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ARTICLE *in* ACTA ENTOMOLOGICA MUSEI NATIONALIS PRAGAE · DECEMBER 2014

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ACTA ENTOMOLOGICA MUSEI NATIONALIS PRAGAE
Published 15.xii.2014 Volume 54(2), pp. 515–527 ISSN 0374-1036
http://zoobank.org/urn:lsid:zoobank.org:pub:06AB713B-00FA-43B7-BE19-DE1FBE02DBB6

Orateon praestans, a remarkable new genus and species from Yemen (Coleoptera: Histeridae: Saprininae)

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Abstract. *Orateon praestans* sp. nov. from Yemen is described and illustrated. Based on the detailed examination of its morphology, *Orateon* gen. nov. is most similar and presumably related to the genera *Terametopon* Vienna, 1987 and *Alienocacculus* Kanaar, 2008 sharing with them ciliate elytral epipleuron, labial palp chaetotaxy and protibial spur position.

Key words. Coleoptera, Histeridae, Saprininae, *Orateon praestans*, new genus, new species, psammophily, Yemen, Arabian Peninsula

Introduction

The genus *Alienocacculus* Kanaar, 2008 (revised recently by Lackner 2011) is a typical Trans-Saharan–Arabian element of the psammophilous Saprininae containing four species spread from Morocco to Saudi Arabia. The genus *Terametopon* Vienna, 1987 that has likewise been revised by the senior author (Lackner 2009) is a psammophile found in Namibia (with a single record from Botswana) containing two subgenera: *Terametopon* s. str. (four species) and *Psammoprinus* Gomy & Vienna, 1997 (two species); one additional species of the genus is of uncertain position. In the collections of the National Museum, Prague, Czech Republic we came across a series of a curious Saprininae beetle from Yemen, which exhibited apparently a combination of characters of the two aforementioned genera, which are presumably closely related. A detailed examination of morphology of the newly discovered taxon resulted in erection of a new genus, described below. The present paper is another contribution to the on-going revisionary works of the Saprininae subfamily by the senior author (see e.g. Lackner 2009a–c; 2010; 2011a,b; 2012; 2013a,b; 2014a,b; Lackner & Gomy 2013; Lackner & Tishechkin 2014; Tishechkin & Lackner 2012).

Material and methods

All dry-mounted specimens were relaxed in warm water overnight. After removal from original cards, the beetles were side-mounted on triangular points and observed under a stereoscopic microscope with diffused light. Some structures were studied using methods described by Ôhara (1994): the head and male genitalia were macerated in a hot 10% KOH solution for about 15 minutes, cleared in 80% alcohol, macerated in lactic acid with fuchsine, incubated at 60ºC for two hours, and subsequently transferred into a 1:1 mixture of glacial acetic acid and methyl salicylate, heated at 60ºC for 15 minutes and cleared in xylene. Specimens were then observed in α-terpineol in a small glass dish. The mentum, labium, labrum, mandibles and antennae were disarticulated. Digital photographs of the male terminalia, mouthparts and antenna were taken by a Nikon 4500 Coolpix camera and edited in Adobe Photoshop CS5. Based on the photographs or direct observations, the genitalia and antennal structures were drawn using a light-box Hakuba klv-7000. SEM photographs were taken at the Laboratory of the Electron Microscopy at the Faculty of Science, Charles University, Prague, Czech Republic, while the stack-piled colour photographs were taken with Nikon D90 camera by the junior author. All available specimens were measured with an ocular micrometer. Morphological terminology follows that of Ôhara (1994) and Lackner (2010). Separate lines of the same label are marked by slash (/). The following acronyms of museums and private collections are used throughout the text:

CGR Giovanni Ratto collection, Genoa, Italy;
NMPC Národní muzeum, Prague, Czech Republic (Jiří Hájek);
TLAN Tomáš Lackner collection, temporarily housed at Leiden, the Netherlands.

Abbreviations of body measurements are as follows:

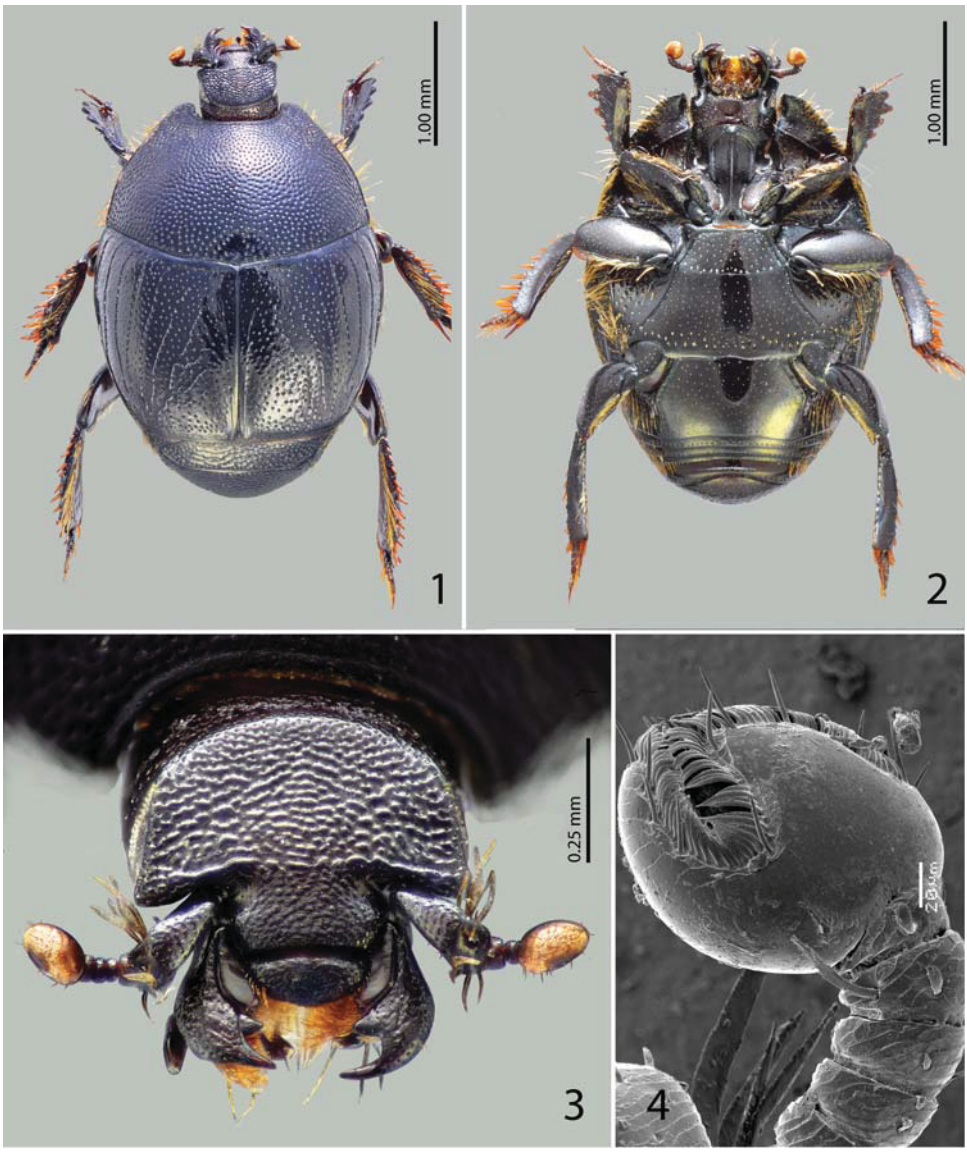
PEL length between anterior angles of pronotum and apices of elytra;
APW width between anterior angles of pronotum;
PPW width between posterior angles of pronotum;
EL length of elytron along sutural line;
EW maximal width between outer margins of elytra.

Taxonomy

Orateon gen. nov.

Diagnosis. Rather small ovoid saprinine genus with entirely punctate dorsal surface, complete set of dorsal elytral striae, strongly narrowed pronotum with correspondingly small head; pronotal hypomeron, elytral epipleuron, lateral disk of metaventrite, metepisternum, metepimeron and all abdominal ventrites laterally with amber setae. Sub-apical tooth on both mandibles large, well developed; labrum with labral pits adorned with two setae; eyes flattened; penultimate labial palpomere with a single long seta. Antennal club almost completely glabrous apart from one deep, almost circular slit-like sensory area on apical surface. Both sets of prosternal striae present, prosternal process compressed laterally, carinal prosternal striae very approximate, almost confluent; prosternal foveae absent. Protibial spur large, bent, growing out from near the protarsal base, claws of last segment of tarsomere as long

or longer than it. Femora and tibiae not particularly thickened; posterior surface of both meso- and metatibiae with long dense amber setae. Eighth sternite of male genitalia apically with rather small velum covered with short sparse setae; spiculum gastrale gradually dilated from middle towards both ends; apex of aedeagus blunt, basal piece of aedeagus rather long.



Figs 1–4. *Orateon praestans* gen. & sp. nov. 1 – habitus, dorsal view; 2 – same, ventral view; 3 – head, frontal view; 4 – antennal club, ventral view.

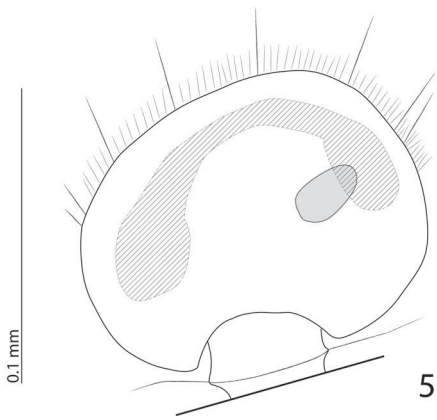


Fig. 5. *Orateon praestans*, gen. & sp. nov., sensory structures of the antennal club.

