

Taxonomic relationships between *Pachycerus* and *Rhabdorrhynchus* (Coleoptera: Curculionidae: Lixinae), with descriptions of two new species of *Rhabdorrhynchus* from the Arabian Peninsula

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Taxonomic relationships between *Rhabdorrhynchus* and *Pachycerus* are discussed, and two new species of *Rhabdorrhynchus* are described: *Rhabdorrhynchus sauditus* (type locality: Saudi Arabia, As Shāqqah al Yamāniyah, 19°42'N, 40°48'E) and *Rhabdorrhynchus emir* (type locality: United Arab Emirates, Jebel Ali, 24°59'N, 55°43'E). Some hypotheses on the distribution of the new species in the Arabian Peninsula, based on a biogeographical analysis, are proposed. © 2008 The Linnean Society of London, *Zoological Journal of the Linnean Society*, 2008, 152, 25–37.

ADDITIONAL KEYWORDS: biogeography – Cleonini – fauna of Arabia – taxonomy.

INTRODUCTION

A study aimed at identifying about two thousand undetermined Cleonini, housed in the Natural History Museum, London, UK (BMNH), and the Naturhistorisches Museum, Basel, Switzerland (NHMB), revealed some specimens of two new, closely related species from the Arabian Peninsula, which share characters typical of *Rhabdorrhynchus* Motschulsky, 1860, with traits appearing in *Pachycerus* Schoenherr, 1823, a genus that has often been associated taxonomically with *Rhabdorrhynchus*. Their generic level classification is thus in need of further investigation.

MATERIAL AND METHODS

This study is based on specimens housed in the BMNH, NHMB, and the Meregalli Collection, Torino, Italy (MER). All specimens examined were dissected: female genitalia were embedded in Solacryl (Medika)

and male genitalia were mounted dry. Genitalia preparations are pinned below the specimens from which they were dissected. Photographs were taken with a Nikon Coolpix 4500 camera, on a Wild M5A stereomicroscope, and were enhanced with Photoshop 7 (Adobe Inc.).

TAXONOMY

Knowledge of the weevils of the Arabian Peninsula is presently quite poor. Scattered records have been included in taxonomic monographs, but very few revisions of the Arabian fauna of Curculionoidea exist (see Colonnelli, 1984, for the Ceutorhynchinae; and see Wanat, 1990, for the Apionidae). No comprehensive checklist exists and no publication regarding the tribe Cleonini has ever appeared, with the exception of the description of *Pachycerus efflatouni* (Tewfik, 1942) based on a single specimen from Yemen (Tewfik, 1942); this species has apparently never been collected since the description.

The genus *Pachycerus* was proposed by Schoenherr (1823) with *Lixus madidus sensu* Schoenherr, 1823 (non Olivier, 1807), = *Curculio cordiger* Germar, 1818 (non Fuessly, 1775), = *Curculio segnis* Germar, 1824

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This is the sixth contribution to the knowledge of the Curculionidae: Lixinae: Cleonini.

as type species by original designation. Schoenherr (1834) cited three species under *Pachycerus*: *Pachycerus varius* (Herbst, 1795), *Pachycerus scabrosus* Brullé, 1832 (attributed to Dejean; = *Pachycerus segnis*) and *Pachycerus albarius* Gyllenhal, 1834 (listed among the synonyms of *P. scabrosus* by Csiki, 1934). Schoenherr (1842) emended the diagnosis and referred six further species to *Pachycerus*: *Pachycerus menetriesi* Gyllenhal, 1842, *Pachycerus karelini* Fåhraeus, 1842, *Pachycerus atomarius* Fåhraeus, 1842 (listed among the synonyms of *Rhabdorrhynchus menetriesi* by Csiki, 1934), *P. segnis* (Germar, 1824), plus two species from South Africa, *Pachycerus sparsus* Fåhraeus, 1842 and *Pachycerus formosus* Fåhraeus, 1842, which were later transferred by Faust (1904) to the genus *Pentatropis* Faust (1904).

The genus *Rhabdorrhynchus* was introduced by Motschulsky (1860), with *P. menetriesi* Gyllenhal, 1842 as type species by original designation. Chevrolat (1873) underlined the strong similarity of this genus with *Pachycerus* ('Mêmes caractères que le *Pachycerus*', Chevrolat, 1873: 85), giving as differential traits the narrower and longer body, the elytra being twice as long as the pronotum, and the hind femora only reaching the apex of ventrite II; he considered *R. menetriesi* a synonym of *Rhabdorrhynchus mixtus* (Fabricius, 1792), and referred three other species to *Rhabdorrhynchus*, *Rhabdorrhynchus anchusae* (Chevrolat, 1854), *Rhabdorrhynchus varius*, and *Rhabdorrhynchus seriegranosus* Chevrolat, 1873. Faust (1904) later synonymized the latter two of these names and clearly characterized *Rhabdorrhynchus* to include a group of closely related species, whereas *Pachycerus* remained vaguely defined and included at least one species not related to the others [*Pachycerus picipes* (Fåhraeus, 1842), a synonym of *Bothynoderes declivis* (Olivier, 1807)].

Faust (1904) treated *Rhabdorrhynchus* (as *Rhabdorrhynchus*) as a subgenus of *Pachycerus* and proposed another subgenus of *Pachycerus*, *Asinocleonus* Faust, 1904 (usually erroneously spelled *Anisocleonus* Faust). *Asinocleonus*, now considered a valid genus, is closely related to *Rhabdorrhynchus* and may have to be merged with it. It is quite difficult to characterize *Rhabdorrhynchus* vs. *Pachycerus* using Faust's (1904) key, because the genera are widely separated in the key (couplet 14' for *Pachycerus* and 43' for *Rhabdorrhynchus*). The distinction is based on the type of elytral vestiture at couplet 12, as follows: '12', dorsum with scales... and rostrum not depressed beyond forehead' (Faust, 1904: 181, translation from German) leads to a few taxa including *Pachycerus*; '12, dorsum with hairs, or with scales but then rostrum having a basal transverse furrow' (Faust, 1904: 181, translation from German) leads to a large number of genera,

