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Rhyssemus rajasthani sp. nov. (Coleoptera: Scarabaeidae: Aphodiinae: Psammodiini: Rhyssemina) from India

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Abstract. A new species of the genus *Rhyssemus* Mulsant, 1842, *Rhyssemus rajasthani* sp. nov. from Rajasthan, India, is described and illustrated. Structural elements of the pronotum (ridges and furrows) are discussed with putting emphasize on the posterior pronotal structure (ridges 4 and 5, and accessory swelling). The differential diagnosis is particularly focused on a comparison with the species *R. karnatakaensis* Pittino, 1984 and *R. procerus* Petrovitz, 1973.

INTRODUCTION

When studying material from the Institut royal des Sciences naturelles de Belgique, Bruxelles, Belgium (forwarded by Alain Drumont), the first author of the work presented here encountered fourteen specimens from Rajasthan (North India), which belonged to a new species of the genus *Rhyssemus* Mulsant, 1842. It is described below under the name *Rhyssemus rajasthani* sp. nov.

The importance of particular characters for the definition of the new species is discussed. In the differential diagnosis, a comparison with the species *R. karnatakaensis* Pittino, 1984 and *R. procerus* Petrovitz, 1973 is particularly regarded, since these species exert certain similar characters in terms of the arrangement of the pronotal structure and/or length of the superior apical spine of the metatibia.

The description of the new species is supplemented by appropriate photographs of external features, aedeagus and epipharynx.

MATERIAL AND METHODS

The specimens were observed by using the MBS-10 and SZP 1120-T stereoscopic microscopes. The photos published here were taken by the use of the Meopta laboratory microscope, CMOS 5 digital camera and Helicon Focus programme.

Measurements of lengths and widths were carried out with the help of an ocular micrometer. It is to note that the elytra length was taken as a distance between a line connecting ends of humeral teeth and elytral apex.

The specimens as mentioned in the section Taxonomy below were examined. Each specimen is equipped with printed labels as follows: a yellow or white label giving locality data; a pale green label (if present) specifying a number related to a photo-documentation system by the second author; and a red label indicating the identification and type status - HOLOTYPUS ♂, ALLOTYPUS ♀ or PARATYPUS / *Rhyssemus rajasthani* sp. nov. / M. Rakovič, L. Mencl & D. Král / det. 2016". Individual lines of every label are separated by a slash (/).

As to the terms describing the pronotal structure in Psammodiini (numbering of pronotal ridges), in the present work, we adhered to the terminology formerly proposed by the first author (Rakovič 1987) considering the presence of five transversal ridges, five transversal furrows and an accessory swelling situated in transversal furrow 4 on each side of the posterior longitudinal furrow. The reasons for this are detailed and explained with the help of a generalized schematic drawing in our quite recent work (Rakovič et al. 2016b).

For morphological terms used in the description of epipharyngeal structures we follow Dellacasa et al. (2001).

The following acronyms stand for collections, in which the specimens studied here are kept:

DKCP David Král collection, deposited in National Museum, Praha, Czech Republic;
IRSB Institut royal des Sciences naturelles de Belgique, Bruxelles, Belgium (Alain Drumont);
LMCT Ladislav Mencl, private collection, Týnec nad Labem, Czech Republic;
MHNG Muséum d'histoire naturelle, Genève, Switzerland (Giulio Cuccodoro);
MRCD Miloslav Rakovič, private collection, Dobřichovice, Czech Republic.

TAXONOMY

Rhyssemus procerus Petrovitz, 1973

Rhyssemus procerus Petrovitz, 1973: 306.