Table 1. Comparison of *Orateon* gen. nov. with the presumably related genera/subgenera *Alienocacculus* Kanaar, 2008, *Terametopon* s. str. Vienna, 1987 and *Psammoprinus* Gomy & Vienna, 1996.

	Alienocacculus	***Terametopon* s. str.**	***Psammoprinus***	***Orateon* gen. nov.**
Antennal club	Glabrous except of one deep, almost circular slit-like sensory area on ventral surface	Glabrous except of one deep, almost circular slit-like sensory area on ventral surface	Dorsal upper two-thirds (roughly) of antennal club covered with dense short sensilla intermingled with scattered longer sensilla; lower third (roughly) glabrous	Glabrous except of one deep, almost circular slit-like sensory area on ventral surface
Frontoclypeal projection	Absent	Present	Absent	Absent
Labral pits	Present	Absent	Absent	Present
Anterior margin of mentum	With deep emargination	Without emargination	Without emargination	With deep emargination
Sub-apical tooth of mandibles	Large, circular	Small	Large, circular	Large, circular
Pronotal shape	Not strongly convergent anteriorly	Not strongly convergent anteriorly	Sides strongly convergent anteriorly	Sides strongly convergent anteriorly
Prosternum shape and chaetotaxy	Flattened to slightly concave, asetose	Flattened to slightly concave, asetose	Concave, setose	Flattened to slightly concave, asetose
Prosternal foveae	Present	Absent*	Absent	Absent
Meso-metaventral stria	Present	Absent	Absent	Present
Protibial spur	Large, bent, situated near tarsal insertion	Large, bent, situated near tarsal insertion	Large, bent, situated near tarsal insertion	Large, bent, situated near tarsal insertion
Eighth sternite: apex chaetotaxy	Without setae laterally	With short setae laterally	With short setae laterally	Without setae laterally
Spiculum gastrale	Almost parallel with abruptly dilated basal and apical ends	Gradually dilated from middle towards both ends	Gradually dilated from middle towards both ends	Gradually dilated from middle towards both ends
Aedeagus	Pointed apically	Blunt apically	Blunt apically	Blunt apically

* Except for one species *Terametopon* (*T.*) *foveatus* Lackner, 2009

Differential diagnosis. Externally resembling *Alienocacculus* Kanaar, 2008 and *Terametopon* Vienna, 1987 with which it shares three characters: 1) pen-ultimate labial palpomere with a single, long seta; 2) presence of large protibial spur growing out from near tarsal insertion; 3) ciliate elytral epipleuron. Largely, *Orateon* differs from the members of *Alienocacculus* by the absence of prosternal foveae, which are always present in *Alienocacculus* and from the members of *Terametopon* it differs by the presence of labral pits and with them associated labral setae. For the complete enumeration of the characters outlining the shared characters and differences between the three aforementioned taxa see also Table 1.

Biology. The type series of this species was collected in the sand of the Tihamah coastal plain (Fig. 24) spreading approximately from Mecca in Saudi Arabia to Aden in Yemen, containing mostly Afrotropical fauna. Beetles were attracted by human faeces, and presumed to have colonized it during the night; they were present also under the 'ball' of human faeces constructed by a couple of dung beetles *Metacatharsius inermis* (Laporte de Castelnau, 1840) early in the morning, approximately 1 meter from the faeces-baited trap (D. Král, pers. comm 2013).

Distribution. Yemen, Al Hudaydah governorate (Fig. 25).

Etymology. "*Orateon*" from Greek ὁρατέον, is the verbal adjective derived form verb ὁράω meaning "to see, to look". The verbal adjectives derived using the affix -τέος, -τέα, -τέον usually imply necessity or urgency, hence the literal meaning of the name is "the one, that has to be seen". The ancient Greek word starts with breathing, which was omitted intentionally to connect the name of the beetle to the Modern Greek adjective ορατος (meaning beautiful) as well. Gender is neuter.

Orateon praestans sp. nov.