including *Rhabdorrhynchus*. Faust probably could not complete the study of the two genera (his revision appeared posthumously): he listed the following species for *Rhabdorrhynchus*: *R. varius*, *Rhabdorrhynchus karelini* (Fåhraeus, 1842), *R. mixtus*, *Rhabdorrhynchus crassicornis* Faust, 1904, *R. menetriesi*, *Rhabdorrhynchus grummi* Faust, 1886, and *R. anchusae*, but in a note under *Pachycerus* (Faust, 1904: 222) he suggested that *P. scabrosus*, *Pachycerus planirostris* (Boheman, 1829), and *Pachycerus badeni* (Faust, 1888), with irrorate ventrites, could be attributed to *Rhabdorrhynchus*, and that *Pachycerus granulatus* (Olivier, 1807) from South Africa was intermediate between the two genera. *P. scabrosus*, *P. planirostris*, and *P. badeni* undoubtedly belong to *Pachycerus*, whereas Meregalli (2002) attributed *granulatus* to *Rhabdorrhynchus*. However, recent studies (M. Meregalli, unpubl. data) suggested that this last species is basal to a monophyletic group of genera, including also *Pachycerus* and *Rhabdorrhynchus*. Throughout the 20th century authors assigned different ranks (using all possible spellings!) to *Rhabdorrhynchus*: a genus, a subgenus, or even a synonym of *Pachycerus*. A complete literature survey is beyond the scope of this paper, and only the most significant references are cited. Reitter (1913) considered the genera distinct, and was the first author to give good distinguishing traits (shape and sculpture of pronotum, shape and vestiture of elytra). Marshall (1928) followed Faust (1904) and described a new species from India as *Pachycerus cynoglossi* Marshall, 1928, attributing it to the subgenus *Rhabdorrhynchus* only in the discussion (Marshall, 1928: 542). Csiki (1934) demoted all the genera of Cleonini to subgenera of *Cleonis* Dejean, 1821 (as *Cleonus* Schoenherr, 1826), listing *Rhabdorrhynchus* immediately after *Pachycerus* as a separate subgenus of *Cleonis*. Penecke (1935) described a further species of *Rhabdorrhynchus* in the genus *Pachycerus*: *Pachycerus armeniacus* Penecke, 1935. Two more *Rhabdorrhynchus* were described by Solari (1950b) (as *Rhabdorrhynchus*), *Rhabdorrhynchus longicollis* Solari, 1950a and *Rhabdorrhynchus curvirostris* Solari, 1950b. Solari (1950a) also extensively treated the genus *Pachycerus*, but in none of his papers did he mention the controversial taxonomic interpretation of *Rhabdorrhynchus*. Aslam (1963) implicitly considered *Rhabdorrhynchus* a synonym of *Pachycerus* (cf. Meregalli, 2002). Dieckmann (1983) maintained *Rhabdorrhynchus* (spelled *Rabdorrhynchus* and *Rhabdorrhynchus*) as a distinct genus, but 'durch die kurzen, ungeknieten Fühler und die Bindung an die Pflanzenfamilie Boraginaceae der Gattung *Pachycerus* nahe stehend' (closely related to *Pachycerus* in the short, not geniculate antennae and the association with the plant family Boraginaceae, Dieckmann, 1983: 320). The author indicated the

ventrites having irregular bare punctures and the elytra being without a dense vestiture of scales as main differentiating traits. This last classification was followed by most subsequent authors: such as Ter-Minasyan (1988) (as *Rhabdorrhynchus*) in the revision of the Cleonini of the Soviet Union; Tempère & Péricart (1989) (as *Rabdorrhynchus*) in the addendum to the Fauna of France; Abbazzi & Osella (1992) and Abbazzi *et al.* (1994) (as *Rabdorrhynchus*) in the checklists of the Italian weevils, etc.

All previously described taxa of *Rhabdorrhynchus* are quite uniform and belong to an evidently monophyletic group. *Pachycerus*, on the other hand, is more heterogeneous; the Palaearctic taxa are more uniform, whereas the other taxa, diffused in the Sahel region of Africa, in Madagascar, and in the Indian subcontinent, are more varied, particularly regarding the shape and sculpture of the head and pronotum, and the vestiture of the elytra. Research currently in progress (M. Meregalli, unpubl. data) indicates that they can be included in distinct species groups; however, the key characters defining the genus, such as the morphology of the rostrum and the structure of the female genitalia, are shared by all the species, thus confirming monophyly of *Pachycerus*.

Pachycerus and *Rhabdorrhynchus* share several characters, the most significant being: the rostrum short, nearly straight in lateral view, subquadrate in transverse section, with flattened dorsum, more or less sharply delimited laterally by raised dorsolateral margins, with the short, downward-curved upper margins of the scrobes reaching the lower margin of the eyes; the antennae not or weakly geniculate, with the scape short and thick and the funicle with very short, transverse segments; the elytra elongate, flattened, with a wrinkled or rough surface, in lateral view with a long, oblique declivity; the aedeagus slender, tubular, moderately curved, with a short triangular apical lamella; the ovipositor with broad hemisternites and cylindrical styli inserted in an apical position. The biology is not known for all the species; however, the available data indicate Boraginaceae as the host plants of some species of both genera (many records, not cited here).

The main characters differentiating *Rhabdorrhynchus* from *Pachycerus* are summarized in Table 1. The traits were mainly examined in the type species, but variation of the same trait in the different species of each genus was considered when necessary.

It is not possible to detect any constant difference between the two genera based on the ratio between segments 2 and 3 of the hind tarsi, which are usually of approximately equal length, or show only minor differences not easily recognized; however, segment 1 of the hind tarsi is usually shorter in *Pachycerus* (Figs 31–33). None of the traits indicated by Chevrolat

(1873) (ratio of elytral to pronotal length and length of hind femora) allow discrimination between the genera.

Preliminary data based on a phylogenetic analysis of all the genera of Cleonini, currently in preparation (M. Meregalli and D. Silvestro, unpubl. data), suggest that *Pachycerus* and *Rhabdorrhynchus* are sister taxa; some of the common characters, and the similar biological requirements, should be considered as synapomorphies. It may be questioned whether *Rhabdorrhynchus* shall be merged into *Pachycerus* as a species group or whether the two taxa shall be maintained distinct at genus level. Many of the differences between *Pachycerus* and *Rhabdorrhynchus*, in particular those of the internal structures (proventriculus, hemisternites, sternite VIII of the ♀), are constant in all the species, thus the two taxa are provisionally maintained as distinct genera here.

RHABDORRHYNCHUS SAUDITUS SP. NOV.

Type locality: Saudi Arabia, As Shâqqah al Yamâniyah, 19°42'N, 40°48'E.

Holotype ♀, *Saudi Arabia:* Saudi Arabia, Shagi Yamani, 40 m[iles] south of Lith [= As Shâqqah al Yamâniyah, about 50 miles south of Lith, 19°42'N, 40°48'E], 28 March 1948, B. P. Uvarov (BMNH).

Paratypes: same data as holotype, 3♂, 2♀ (1♂, 1♀, MER; 2♂, 1♀, BMNH).