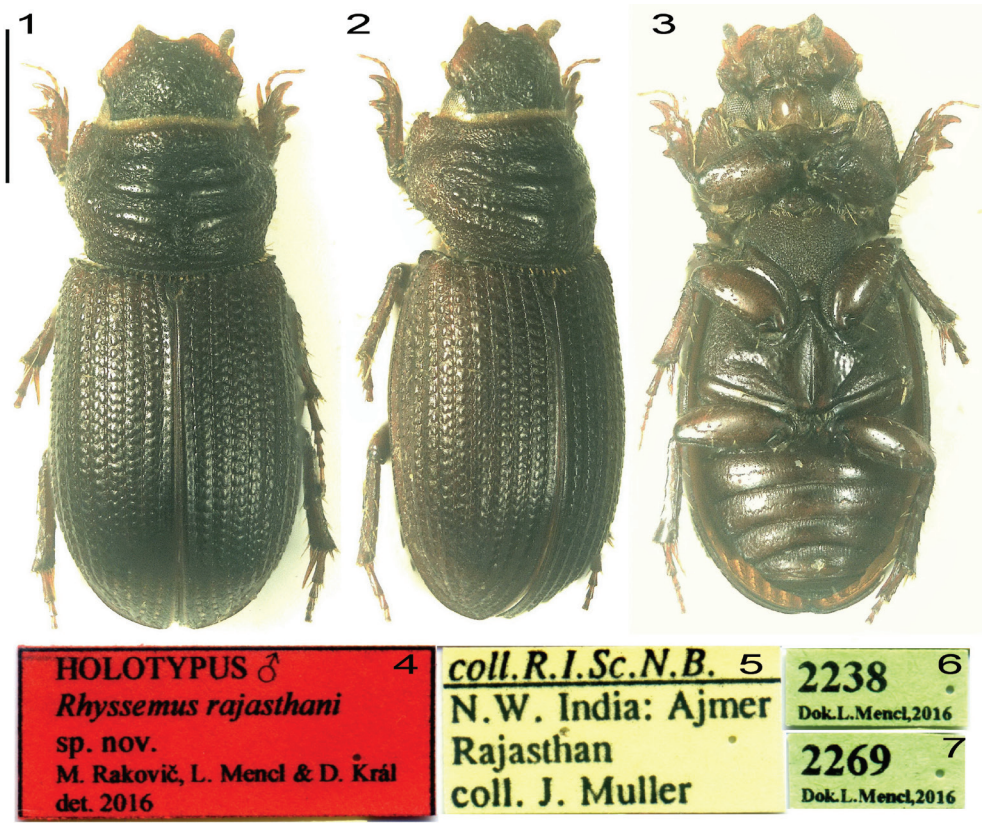
Type material studied. INDIA, Territory of Delhi: Paratype (♂) (MNHG) equipped with the following printed labels: 1) white: "New Delhi / Lichtfang / lg. H. Franz"; 2) red: "PARATYPUS"; 3) red: "Rhyssemus / procerus nov. / Petrovitz"; 4) white: "coll. / Petrovitz".

Note. The paratype was studied to make possible the differential diagnosis and the subsequent discussion.

Rhyssemus rajasthani sp. nov.

(Figs. 1-23)