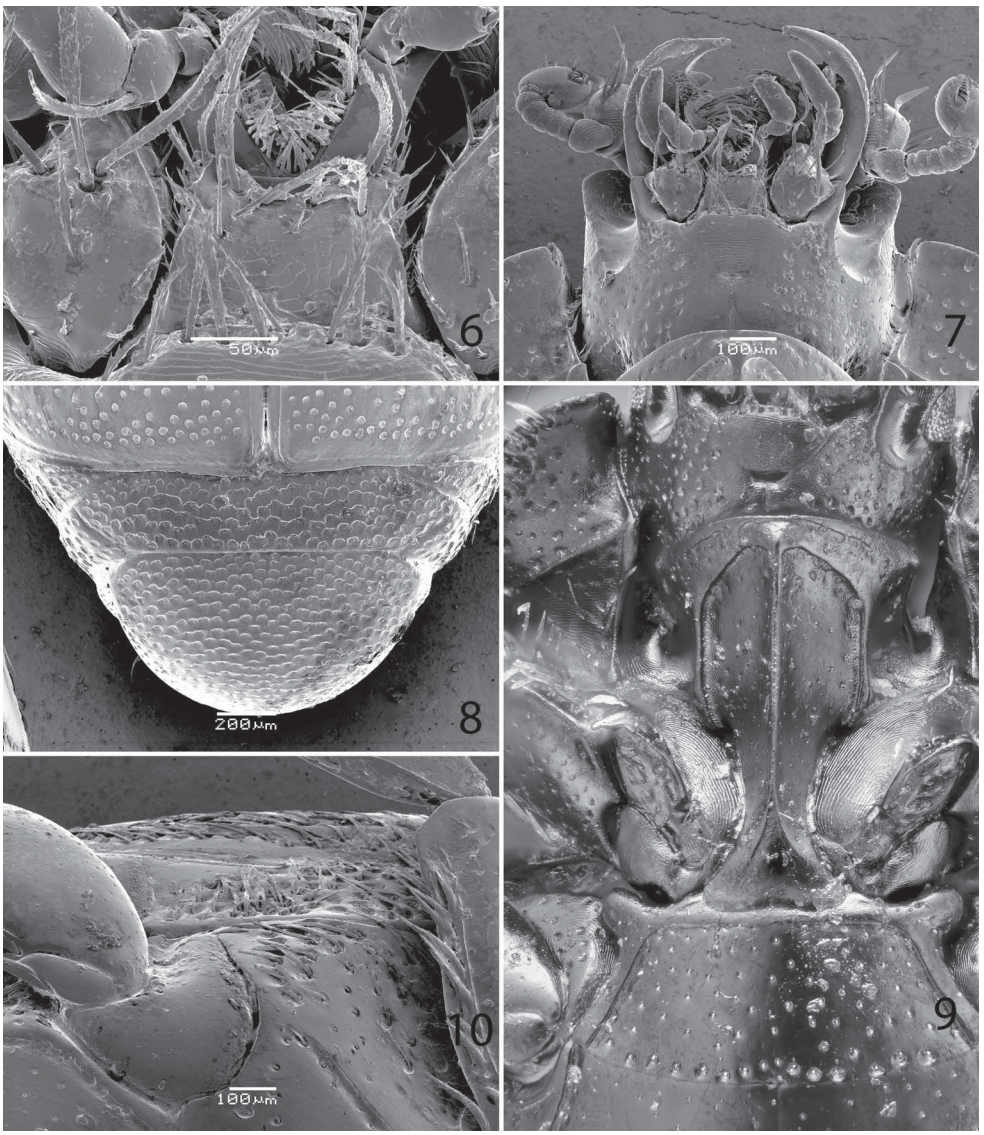
(Figs 1–23)

Type locality. Yemen, Al Hudaydah governorate, Al Munirah, 15°20′10″N 42°50′12″E, 21 m a.s.l.

Type material examined. Holotype: ♂, side-mounted on a triangular point, genitalia dismembered, glued to the same triangular point as the specimen, with the following labels: "YEMEN, Al Hudaydah gov. / AL MUNIRAH, / 21m, 31.x–1.xi.2005 / N 15°20'10" E 042°50'12" / David Král lgt." (printed); followed by: "ex coll. D. Král / National Museum / Prague, Czech Republic" (printed); followed by: "*Orateon praestans* n.sp / HOLOTYPUS / Det. T. Lackner & G. / Ratto, 2013" (red label, printed) (NMPC). Paratypes: data identical to those of the holotype: 5 ♂♂ 9 ♀♀, of which 1 ♂ and 1 ♀ coated with gold (NMPC), 1 ♂ 3 ♀♀ (TLAN), 1 ♀ (CGR).