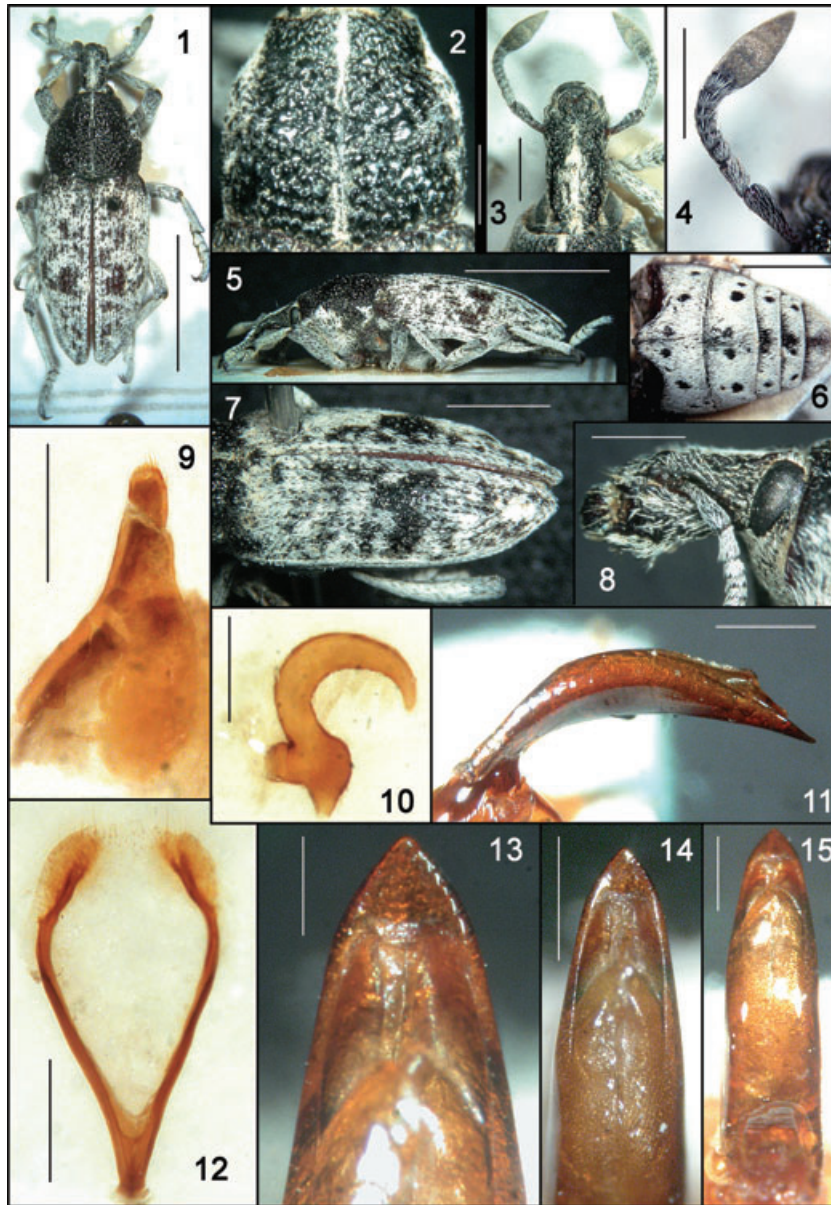
Diagnosis: A *Rhabdorrhynchus* of small size, characterized by the following features: pronotum convex, globose, granulose, at maximum width nearly as broad as elytra; rostrum flattened on dorsum, with distinct, roughly punctured dorsolateral keels, elytra elliptical, with dense vestiture of whitish scales; aedeagus slender, apex triangular; sternum VIII of female with arms joined at base; spermatheca with slender and curved cornu, thickened nodule and distinct ramus.

Measurements: Body length including rostrum, 8.40–9.79 mm. Rostrum: length 1.60–1.86 mm, width 0.90–0.94 mm. Pronotum: length 2.51–3.08 mm, width 3.05–3.37 mm (ratio 0.85–0.93). Elytra: length 5.72–6.09 mm, width 3.50–3.86 mm (ratio 1.55–1.63). Ratio of elytral to pronotal length, 1.98–2.28; ratio of elytral to pronotal width, 1.14–1.16.

Description: Body elliptical, barely convex in lateral view, integument moderately glossy, reddish on elytra, dark reddish on head, pronotum and legs;

Table 1. Differential characters between *Pachycerus* and *Rhabdorrhynchus*

<i>Rhabdorrhynchus</i>	<i>Pachycerus</i>
Rostrum: dorsolateral keels broad, irregular, very deeply sculptured and punctured; dorsum deeply sculptured, with very irregular punctures and granules, usually with at least a hint of a shallow transverse impression beyond head. Epistoma broad, triangular, well delimited posteriad by two oblique furrows, apex concave.	Rostrum: dorsolateral keels straight, usually sharp, narrow, not punctured, dorsum with dense, shallow and more regular punctation, with a broad triangular raised plate, widened forwards, or with a narrow median keel, lacking a basal transverse impression. Epistoma small, scarcely delimited posteriad, apex straight or convex in median part.
Antennae: segment 1 of funicle longer and barely broader than segment 2; basal third of segment 1 of club glossy, with sparse scales similar to those of the funicle, simulating a short eighth funicle segment (Figs 37, 38, 41, 42).	Antennae: segment 1 of funicle globose, narrowed near insertion to scape, broadened at suture with segment 2 and distinctly wider than segment 2; segment 1 of club also regularly hairy at base in most species, or with a barely distinct glossy part (Figs 39, 40).
Pronotum globose, often slightly convex in lateral view, with more or less dense granulation, dorsum with a median smooth line, often depressed in a shallow groove, usually covered with white glossy scales, in part interrupted by a median granule.	Pronotum flattened on dorsum, irregularly sculptured, with few, sparse granules; disc often with a shallow and broad, irregularly rhomboidal impression, median part flat or, mainly anteriad, with a narrow raised keel, lacking a groove with white scales.
Scutellum small and narrow, distinct.	Scutellum not visible, or very minute.
Elytra elongate, sides subparallel, maximum width near middle of length; vestiture not hiding integument, composed of small patches of white simple scales scattered on the surface, more or less dense, and occasionally with yellow narrow hair-like scales, more uniformly placed on the odd intervals; bifid scales absent or only present on underside of head and sternal segments.	Elytra ovate-elliptical, sides weakly converging from base to apex, maximum width shortly behind humeri; vestiture more or less dense above most of the surface, composed of simple or often bifid scales, sometimes leaving out two irregular patches on median part on intervals 3–7.
Ventrites usually 'irrorate', with sparse slender scales leaving out bare scattered patches not well delimited and irregularly distributed.	Ventrites densely coated with simple or, usually, bifid scales, leaving out bare round patches, well delimited and symmetrically placed.
Underside of segments 2 and 3 of the fore tarsi with a thick, complete pad of orange setae.	Underside of segments 2 and 3 of the fore tarsi variable, often with a reduced pad.
Apical field of wings as long as wide (Figs 35, 36).	Apical field of wings longer than wide, minor differences in the veins are also detectable (Fig. 34).
Blades of proventriculus short, chaetae nearly reaching base of the blade (Figs 46, 47).	Blades of proventriculus very elongate, chaetae only present in their apical half (Fig. 45).
Sternite VIII of ♀ with arms U- or V-shaped, connected at base; sclerotization of apical plate moderate or limited to a small area around arms (Fig. 44).	Sternite VIII of ♀ with arms connected at mid length, apodeme long to very long, sometimes nearly as long as the apical plate, arms usually widened; apical plate often in large part, or completely, sclerotized (Fig. 43).
Spermatheca with narrow, curved cornu, usually acuminate at apex.	Spermatheca with broad, moderately curved cornu, not acuminate at apex.
Hemisternites variable, but usually regularly constricted apicad (Fig. 49).	Hemisternites always very broad, sharply constricted apicad (Fig. 48).
Symbiont pouches not examined in all the species; those seen are shorter than the hemisternites, and are scarcely sclerotized.	Symbiont pouches elongate, sometimes longer than the hemisternites.