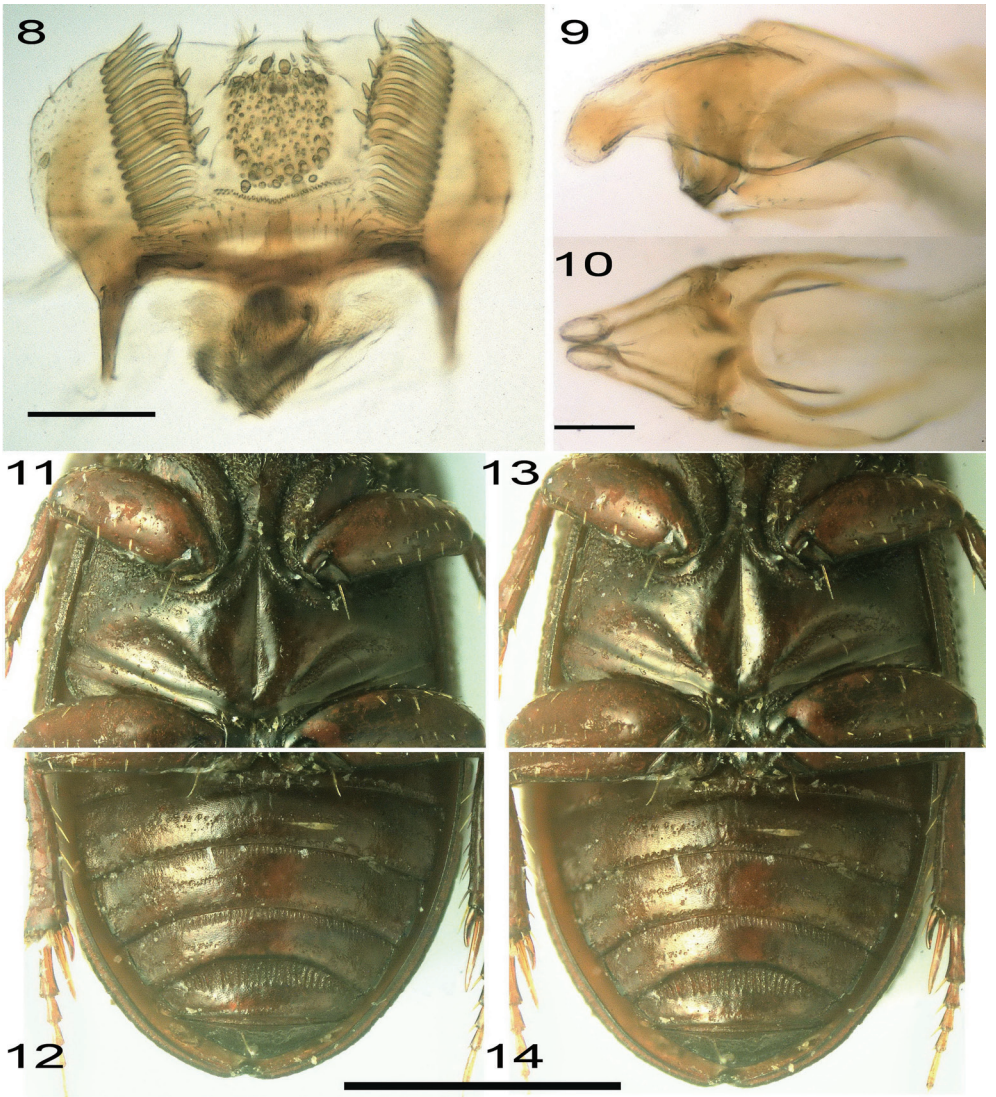
Type material. INDIA, RAJASTHAN: Holotype (♂) (IRSB) equipped with the following printed labels: 1) yellow: "Coll. R. I. Sc. N. B. / N.W. India: Ajmer / Rajasthan / coll. J. Muller"; 2) pale green: "2238 / Dok. L. Mencl 2016"; 3) red: see the section Methods. Allotype (♀) (IRSB) also equipped with three labels: 1) yellow with same data as above; 2) pale green with number 2240 instead of 2238; red: see the section Methods. 12 paratypes (2 DKCP, 6 IRSB, 2 LMCT, 2 MRCD) (each equipped with two labels: yellow with same data as above; 2) red (see the section Methods); one paratype (a male specimen) additionally equipped with same pale green label as holotype, but with number 2239 instead of 2238. . 21 paratypes (DKCP), each equipped with an appropriate red, printed label (see above) and with the following two white, printed labels: "India bor. occ. / RAJASTHAN province / 35 km N. of DAUSA / Nararimata env. ; 461 m // India 2002 Expedition / 27°08.22´N 76°20.39´E / 10. ix -15. X. 2002; / P. Šípek lgt. light trap". 6 paratypes (DKCP), each also equipped with an appropriate red, printed label (see above) and with the following two white, printed labels: "INDIA NW prov. Rajasthan; / district Alwar, 30 km N of / Dausa: Gola-Ka-Bass vill. // N 27°05´31´´, E 76°18´47´´, / 359 m. P. Šípek lgt. – 5.-9. ix. / 2005". See also Figs. 4-7 for the appearance of labels.