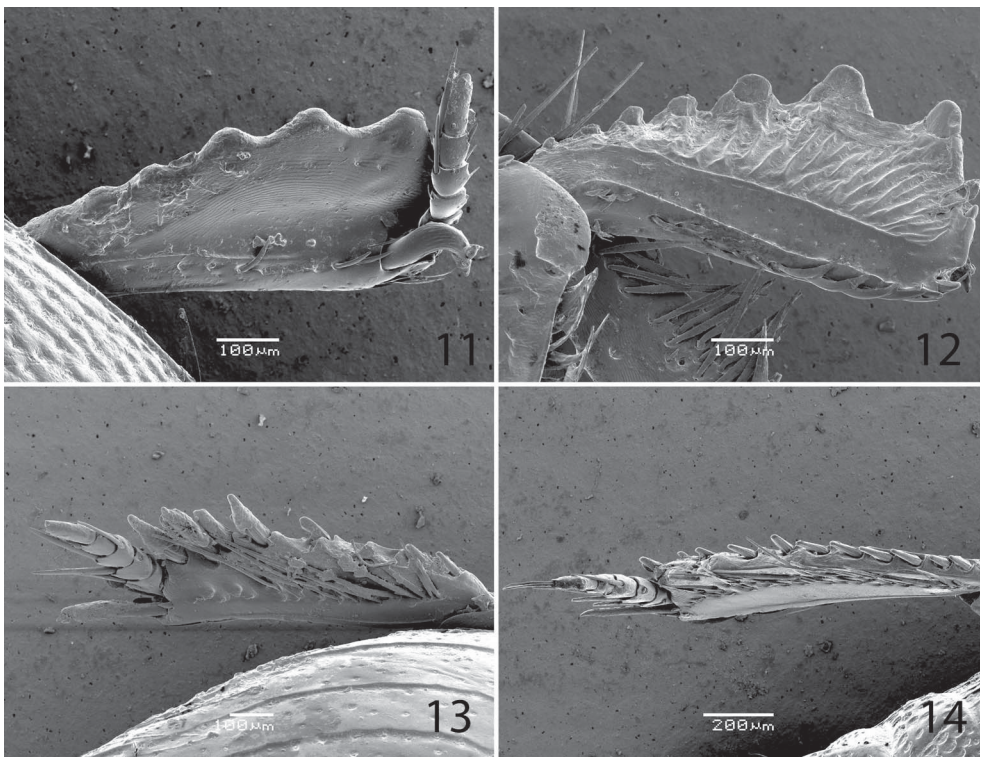
Description. Body (Figs 1–2) moderately convex, PEL: 2.00–2.95 mm; APW: 0.75–1.00 mm; PPW: 1.75–2.45 mm; EL: 1.00–1.75 mm; EW: 1.75–2.50 mm, completely punctate dorsally, punctation much denser on pronotum where punctures are almost confluent than on elytra where the punctures are separated by several times their diameter, cuticle chestnut brown; legs, mouthparts and antennae dark brown; antennal club amber colored. Antennal scape (Fig. 3) dilated and thickened, densely punctate, with several long amber setae; antennal club (Fig. 4) ventrally glabrous, with mohawk-like sensory area on apex; sensory structures of antennal club (Fig. 5) in form of a single stipe-shaped vesicle situated on internal distal part of antennal club attached to circular sensory area visible also from the external view; this sensory area is continued under apex of antennal club onto external proximal part of club; however, external proximal part of club without vesicle. Mandibles (Fig. 3) punctate, with evenly rounded outer margin strongly curved inwardly; acutely pointed; sub-apical tooth on inner margin of

both mandibles large, triangular; labrum (Fig. 3) semi-circular, slightly convex with median depression, coarsely and densely punctate; labral pits with two labral setae arising from each; mentum (Fig. 6) with deep median emargination adorned by several long ramose setae, laterally with shorter dense ramose setae, surface of mentum imbricate; cardo of maxilla (Fig.



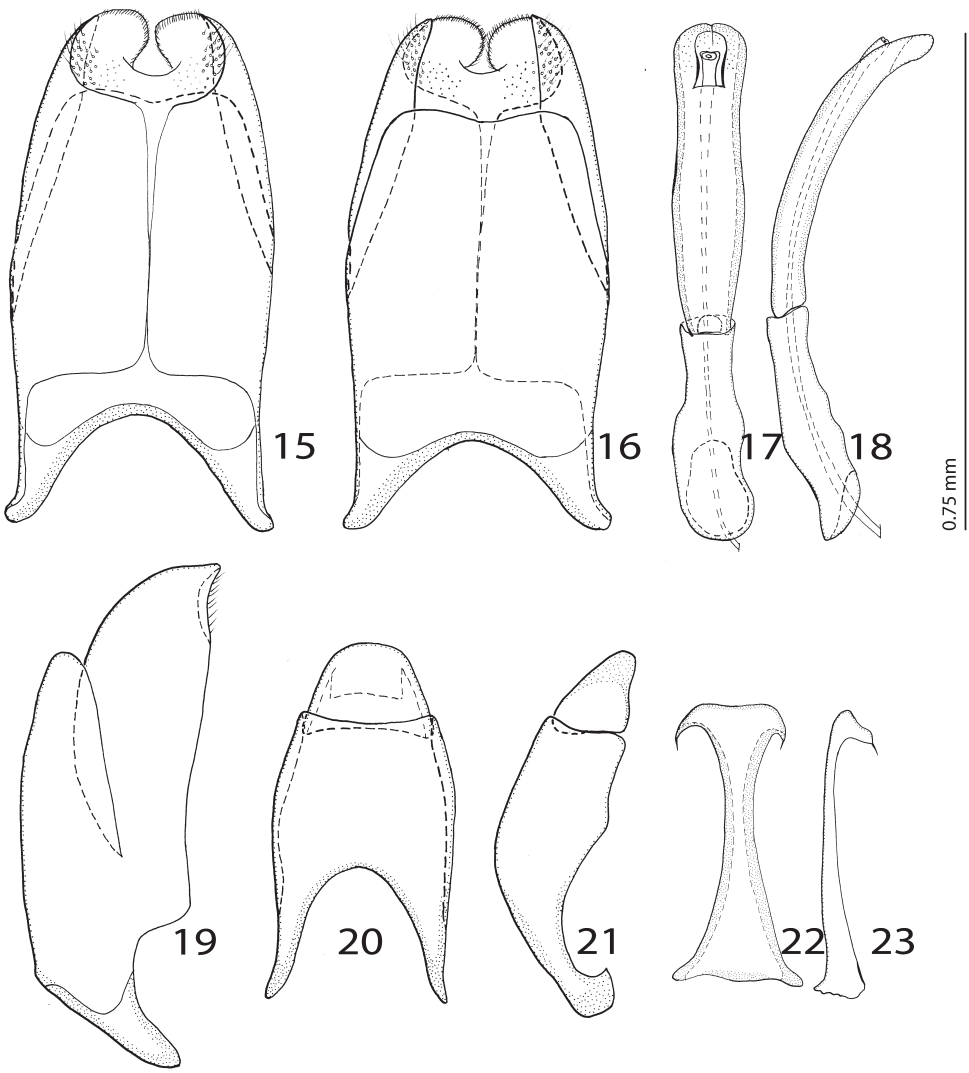
Figs 6–10. *Orateon praestans* gen. & sp. nov. 6 – mentum, ventral view; 7 – head, ventral view; 8 – propygydium + pygidium; 9 – prosternum + mesoventrite; 10 – metepisternum + elytral epipleuron.