Figures 1–15. *Rhabdorrhynchus sauditus*, holotype ♀. Body, dorsal view (1); lateral view (5). Ventrites (6). Elytra (7). Rostrum, dorsal view (3); lateral view (8). Pronotum (2). Antenna (4). Sternite VIII (12). Spermatheca (10). Ovipositor (9). Paratype ♂. Aedeagus, median lobe, dorsal view (15); lateral view (11); detail of median lobe (14), and apex (13). Scale bars: 1–5, 5 mm; 6 and 7, 2 mm; 2–4 and 8, 1 mm; 9–12, 14 and 15, 0.5 mm; 10 and 13, 0.2 mm.

vestiture composed of dense, white, elliptical, glossy, simple scales and narrow, hair-like, yellowish scales, with bifid scales only present on underside of head (Figs 1, 5).

Rostrum subquadrate in cross section, in lateral view nearly straight from base to antennal insertion, slightly curved and thickened at apex. Surface roughly sculptured, with two dorsolateral, broad, glossy keels, higher and converging at their base on vertex, not touching eyes, irregularly delimited and

slightly divergent anteriorly, punctured on their inner side, joined to upper margin of scrobe above antennal insertion, and extended up to apex; in lateral view keels high, convex above eyes, slightly sinuate downwards at middle of rostrum length, raised again above antennal insertion, narrowed and sharpened towards apex, in some specimens only distinct and glossy in the basal part, between the eyes, shallower anteriorly and forming densely punctured raised dorsolateral margins, not extending to apex. Dorsum of rostrum

flat, densely and deeply sculptured, with wrinkles and punctures, median part forming an irregular subtriangular plate, broadened anteriorly, separate from the dorsolateral keels by two narrow, moderately impressed furrows, flattened at antennal insertion, and directed laterally around epistoma at apex. Apex curved downwards, epistoma semicircular, well delimited, flat, broadly punctured, and nearly matt, concave at apex. Lateral sides, delimited by the expanded upper margin of scrobes and the dorsolateral keels, partly visible from above, triangular, broadened basally. Vestiture: sparse hair-like scales inserted in the wrinkles and punctures on the dorsolateral keels and sides; larger, denser, glossy, white scales on the median part, covering integument. Scrobes curved, deep; upper margin thickened, expanded outwards, fully visible from above, in lateral view distinctly convex and densely punctured above antennal insertion, smooth, more glossy behind, curved towards base of eyes; lower margin short, subparallel to upper margin, curved downwards (Figs 3, 8). Antennae inserted at three-quarters of rostrum length; scape slightly curved forwards, regularly thickened from basal third; funicle as thick as scape at apex, segment 1 subconical, 1.3 times longer than broad; segment 2 subquadrate, half as long as segment 1; segments 3–7 transverse, 3rd very short, 7th slightly broader; club large, elliptical; scape and funicle with dense white scales and some slightly longer white setae; club elliptical, basal part of segment 1 glossy and with some smaller white scales, simulating an eighth segment of funicle; remaining part of club silvery hairy (Figs 4, 38, 41).

Head short, transverse; vertex flat, roughly punctured; interocular pit distinct; eyes large, moderately convex, reaching upper side of head, their upper half visible from above, interocular distance on head three-quarters as wide as rostrum at its maximum width between upper margins of scrobes; in lateral view eyes elongate, moderately narrowed in their lower part, lower margin rounded. Vestiture: white scales around eyes, mainly on upper part; hair-like scales on sides; short, bifid scales connate near base on underside.

Pronotum large, as long as broad, dorsum slightly convex in lateral view, globose, base medially slightly expanded towards scutellum, not acutely prominent; sides moderately and regularly rounded from base to near apex, slightly more convergent apically; apex curved on middle, prominent above head, nearly straight on sides, ocular lobes barely distinct, with a fringe of long and thick light-yellowish setae. Dorsum with a narrow, relatively deep median groove, narrowed on its middle and with a cleft granule or with a thin median carinula, which can be larger and more raised in the centre; surface with dense granules,

irregularly placed, conically raised near base and sides, slightly flattened on top of disc; interspaces between the granules matt, microsculptured, forming short irregular rows; sides with conical granules prominent when seen from above. Vestiture: very short, barely distinct hair-like scales sparse on dorsum, longer and more dense on the posterior part of the upper half of sides; larger white scales on the anterior part of the median groove and the anterior part of sides, extended to base in the lower part of sides (Fig. 2).

Scutellum narrow, triangular, bare.

Elytra elongate-elliptical, at base as wide as base of pronotum, sides subparallel, slightly narrowed behind humeri, in lateral view depressed, gently declivous, barely sloping. Apex of each elytron with a short acute projection. Surface unevenly and deeply wrinkled, with sparse small glossy granules clearly visible above the white scales of the vestiture, denser on basal half, in some specimens extending for the whole length along suture and the odd intervals, sparse and smaller on the even intervals; intervals flat, base of intervals 3 and 5 slightly raised; odd intervals as wide as even ones, clearly delimited only in apical half of elytra; striae on basal half with shallow, irregularly impressed punctures, much wider than intervals at base, narrowing in posterior half to form grooves distinctly narrower than intervals towards apex. Vestiture: larger white scales forming a thick coating that covers surface, continuous and rather uniform on sutural interval, but arranged in several large patches on rest of elytra, except for small sparse uncoated spots and two larger irregular bare patches on intervals 2–5 behind middle of length; hair-like yellow scales scattered over whole surface, not covering integument, usually denser on even intervals and on the part of the surface devoid of larger scales, including part of the large bare patch on interval 4; short, white setae similar to the larger scales obliquely inserted on the granules; base lacking scales or setae (Fig. 7).

Prosternum smooth, space between anterior margin of fore coxae and apex as long as diameter of fore coxae; metasternum longer than diameter of middle coxae. *Ventrite* I as long as ventrite II, weakly convex in middle in female, flattened and with a narrow median impression in male; ventrites III and IV less than half as long as II, slightly convex, ventrite V short, transverse. Vestiture: larger white scales forming a thick, uniform coating, delimiting round bare patches; on ventrites I and II, four lateral and two median, closely approached patches; on ventrite II, the two outer patches smaller; on ventrites III and IV, the two outer patches absent and the median ones merged; on ventrite V, a bare irregular median line on basal half (Fig. 6).

