river, and in areas where rice is possibly cultivated [7]. In contrast, the fourth species, *A. congoanus*, was collected at high altitude in a National Park, far from populated areas. Thus, it is evident that this species does not live on rice. It is highly probable that, as in *Lissorhoptrus* [3], the species of *Afroryzophilus* can also feed on different plants belonging to the family Poaceae.

**Author Contributions:** Both authors contributed equally to the design, analysis and writing of the paper.

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**Conflicts of Interest:** The authors declare no conflicts of interest.

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