7) laterally with single long and several shorter ramose setae; stipes (Fig. 7) triangular, with three long ramose setae; terminal maxillary palpomere (Fig. 7) evenly narrowing apically, apex truncate; terminal labial palpomere (Fig. 7) thickened, its width approximately half its length; penultimate labial palpomere with single long ramose seta. Clypeus and frons (Fig. 3) flattened, wholly densely and coarsely punctate, punctures forming wrinkles; frontal and supraorbital striae vaguely present, frontal stria interrupted medially; anterior angles of head projected; eyes flattened, almost invisible from above. Pronotal sides (Fig. 1) strongly narrowing anteriorly; anterior emargination for head deep; apical angles acute and conspicuous, marginal pronotal stria weakly developed, but complete, slightly weakened behind head; disc entirely covered with almost confluent punctation, punctures antero-laterally coarser than medially; pronotal depressions absent; scutellum very small; pronotal hypomeron (Fig. 2) with dense long amber setae. Elytral epipleuron (Fig. 10) with long amber setae; marginal epipleural stria thin, almost unrecognizable under the setae of elytral epipleuron; marginal elytral stria thin, complete, apically attaining complete apical elytral stria. Humeral elytral stria short, impressed only on basal fifth; outer (?) subhumeral stria present, originating at elytral base, reaching about half of elytral length apically, occasionally longer, almost complete; first



Figs 11–14. *Orateon praestans* gen. & sp. nov. 11 – protibia, dorsal view; 12 – same, ventral view; 13 – mesotibia, dorsal view; 14 – metatibia, dorsal view.

dorsal elytral stria the longest, almost complete (sometimes shortened apically), carinate on outer margin; second dorsal elytral stria slightly shorter than the first, curved inwardly near base, also carinate on outer margin; striae 3–4 weakened on their basal halves, impressed as rows of punctures, on apical halves carinate on outer margins (in several studied specimens striae 2–4 longer, almost reaching elytral apex); a vague fifth dorsal elytral stria present as a



Figs 15–23. *Orateon praestans* gen. & sp. nov., male genitalia. 15 – 8th sternite, ventral view; 16 – same, dorsal view; 17 – aedeagus, dorsal view; 18 – same, lateral view; 19 – 8th sternite and tergite, lateral view; 20 – 9th+10th tergites, dorsal view; 21 – same, lateral view; 22 – spiculum gastrale, ventral view; 23 – same, lateral view.

row of punctures; on fourth elytral interval a vague short stria present in several specimens; striae 2–4 and sutural elytral stria basally all joined by basal elytral stria; sutural elytral stria thin, complete, on basal half distanced from elytral suture (in several studied female paratypes joined with fourth dorsal elytral stria). Elytral disc covered by scattered punctation, punctures separated by several times their diameters, becoming denser before the elytral apex.

Propygidium (Fig. 8) almost completely exposed; with large confluent punctures; pygidium (Fig. 8) convex, with shallower confluent punctation.