Legs slender, femora scarcely thickened in middle; fore tibiae elongate, inner side weakly sinuate, inner preapical teeth moderately developed in female, barely distinct in male, apex moderately broadened, with about ten short yellowish apical denticles, uncus strong; middle and hind tibiae slender, cylindrical; tarsal segments as long as broad, segment 3 with scarcely widened lobes (Fig. 32); underside of each segment with fringe of orange setae limited to lateral margins; onychium nearly as long as segments 1–3, claws robust. Vestiture: thick coating of white scales on the whole surface, including tarsi; longer white semi-erect setae on inner side of tibiae, particularly middle and hind, and on tarsi.

Aedeagus slender, median lobe weakly curved, apical lamella triangular, shortly acutely pointed (Figs 11, 13–15)

Spiculum gastrale narrow, slender, weakly curved.

Proventriculus with short blades, chaetae not extended towards pharynx (Fig. 46).

Hemisternites broadened basad, gradually tapering towards apex; styli subquadrate, short, apical (Fig. 9); symbiont pouches short, compact, globose; spermatheca with long and narrow, acutely pointed curved cornu, subquadrate ramus, and thickened nodulus (Fig. 10). Sternum VIII with thin arms joined at base and broadly widened, sclerotized plate nearly absent, limited to a small area around apex of arms (Fig. 12).

Variation: The holotype is the largest specimen; size varies from 8.40 to 9.79 mm, but most of the paratypes are only very slightly smaller than the holotype. Variation among the six specimens examined is mainly evident in the rostrum, which can have the dorsolateral keels, strongly developed, higher and glossy, as in the holotype, or only distinct and glossy in the basal part, between the eyes and shallower, less distinct anteriorly, and forming densely punctured raised dorsolateral margins, not extending to apex; the granules on the pronotum are always very dense and conical, but sometimes more irregularly distributed; the narrow median groove of the pronotum can be nearly completely interrupted by a granule in the centre or can show a very thin median carinula, which can be larger and more raised in the centre. The elytral shape and vestiture are very uniform, but in some specimens the small glossy granules are nearly exclusively limited to the basal part; the ratio of elytral to pronotal width is very constant, whereas the ratio of elytral to pronotal length is more variable. The female genitalia are very constant, with the arms of the sternite VIII typically subangulate laterally.

Etymology: Named after the country of origin, Saudi Arabia.

Distribution: The type locality is south of Lith, in the central part of the Saudi Arabian coast of the Red Sea.

***RHABDORRHYNCHUS EMIR* SP. NOV.**

Type locality: United Arab Emirates, Jebel Ali, 24°59'N, 55°43'E.

Holotype ♀, *United Arab Emirates:* United Arab Emirates, Umg[ebung] Jebel Ali, 24°59'N, 55°43'E; Dünen am Strand, 15 March 1990, H. J. Bremer legit (NHMB).

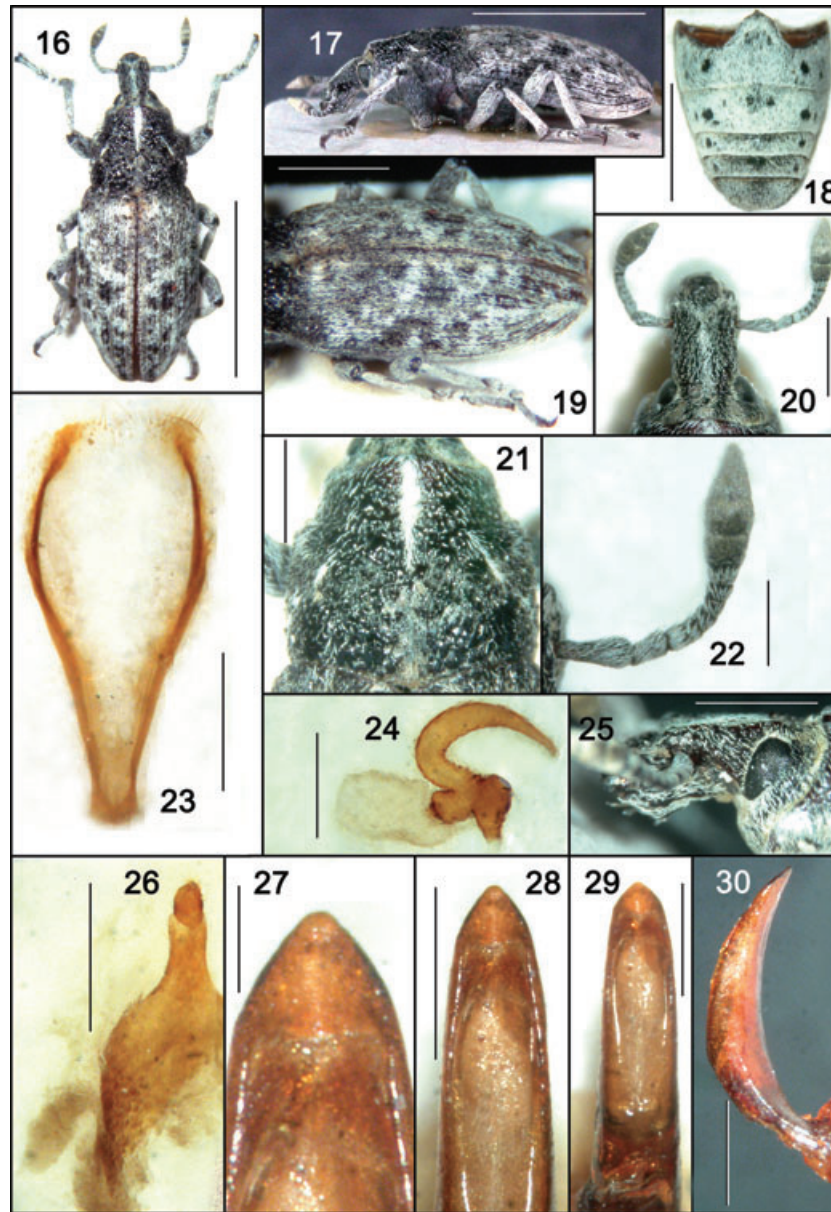
Paratype ♂, *United Arab Emirates:* United Arab Emirates, Dubai Emirate, 55°40'18"E, 24°56'07"N, 16 April 1993, Barbara J. Tigar/Brit. Mus. 1994-180/262 (BMNH).

Diagnosis: A *Rhabdorrhynchus* very similar to *R. sauditus* sp. nov., characterized by the short, flat rostrum, with scarcely developed dorsolateral keels; the pronotum scarcely convex, with flat, non-impressed narrow median line, and convex, irregular granules flattened on top; the ventrite VIII of the female with moderately broadened arms and the hemisternites long tapering at apex.

Measurements: Holotype ♀. Body length including rostrum, 7.56 mm. Rostrum: length, 1.40 mm; width, 0.74 mm. Pronotum: length, 2.23 mm; width, 2.46 mm; ratio, 0.91. Elytra: length, 4.95 mm; width, 3.07 mm; ratio, 1.61. Ratio of elytral to pronotal length, 2.22; ratio of elytral to pronotal width, 1.25. Paratype ♂. Body length including rostrum, 5.72 mm. Rostrum: length, 1.01 mm; width, 0.59 mm. Pronotum: length, 1.79 mm; width, 1.92 mm; ratio, 0.93. Elytra: length, 3.78 mm; width, 2.42 mm; ratio, 1.56. Ratio of elytral to pronotal length, 2.11; ratio of elytral to pronotal width, 1.26.