Figs. 1-7. *Rhyssemus rajasthani* sp. nov., habitus and labels pinned under holotype and allotype: 1- ♂ holotype, dorsal view; 2- ♂ holotype, dorso-lateral view; 3- ♂ holotype, ventral view; 4- red label under holotype; 5- yellow label under every type specimen; 6- pale green label under holotype; 7-pale green label under allotype. Scale line: 1 mm for Figs 1-3. Photographs by L. Mencl.

Description of holotype (♂). Small (body length of 3.8 mm), distinctly broader behind, maximum width (at about 0.6 elytra length) of 1.6 mm, glabrous, shining, dark brown; clypeus lateral margins lighter, reddish brown, habitus in dorsal aspect as in Fig. 1.

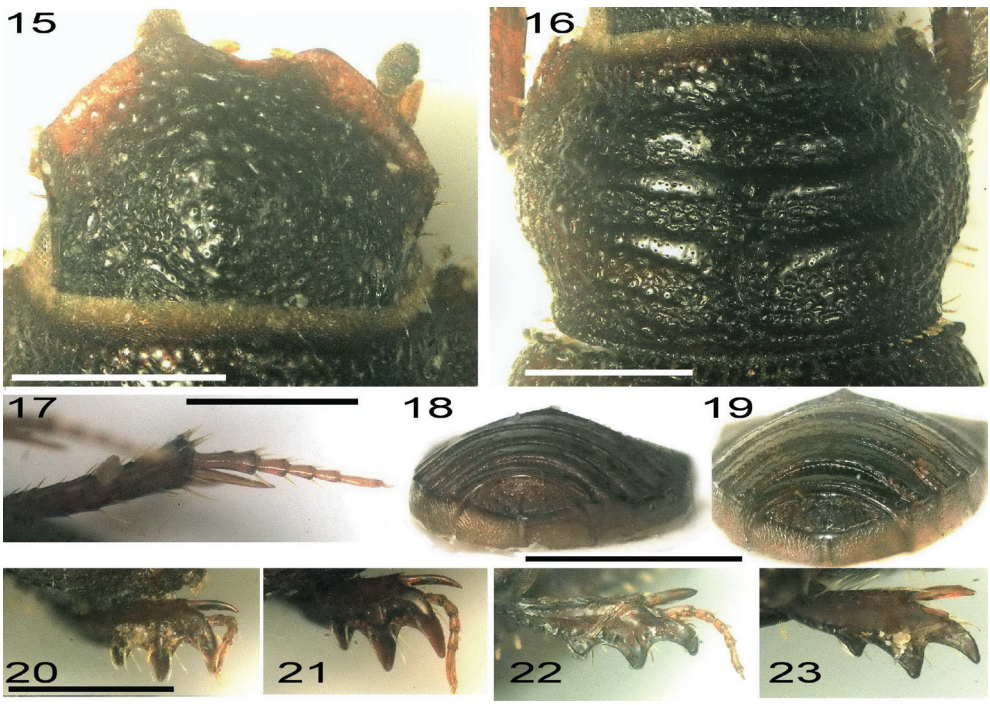
Head (Fig. 16) convex, granulate, with one pair of low, not very distinct posterior oblique ridges and moderately distinct supraocular ridges. Clypeus with round anteromedian