Anterior margin of median portion of prosternum (Fig. 9) rounded; marginal prosternal stria intermittent; prosternal foveae absent; prosternal process compressed laterally; carinal prosternal striae divergent on prosternal apophysis, thence running very approximate along entire prosternal process; lateral prosternal striae (Fig. 9) well impressed, on their basal half running parallel, thence abruptly curved towards apex, their apical ends curved inwardly.

Anterior margin of mesoventrite (Fig. 9) medially straight; discal marginal mesoventral stria well impressed, thin, complete; disc of mesoventrite with sparse punctures separated by several times their diameters; meso-metaventral suture impressed as a row of sparse large punctures.

Intercoxal disc of metaventrite with shallow longitudinal median excavation in male, forming two vague tubercles near suture with first visible abdominal ventrite (in female this median excavation as well as tubercles absent), punctation of metaventrite even sparser than that of mesoventrite, punctures becoming larger and denser apically; lateral metaventral stria well impressed, apically curved outwardly, stopping short of metacoxa; lateral disc of metaventrite excavated, with long amber setae; metepisternum (Fig. 10) with large dense punctures furnished with long amber setae, smooth apically.

Intercoxal disc of first abdominal ventrite (Fig. 2) almost completely striate laterally, with scattered microscopic punctation.

Protibia (Fig. 11) on outer margin with three triangular teeth topped by moderately large denticle (worn off and blunt in some specimens) followed by three low teeth topped by minuscule denticle diminishing in size in proximal direction; setae of outer row sparse and rather short; protarsal groove deep; protibial stria shortened apically; setae of median row longer and thicker than those of outer row; protibial spur large, thick and bent, growing out from near the protarsal base; apical margin of protibia ventrally with two short denticles; outer part of protibial surface covered with longitudinal rib-like wrinkles well separated from median part of ventral protibial surface by a carinate stria; median part of ventral protibial surface almost smooth, only with scattered microscopic punctation; posterior protibial stria complete, terminating in two short inner posterior denticles; setae of inner row along inner protibial margin on basal half short and ramose, on apical half almost twice as long and thick as on basal half, lamellate; tarsal claws of all tibiae as long or slightly longer than terminal tarsomere, slightly bent. Mesotibia (Fig. 13) on outer margin with two dense rows of approximate denticles growing in size in apical direction; setae of outer (?) row dense and long; posterior mesotibial stria shifted near mesotibial margin, shortened apically; mesotibial spur long and thick, straight. Anterior mesotibial stria carinate on outer margin, shortened apically; anterior surface of protibia with scattered microscopic punctures; inner row of setae of mesotibia rather thin and short. Meso- and metatarsomeres thickened, telescopically falling into each-other, diminishing in thickness apically. Metatibia (Fig. 14) more slender than

mesotibia, however generally similar to it; denticles on outer margin of metatibia shorter than those of mesotibia, on posterior surface of metatibia two differently long rows of setae well discernible (indistinguishable on mesotibia, which appears to bear only a single row of setae); setae of inner row denser and longer than those of mesotibia.

Male genitalia. Eighth sternite (Figs 15–16) divided longitudinally; vela present, laterally with several pores furnished by setae with more pseudo-pores mesally; eighth tergite and eighth sternite fused laterally (Fig. 19). Ninth tergite (Figs 20–21) longitudinally fused medially; spiculum gastrale (Figs 22–23) gradually dilated from middle toward both ends. Aedeagus (Figs 17–18) slender, slightly bisinuate; parameres fused along their basal 3/4; basal piece of aedeagus rather long, ratio of its length : length of parameres 1 : 1.5; aedeagus curved ventrad, apex of aedeagus with pores and pseudo-pores (Fig. 17).

Sexual dimorphism. Females are devoid of shallow longitudinal metaventral depression as well as two vague tubercles near the suture with first abdominal ventrite.

Etymology. The specific epithet of the newly described taxon, Latin participle "*praestans*", means "outstanding".

Discussion

Although we were initially hesitant with erecting a new genus for the new Yemeni species, it bears a combination of characters, which does not allow it to be placed either in *Alienocacculus* or in *Terametopon*. *Orateon* can be differentiated from *Alienocacculus* by: 1) the shape of labrum, which is wider than it is long, semicircular, finely punctate, with a large shallow depression, whereas in *Alienocacculus* it is flattened, or slightly convex, punctate to rugulose-lacunose; 2) pronotal shape, which is strongly convergent anteriorly with a correspondingly small head, whereas the pronotum of *Alienocacculus* is not strongly convergent anteriorly and the head is of 'normal' proportions; 3) absence of prosternal foveae (present in *Alienocacculus*); 4) spiculum gastrale that is gradually dilated from middle toward both ends (slender and parallel-shaped in *Alienocacculus*) and; 5) blunt apex of the aedeagus (acutely pointed in *Alienocacculus*). Among the listed characters that differ between the two taxa, the genital characters are probably the ones carrying most phylogenetic weight. Regarding *Terametopon*, the presence of labral pits and setae in *Orateon* and their absence in the members of both subgenera of *Terametopon* is perhaps the character carrying the most phylogenetic signal between the two taxa. Looking closer at the differences between *Orateon* and the nominotypical subgenus *Terametopon* s. str. the absence of a large peculiar fronto-clypeal projection found uniquely in the members of the subgenus *Terametopon* s. str. (for figure see Lackner 2009c: Fig. 4) is perhaps the main differentiating character, while between *Orateon* and members of the subgenus *Psammoprinus,* the main differences are found predominantly in the well developed and complete sets of both prosternal striae of *Orateon* (absent or only rudimentary among the members of *Psammoprinus*; Lackner 2009c: Fig. 64) as well as depressed, setose prosternal process of *Psammoprinus* versus asetose, flattened prosternal process of *Orateon*. *Orateon* represents perhaps a morphological transitional form between two psammophile taxa: genera *Alienocacculus* and *Terametopon*. When comparing the morphologies of the three taxa, *Orateon* shares more characters with