Description: Body of small size, integument moderately glossy, dark reddish at base of elytra, progressively darkened, black on pronotum; vestiture composed of narrow, hair-like, yellowish scales and larger, elliptical, acuminate white scales, about five times longer than broad, glossy, generally covering integument where present (Figs 16, 17).

Rostrum slightly longer than wide, nearly straight in lateral view, moderately thickened at apex. Dorsolateral keels broad but barely developed, densely and roughly punctured, slightly more raised and smoother only above eyes, sinuate and converging anteriorly towards antennal insertion, in lateral view nearly straight from base to antennal insertion, barely curved downwards at middle of the rostrum length;



Figures 16–30. *Rhabdorrhynchus emir*, holotype ♀. Body, dorsal view (16); lateral view (17). Ventrites (18). Elytra (19). Rostrum, dorsal view (20); lateral view (25). Pronotum (21). Antenna (22). Sternite VIII (23). Spermatheca (24). Ovipositor (26). Paratype ♂. Aedeagus, median lobe, dorsal view (29); lateral view (30); detail of median lobe (28) and apex (27). Scale bars: 16 and 17, 5 mm; 18, 2 mm; 19–21 and 25, 1 mm; 22, 23, 26, 28–30, 0.5 mm; 24 and 27, 0.2 mm.

dorsum flattened or subdepressed, lacking distinct furrows or keels, delimited by the dorsolateral keels and thus narrowed anteriorly between antennae, roughly wrinkled and punctured, interspaces between wrinkles raised to form irregular small glossy granules; sides in front of eyes flat, densely wrinkled and punctured. Epistoma semicircular, well delimited, broadly punctured, and nearly matt, concave at apex. Vestiture: yellowish-white hair-like scales inserted in granules and punctures, relatively dense; larger

white scales forming a stripe on median part, hiding integument. Scrobes short, deep; upper margin moderately convex and raised above antennal insertion, not expanded outwards, straight, reaching the lower margin of eyes; lower margin of scrobes not delimited by a glossy smooth keel, short, directed downwards (Figs 20, 25). Antennae with scape short, thick, conical, straight, and moderately broadened from base; funicle nearly as wide as scape at its apex, segment 1 subcylindrical, about 1.5 times longer than

broad, segment 2 subquadrate, segments 3–7 transverse, seventh slightly larger; club long elliptical; vestiture of the antennae as in *R. sauditus* (Fig. 22).

Head short, transverse, vertex convex, rough; interocular pit distinct; eyes moderately convex, their upper half visible from above, in lateral view subtriangular–elliptical, lower margin subacute. Vestiture: scattered hair-like scales and a patch of larger white scales on centre of vertex; underside with scales white, in part bifid, connate near apex.

Pronotum large, in lateral view dorsally nearly flat, base medially moderately expanded towards scutellum; sides subparallel, from base barely widening up to apical quarter and shortly narrowing preapically in female holotype, very weakly convergent apicad in male paratype; apex prominent above head, ocular lobes weakly but distinctly developed, with some yellow setae; dorsum in holotype with irregularly shaped, sparse glossy granules, which are smaller, widely separate, and scarcely raised on disc, and larger and more glossy, in part fused, towards base, apex, and sides, where they are higher but similarly flattened in their upper part; in paratype male granules on dorsum scarcely raised, semicircular, delimiting the external margin of irregularly impressed punctures; disc with a narrow and flat median keel, continuous from base to apex, narrowed at middle, smooth, not impressed; sides with smaller, rounded, and slightly conical granules. Vestiture: hair-like scales relatively frequent on dorsum, thicker in the basal half of the median keel and on sides, progressively larger towards anterior part; large white scales forming a thick oblique stripe on the anterior part of the median line, two small elongate spots in dorsolateral position, and a scarcely defined line starting from the spots and directed towards apex (Fig. 21).

Scutellum narrow, long triangular.

Elytra barely wider than base of pronotum, sides subparallel, maximum width along middle of their length, declivity oblique, gently sloping. Apex of each elytron with an acute projection behind interval 3, and with a hint of a raised keel joining the junctions between intervals 2 and 10 and intervals 3 and 9. Surface nearly smooth, with very few granules on basal part; all intervals flat, odd undifferentiated from even, striae with shallow punctures, larger at base, and progressively narrower towards apex. Vestiture: yellow hair-like scale quite dense on odd intervals and sparsely scattered on even intervals; larger white scales forming dense, vaguely delimited patches covering integument over the whole surface, leaving out small irregular spaces usually covered by hair-like scales and a slightly better delimited bare patch on intervals 2 and 4 slightly beyond median of elytra (Fig. 19).

Prosternum shape, sculpture, and vestiture as in *R. sauditus*.

Ventrite I as long as ventrite II, ventrite I plus ventrite II as long as ventrite III plus ventrite IV; ventrites III and IV nearly half as long as ventrite II, ventrite V transverse. Vestiture very dense on all ventrites, composed of large glossy white scales, leaving out four lateral bare spots on ventrites I and II, the outer ones small and scarcely distinct, and two small median spots barely delimited and nearly completely merged; on ventrites III and IV, two lateral bare round spots and indications of a median patch, on ventrite V, indication of a bare patch at base (Fig. 18). Secondary sexual characters are similar to those of *P. sauditus*.

Legs shape and vestiture as in *R. sauditus*.

Aedeagus slender, moderately curved.

Apical lamella, shortly triangular (Figs 28–30).

Hemisternites broadened basad, narrowly attenuated at apex; styli subquadrate, short, apical (Fig. 26).

Spermatheca with long narrow, curved and acuminate cornu, subquadrate ramus, and thickened nodulus (Fig. 24).

Sternum VIII with arms thin, joined at base, moderately widened; sclerotized plate nearly indistinct, limited to a small area around apex of arms (Fig. 23).

Variation: The paratype male is much smaller (5.72 mm), the pronotum has sides that are very weakly convergent apicad, and the granules on the dorsum are scarcely raised, semicircular, delimiting the external margin of irregularly impressed punctures. The other traits characterizing *R. emir* are constant in the two specimens examined.

Etymology: The specific epithet is a noun in apposition. It is derived from ‘emir’, also sometimes written as Amir or Ameer (arabic: أمير, commander), a high title of nobility or office, historically used in Islamic nations of the Middle East, North Africa, and the Turkish world; in reference to the species’ provenance, the United Arab Emirates.

Ecology: The type specimen was collected on sand dunes along the beach.