Figs. 8-14. *Rhyssemus rajasthani* sp. nov., details: 8- ♂ paratype, epipharynx; 9- ♂ paratype, aedeagus, lateral view; 10- ♂ paratype, aedeagus, dorsal view; 11- ♂ holotype, metaventrum, ventral view; 12- ♂ holotype, abdomen, ventral view; 13- ♀ allotype, metaventrum, ventral view; 14- ♀ allotype, abdomen, ventral view. Scale lines: 0.1 mm for Figs. 8-10, 1 mm for Figs.11-14. Photographs by L. Mencl.

emargination, considerably angulate each side of it-, clypeal sides not sinuate behind anterior angles, only moderately arcuate; lateral margin of clypeus nearly aligned with and only minutely separated (by almost indistinct notch) from anterior margin of gena; genae not exceeding eyes, margin of gena with few (about four) acute macrosetae, shorter anteriorly and considerably longer posteriorly. Clypeus surface granulate, granules rather sparse, round and small at margins, becoming transversal and larger (but not denser) toward middle protuberance; middle protuberance not strongly elevated, consisting of few rather round, large granules, each of them having a puncture. Head surface in front of as well as behind anterior pair of oblique ridges with elongate granules.

Epipharynx (Fig. 8) transversal, anterior outline almost straight, lateral outlines regularly widely rounded; tormae and nesium well sclerotised, approximately symmetrical, apotormae missing; epitorma almost quadrate, weakly sclerotised; helus with group of somewhat irregularly spaced sensilla (including two remarkably large ones medially) and two longitudinal rows of long microtrichia anteriorly; corypha and zygum absent; phobae weakly sclerotised, glabrous; chaetoparia with row of 18 long, stout, closely spaced spines; area of prophobae well sclerotised, bearing longitudinal row of four short, stout, sparsely spaced spines.



Figs. 15-23. *Rhyssemus rajasthani* sp. nov., details: 15- ♂ holotype, head; 16- ♂ holotype, pronotum; 17- ♂ paratype, left posterior tibia and tarsus; 18- ♂ paratype, pygidium and abdominal ventrites, ventrocaudal view; 19- ♀ paratype, pygidium and abdominal ventrites, ventrocaudal view; 20- ♂ holotype, right protibia and protarsus, dorsal view; 21- ♀ allotype, right protibia and protarsus, dorsal view; 22- ♂ holotype, left protibia and protarsus, oblique ventral view; 23- ♀ allotype, left protibia, oblique dorsal view. Scale lines: 0.5 mm. Photographs by L. Mencl.

Pronotum (Fig. 16) convex, transversal, broadest at about middle; with complete pronotal structure of Psammodiini (five transversal ridges, five transversal furrows, posterior longitudinal furrow - see the section Material and Methods for terminology - and accessory swelling each side of the posterior longitudinal furrow, in transversal furrow 4, i.e. between ridges 4 and 5). Lateral margins regularly arcuate from anterior corners nearly to base, but suddenly changing their direction at point close to base, to continue parallel with body axis, thus making the pronotum suddenly narrowed before base; crenate, with tough, apically only moderately dilated macrosetae. Transversal ridge 1 consisting of discrete granules, widest at middle (with about three granules per ridge width there), ridge 2 higher than ridge 1, mostly continuous though if granulate at middle, merging in row of discrete granules laterally, ridges 3 and 4 moderately higher than ridge 2, mostly continuous, not granulate on disc, granulate laterally, ridge 5 vestigial, consisting of granules and partially lost on the background of posterior granulate structures, accessory swelling consisting of row of discrete granules each side of posterior longitudinal furrow. Transversal furrow 1 neither deep nor wide, its surface irregularly uneven (punctate/granulate), furrow 2 also narrow, transversally wrinkled, furrow 3 much wider, transversally punctate/wrinkled, furrow 4 and posterior longitudinal furrow also transversally wrinkled. Lateral callus only slightly elevated.

Scutellum small, narrowly ogival, moderately alutaceous, minutely punctate on posterior half.