Figs 24–25. Distribution and habitat of *Orateon praestans* gen. & sp. nov. 24 – habitat of the new species in the Tihammah coastal plain (photo: D. Král); 25 – map of Yemen, with the governorate Al Hudaydah (in red); black triangle marking the locality of the new taxon (map based on Wikipedia).

Trans-Saharan–Arabian *Alienocacculus*, than with Namib Desert endemic *Terametopon*, but does not clearly fit into either of them. Although generally similar, and geographically closer to *Alienocacculus*, it clearly differs from it especially by the absence of prosternal foveae, labral shape and characters of male genitalia. From the likewise generally similar, but geographically more distant *Terametopon* it differs chiefly by the frontal and prosternal, as well as genital characters (for morphological differences between the three taxa see Table 1). Based on the high number of shared morphological characters, we can hypothesise that these three taxa had a common ancestor, which gave rise to all three mentioned genera that spread out and colonized the desert environment. According to the recent phylogenetic analysis aimed at the disentangling of the relationships of the higher taxa of the subfamily (Lackner 2014b) psammophily arose only once during the evolution of the subfamily, but has been subsequently lost several times during the history. The newly discovered taxon, *Orateon praestans*, was collected in the Afrotropical zone of Arabian Peninsula sensu Olson *et al.* (2001). Judging from its habitat, as well as external morphology (e.g. dilated protibiae or underside of body with vestiture) it undoubtedly belongs to the rich assemblage of the psammophilous Saprininae. Most of the Saprininae beetles considered psammophiles are collected during the day, but recently there have been reports on several psammophile taxa (*Alienocacculus vanharteni* Kanaar, 2008 or *Reichardtiolus aldhaferi* Lackner, 2014) collected at light, with apparent night time activity (Kanaar 2008, Lackner 2014a). *Orateon*

praestans was observed to colonize human faeces between dusk and early morning, which indicates that it also prefers night time for its dispersal.

According to the map of the terrestrial ecoregions of the Arabian Peninsula (World Wildlife Fund 2005) the type locality of the new genus (Al Munirah, Tihammah coastal plain) lies in the Arabian Peninsula coastal fog desert ecoregion, which covers much of the western and eastern coasts of the Arabian Peninsula. Although the name of this ecoregion implies ample fogs, according to Büttiker (1979) the Tihammah coastal plain receives little or no fog but can record high levels of humidity. It can be roughly divided into two main habitat types: 1) the "sabkhas"– sandy beaches along the coast where *Orateon* has been collected, and, 2) intertidal mudflats and areas of mangrove (World Wildlife Fund 2005). The rocks forming the western border of the Arabian Peninsula (Saudi Arabia and Yemen) were, prior to the rifting of the Arabian Plate north and it colliding with the Eurasian Plate, contiguous with those of Northeast Africa and the Horn of Africa (Penati & Vienna 2006). Nowadays, this part of the plate (and the type locality of the new genus) is separated from the African Plate by the Red Sea Rift, a narrow basin only about 100 km wide in Northern Yemen. Based on the geography outlined above it is possible that *Orateon* is present also elsewhere along the Arabian Peninsula coastal fog desert ecoregion (sensu World Wildlife Fund 2005) or even across the Red Sea, in the desert regions of Eritrea or Ethiopia.

Acknowledgements

My wife Pepina Artimová is thanked for the line drawing of the sensory structures of the antenna using Adobe Illustrator CS3 as well as for her help with the generic and specific epithet of the new taxon. Thanks are due to Jiří Hájek (NMPC) for the loan of the specimens as well as to David Král (Prague, Czech Republic) for the photograph of the habitat and information pertaining to the newly described taxon. I would like to express my sincere thanks to two anonymous reviewers as well as the editor of this manuscript for their input and improvements. This research was supported by the Internal Grant Agency (IGA n.20124364) Faculty of Forestry and Wood Sciences, Czech University of Life Sciences Prague.

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