Remarks: *Rhabdorrhynchus emir* differs from *R. sauditus* sp. nov. in the following traits: size smaller (5.72–7.56 mm vs. 8.40–9.79 mm), rostrum with dorsolateral keels scarcely raised throughout their entire length, densely punctured and barely distinct before antennal insertion; dorsum flat, lacking longitudinal grooves; scape shorter, straight, thickened from base (slightly curved forwards, relatively narrower, thickened from basal third in *R. sauditus*); pronotum with shallow and broader median groove, more densely

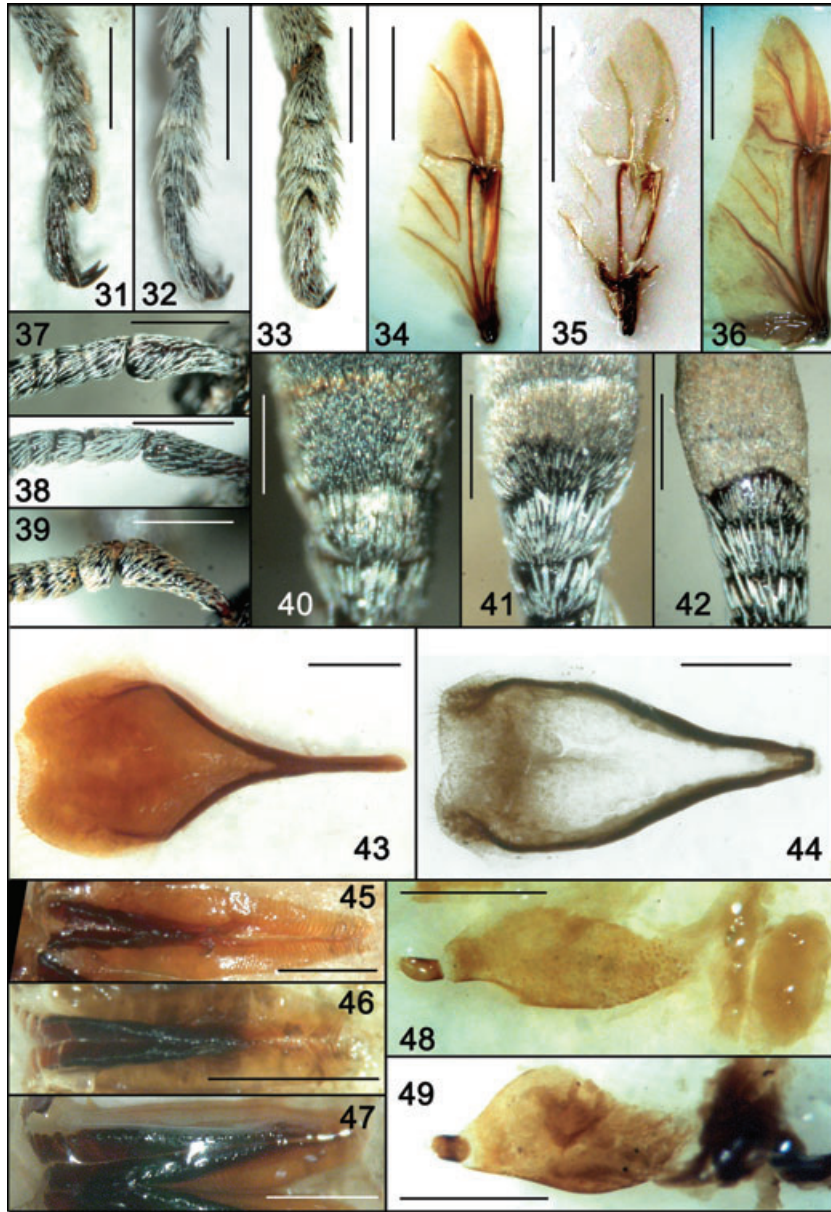
covered with scales in its anterior half, and with granules less dense, scarcely distinct, scattered on surface and not conically raised, and elytra nearly completely without granules excepting a few near base, without short, semi-erect setae; larger white scales less dense, smaller yellow scales slightly broader and more frequent, forming a nearly uniform vestiture on sutural interval. Sternum VIII of female with arms weakly curved and moderately broadened, length/width ratio 2.30 (arms subangularly broadened, ratio 1.84–1.98 in *R. sauditus*); hemisternites long, more sharply attenuated at apex; spermatheca with cornu more slender, narrower and more strongly curved. Aedeagus slightly broader, sides subangularly constricted before apical lamella. All other species of *Rhabdorrhynchus*, none of which have ever been recorded for the Arabian Peninsula, are larger, and usually have a much sparser elytral vestiture, with larger white scales scattered in small patches and the rostrum more distinctly grooved basally, before the vertex. *P. efflatouni* (Tewfik, 1942), from Yemen, Wadi Sharis, according to its description, is apparently quite close to some species from sub-Saharan Africa and is characterized by the presence of bifid or digitate scales, the pronotum lacking isolate granules and with a broad median impression, and the elytra having glossy black spots.

DISCUSSION

The two new species have very typical morphological characters, and their closest phylogenetic relationships are uncertain. They were attributed to the genus *Rhabdorrhynchus* because they agree with it in the following characters: rostrum very deeply and irregularly sculptured; dorsolateral keels broad, deeply punctured, extended to vertex; epistoma well delimited, triangular, concave at apex; antennae short, almost not geniculate, scape very short, funicle segment 1 subcylindrical and club segment 1 glossy at base, and with scales similar to those of funicle segment 7 (Figs 38, 41); pronotum broad, weakly convex, densely and relatively uniformly granulate, with a median groove, partly interrupted in middle, densely covered with white scales in anterior half; scutellum visible; elytra elongate, with subparallel sides; vestiture composed of simple white scales mainly arranged in patches, where they are very dense and generally covering integument, mixed with yellow hair-like scales; wings with apical field as long as wide (Fig. 35); spermatheca with slender, curved cornu; hemisternites regularly constricted at apex and symbiont pouches short, globose; sternum VIII of female with arms connected basally, central plate not sclerotized, membranous, with sclerotization only sur-

rounding apical part of the arms. The two Arabian species approach *Pachycerus*, particularly *P. opimus*, in a few characters, namely in the shape of the pronotum, the ventrites not being 'irrorate', but with a dense vestiture of scales leaving well-delimited bare patches, and the underside of segments 2 and 3 of the fore tarsi lacking a dense pad of orange setae. Also the blades of the proventriculus are apparently intermediate between the two genera (Fig. 46). These are probably to be considered as plesiomorphic states retained in the two Arabian species, reinforcing the suggested close relationships between the two genera.