Elytra (Figs. 1 and 2) broader behind, widest at about 0.6 elytra midlength, their length-to-width ratio of 1.50, with ten striae and ten intervals, with distinct, sideward-directed humeral teeth. Elytral striae narrow, their punctures longitudinal, not crenating intervals. Elytral intervals observed under low magnification seemingly only transversally incised, but exerting two rows of granules under sufficient magnification (about 30x): outside row of large granules having small, backward directed elevation at its posterior margin and inside row of much smaller granules of shape similar to large granules in the outside row (Figs. 1 and 2). Differences in heights between odd and even elytral intervals present neither on elytral disc nor on elytral apex.

Legs brown. Dorsal face of protibia with longitudinal row of macrosetigerous punctures parallel with outer margin, otherwise glabrous, smooth, shining, impunctate; terminal spine moderately arcuately bent outward in apical half. Basimetatarsomere about as long as metatarsomeres 2-4 combined. Superior terminal spine of metatibia moderately exceeding middle of metatarsomere 2 (Fig. 17); inferior terminal spine of metatibia much shorter; for particular elements of mesotibia and mesotarsus, there are similar relationships as mentioned here for metatibia and metatarsus. Profemora with large, superficial, quite irregularly shaped punctures (Fig. 3); meso- and metafemora with sparse, fine punctures and with setigerous punctures arranged as shown in (Fig. 11).

Ventrum (Fig. 3). Prevalent areas of ventral surfaces glabrous, smooth (with exception of details described as follows) and shining. Meso-metavenral plate with nearly complete, narrow longitudinal furrow. Abdominal ventrites 3-4 with quite distinct, ventrite 5 with less distinct transversal serrate lines ("zig-zag" lines), abdominal ventrites 4-6 fluted anteriorly (Fig. 12).

Pygidium sparsely, finely granulate (Fig. 18).

Aedeagus as in Figs. 9-10.

Sexual dimorphism. There are no peculiar differences between males and females, which can sometimes be observed in some *Rhyssemus* on the underside (Figs. 11-14, 18 and 19). Slight differences can be found in shapes of protibial apical spines (Figs. 20-23).

Variability. The body length varies between 4.3 and 4.0 within the type series. There is no considerable variability in the colour. Oblique ridges on the head can be more or less distinct and more or less granulate. On the other hand, the nature of anterior as well as posterior structural elements of the pronotum is fairly constant.

Differential diagnosis. At first sight, in the new species, the structural elements of the pronotum, i.e. the pronotal ridges and furrows (Figs. 1, 19) are very characteristic of the new species, distinctively different from those of any species known from India, but also even from those known from the whole Oriental and Palearctic Regions. Certain similarity in the structure and sculpture of the pronotum can be considered in the species *R. karnatakaensis*. Based on a comparison of the type specimens of the species described here with the description of the species *R. karnatakaensis* (Pittino 1984), the two species can be definitely separated from each other as follows. The species *R. karnatakaensis* is smaller (2.9 mm); the body length of *R. rajasthani* sp. nov. is of 3.3-4.0 mm. *R. karnatakaensis* is widest nearly at middle of elytra; *R. rajasthani* is moderately broader behind: widest at about 0.6 elytra length. Pronotum length to pronotum width ratio is of about 0.71 and 0.74 in *R. karnatakaensis* and *R. rajasthani,* respectively. Pronotal ridges 2-4 are strongly convex and narrow in *R. karnatakaensis* but only moderately convex and not particularly narrow in *R. rajasthani* sp. nov. The posterior longitudinal furrow is deep and narrow in *R. karnatakaensis* and rather shallow and deep in *R. rajasthani* sp. nov. In *R. karnatakaensis*, even elytral intervals are slightly lower than odd ones on elytral disc, and on elytral apex, the even intervals are almost lacking tubercles, thus appearing obviously lower than the odd ones; in *R. rajasthani* sp. nov., there are no differences in heights between odd and even elytral intervals. *R. karnatakaensis* has six erect setae (three on each side) on the apical pygidial margin, while *R. rajasthani* sp. nov. has only two pygidial setae (one on each side). The basal metatarsomere of *R. karnatakaensis* is distinctly longer than the superior terminal spine of the metatibia; in the new species *R. rajasthani* sp. nov., the superior terminal spine of metatibia reaches about middle of the second metatarsomere.