Although the paucity of faunistic and ecological data, in particular with regard to the south-eastern region, means that knowledge of the Arabian fauna is still very incomplete, it is noteworthy that no specimens of the new species of *Rhabdorrhynchus* from any other parts of the peninsula were found among many hundreds of Arabian Cleonini, housed in several European Museums and examined in the course of the present study, including the large collections acquired in the last 20 years by expeditions in Saudi Arabia and neighbouring countries organized by, and now preserved in, the NHMB. Therefore, it can be assumed with relative confidence that the two new species are restricted to coastal habitats of the Arabian Peninsula: along the Red Sea in the case of *R. sauditus*, and along the Persian Gulf in the case of *R. emir*. Their apparently narrow ranges, in spite of being fully winged, are probably determined by the lack of host plants in the nearly completely desert environment that lies outside the fragmented coastal vegetated coenoses where they live. Such a distribution pattern of two close vicariant species stimulates some consideration of its biogeographical origin and speciation mechanisms. As indicated by Büttiker (1979), the Arabian Peninsula is a transition zone between the Afrotropical, Palaearctic, and Indo-Malayan biogeographical regions. Recently, a scheme of terrestrial ecoregions developed by Olson *et al.* (2001) was used to investigate the characters of the Saudi Arabian fauna of Histeridae (Coleoptera) (Penati & Vienna, 2006). According to this scheme, the coasts of the Arabian Peninsula, from about 20°N along the Red Sea to Oman and the eastern part of the Arabian Emirates Republic, are part of the Afrotropical region, and include various ecoregions, varying from the Arabian Peninsula coastal fog desert, characterized by patches of relatively luxuriant vegetation, particularly on hill slopes, to more arid or desert sandy plains. The remaining part of the peninsula belongs to the Palaearctic region, and mostly includes desert ecoregions (Olson *et al.*, 2001; see also Penati & Vienna, 2006:10, fig. 3, for a map and an excellent description of the ecoregions). According to the bionomic data associated with the holotype of *R. emir*, it appears that these Cleonini inhabit coastal sandy



Figures 31–49. *Rhabdorrhynchus menetriesi*, Anatolia, Kaptanmaraş, ♂. Hind tarsus (33). Hind wing (36). Scape and first segments of antenna (37). Segment 7 of antenna and club (42). Blade of proventriculus (47). *Rhabdorrhynchus karelini*, Kyrgyzstan, Issyk-Kul, ♀. Sternite VIII (44); ovipositor (49). *Pachycerus segnis*, Anatolia, Izmir, ♀. Hind tarsus (31). Hind wing (34). Scape and first segments of antenna (39). Segment 7 of antenna and club (40). Blade of proventriculus (45). Sternite VIII (43). Ovipositor (48). *Rhabdorrhynchus sauditus*, holotypus ♀. hind tarsus (32). Hind wing (35). Scape and first segments of antenna (38). Segment 7 of antenna and club (41). Blade of proventriculus (46). Scale bars: 34–36, 2 mm; 31–33, 1 mm; 37–39 and 43–49, 0.5 mm; 40–42, 0.2 mm.

semidesert ecosystems. The two type localities are located at the margin between the Afrotropical and the Palaearctic regions in Arabia, and, considering the habitat utilized (known for one of them), and the uncertainty regarding their phylogenetic relationships, it cannot be stated whether they should be considered true Palaearctic or sub-Saharan (Sahelian)

elements; one of the two new species ranges in an area mainly occupied by taxa with Afrotropical or Sahelian affinities, whereas the other new species inhabits an area mainly occupied by Palaearctic taxa. Southern African affinities of these two Arabian species can probably be excluded, because no *Rhabdorrhynchus* or *Pachycerus* are known for that region, with the excep-

tion of a Madagascanian *Pachycerus*, *P. badeni* Faust, 1888, a taxonomic vicariant of a taxon diffused in the Sahel. The extremely dry deserts of central Arabia were already fully developed by at least the Pliocene, probably earlier (Adams, 1998), and, considering that the two species differ only in minor traits, it seems unlikely that they are relicts isolated at the extremes of the range of an ancestral species formerly occupying the whole peninsula before the onset of the harsher deserts. Thus, a more recent speciation can be invoked, although evidence of vicariance between the western and the eastern coasts of the Arabian Peninsula, the faunas of which have to a great extent different affinities, is not very strong. In Curculionoidea, for example, various apterous and generally xerophilous species of the genus *Ocladius* Schoenherr, 1823, mostly with Ethiopian affinities, are restricted to the coasts of the Red Sea and surrounding mountains, whereas only one strictly eremic species, with Turanian affinities, reaches the south-eastern part of the peninsula (Meregalli & Colonnelli, 2006). This implies that, for wingless species, not only is expansion from the coasts of the Red Sea to the deserts of central Arabia usually prevented, probably by the coastal mountain chain, but also that the only other alternative, the expansion along the southern coasts in apparently favourable habitats, is an improbable, or at least rare, event. Similarly, Palaearctic taxa are seldom found in the south-western parts of the peninsula, although they are quite common in the northern half, and can reach the southern and eastern coasts, particularly in the case of eremic entities. Winged taxa generally have a greater dispersal capability, which is of course subject to the availability of suitable habitats. *R. sauditus* and *R. emir* may have originated from the dispersal of an ancestral species, either with Sahelian or (southern) Palaearctic affinities, along the coasts of the Arabian Peninsula, in favourable habitats, with subsequent speciation of the populations at the extremes of the range, as they became isolated during the more arid phases, or differentiated because of reduced gene flow following the increase of the distance between winged, but scarcely vagile, populations.

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APPENDIX

CHECKLIST OF THE SPECIES OF *RHABDORRHYNCHUS*
MOTSCHULSKY, 1860

- Rhabdorrhynchus anchusae* (Chevrolat, 1854). *Revue et Magazin de Zoologie*, **2** (VI): 480. Syria, Iran, Turkey.
- Rhabdorrhynchus armeniacus* (Penecke, 1935). *Koleopterologische Rundschau*, **21**: 206–227. Armenia.
- Rhabdorrhynchus curvirostris* Solari, 1950b. *Memorie della Società Entomologica Italiana*, **29**: 43. Algeria.
- Rhabdorrhynchus cynoglossi* (Marshall, 1928). *Annals and Magazine of Natural History*, **10**: 550. India.
- Rhabdorrhynchus emir* Meregalli, 2006, here described. Arab Emirates Republic.
- Rhabdorrhynchus grummi* (Faust, 1886). *Horae Societatis Entomologicae Rossicae*, **20**: 167. Turkestan; Uzbekistan.
- Rhabdorrhynchus karelini* (Fåhraeus, 1842). In: Schoenherr, *Genera et species Curculionidum*, **6** (2): 119. Southern Ukraine, Caucasus, Iran, Kazakhstan, Uzbekistan.
- Rhabdorrhynchus longicollis* Solari, 1950b. *Memorie della Società Entomologica Italiana*, **29**: 41. Algeria.
- Rhabdorrhynchus menetriesi* (Gyllenhal, 1842). In: Schoenherr, *Genera et species Curculionidum*, **6** (2): 118. Southern Europe, Caucasus, Anatolia, Turkestan.
- Rhabdorrhynchus mixtus* (Fabricius, 1792). *Entomologia Systematica*. **2**: 417. Southern Europe, Northern Africa, Northern Caucasus.
- Rhabdorrhynchus sauditus* Meregalli, 2006, here described. Saudi Arabia.
- Rhabdorrhynchus varius* (Herbst, 1795). *Natursystem aller bekannten in- und ausländischen Insekten. Käfer*. **6**: 252. Central-southern Europe, Northern Africa, Anatolia, Kazakhstan, Turkestan.