The last character mentioned above (the length of the superior terminal spine) is of great importance to the present description of the new species. Most (though if not all) *Rhyssemus* species have the spine about as long as the basal metatarsomere. This also holds in considering species from the Indian subcontinent: from among species, which have still been described, only the species *R. procerus* has its superior terminal spine of the metatibia reaching the middle of metatarsomere 2. The differences between the two species are as follows: the elytra are distinctly broader behind in the new species, subparallel in *R. procerus*; the humeral teeth are relatively just average in size in the new species, relatively small in *R. procerus*; individual granules in elytral intervals can be recognized under a higher magnification only (about 30x) in the new species, under a much lower magnification (from about 10x) in *R. procerus*; the transversal accessory swelling on the pronotum consists of a row of granules, but is still quite distinct in the new species, vestigial, nearly indistinct in *R. procerus*.

Distribution. Still known from the type locality only: North India, Rajasthan, Ajmer (Ajmer is the name of a city and district in Rajasthan).

Name derivation. Toponymic (adjective derived from the name of the Indian state Rajasthan of India, in which the type location is situated).

DISCUSSION

The new species described here is characterized by the present description and illustrations. The differential diagnosis was focused on a comparison with two species from the Indian subcontinent, which exerted some similar features: *Rhyssemus karnatakaensis*, described from S. India, Karnataka (which has a similar pronotal structure and sculpture) and *R. procerus*, described from N. India, New Delhi (which has a long superior apical spine of the metatibia - reaching the middle of metatarsomere 2). The reliable comparison with the former one was possible thanks to the accurate, detailed and unambiguous description of *R. karnatakaensis* by the author (Pittino 1984). The comparison of important characters with the latter one was facilitated by studying a paratype specimen; this specimen was lacking both metatarsi, but the comparison was considered to be necessary due to the statement concerning the spine length in the original description (Petrovitz 1973).

As to the posterior transversal elements of the pronotal structure (ridge 4, accessory transversal swelling and ridge 5) the species discussed in the differential diagnosis (*R. karnatakaensis*, *R. procerus* and *R. rajasthani* sp. nov.) are just examples of those, in which some of these elements can be considered as missing (though if they can sometimes be very weak, vestigial, thus being not actually, but only seemingly missing). In cases like this, the authors, who usually write about "six ridges" in most *Rhyssemus* species, tend to simply consider the presence of five ridges, without suggesting any specification which of the "six ridges" *sensu auct.* is missing. Within the concept employed here, it is easy to identify the missing (or sometimes only seemingly missing) posterior structural element (ridge 4, accessory swelling or ridge 5) based on the position of the present structures and this information is of importance, since it can be helpful in the description as well as determination of species. This example thus provides a support for the concept of "five transverse ridges and an accessory transverse swelling", as previously proposed by Rakovič (1987) and recently also explained and illustrated by Rakovič et al. (2016b).

As to the length of the superior terminal spine of the metatibia and its comparison with the length of the basal metatarsomere, it is to realize that this character is of special importance in the tribe Psammodiini. A vast majority of *Rhyssemus* species, but not all of them, have the spine about as long as the basal metatarsomere. There are also species in the genus having the spine considerably longer (reaching at least the middle of metatarsomere 2), as mentioned above. This applies not only to the two species from the Indian subcontinent, *R. procerus* and *R. rajasthani* sp. nov., but also to some species from other areas. This fact can be exemplified by *R. rubeolus* Harold, 1871, known from the Palearctic and Afrotropical Regions (Rakovič et al. 2016a).

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