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# First Record of Three Species of Genera *Panotrogus* Reitter, 1902 and *Pseudopanotrogus* Petrovitz, 1969 (Coleoptera; Scarabaeidae; Rhizotrogini) from India

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## ABSTRACT

Tribe Rhizotrogini is a tribe of June beetle containing many species of agronomic importance in India. It holds major genera like *Brahmina* (Blanchard 1851), *Eotrichia* (Medvedev 1951), *Holotrichia* (Hope 1837) or *Sophrops* (Fairmaire 1887) in India. A survey based on light trap collection was conducted in various locations of Uttarakhand to check for the presence of the species. During surveys in the years 2021 and 2022, various chafer beetles were collected to observe the distribution pattern and their hosts. Among these various species, three beetle species are here reported for the first time i.e. *Panotrogus expansus* Keith, 2003, *Panotrogus pakistanus* Keith, 2002 and *Pseudopanotrogus extrarius* Keith, 2005 from Uttarakhand, India. This also represents their first record for India. Their habitus and male genitalia are provided herein to aid in identification. A complete list of species from the Himalayan region is also provided.

*Keywords:* Beetles, Scarabaeidae, Melolonthinae, Uttarakhand, light trap, new record.

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## INTRODUCTION

Beetle diversity in Indian Himalaya account for 47.16% of the total beetle diversity of India. Their main families include Scarabaeidae, almost 10% of total beetles species form Himalaya region. Currently, Scarabaeidae has 1843 species from India; however, Himalaya occupies 983 species from it. Scarabaeidae are the most diversified family among beetles group and are primarily scavengers (recycling dung, carrion, decaying plant material) or phytophagous. Predominantly, the phytophagous species occur in four subfamilies i.e. Melolonthinae, Rutelinae, Dynastinae and Cetoniinae.

Members of the subfamily Melolonthinae Leach, 1819 (Coleptera: Sacraoibodea) are known as June beetles. They belong to eleven tribes under north-western and north-eastern Himalaya of India (Löbl & Löbl, 2016). They are significant pests of cereals, fruit crops, forest and ornamental plant and their role has been reported in almost all states of India (Chandla et al, 1998; Theurkar et al, 2012). Among these tribes, Rhizotrogini comprise about 1800 species worldwide (Lacroix, 2022). It has about 43 genera in the Palearctic region (Löbl & Löbl, 2016)**,** of which 14 occur in the Indian Himalayan regions i.e. Himachal Pradesh, Uttarakhand, Uttar-Pradesh, Sikkim, Arunachal Pradesh, Jammu-Kashmir and Ladakh.

Of these, *Panotrogus* Reitter, 1902 and *Pseudopanotrogus* Petrovitz, 1969 are also occurring in the Himalayan states. At present, *Panotrogus* occurs in India with four species *Panotrogus batillinus* Bates, 1891*, P. hirsutus* Moser, 1913*, P. inexpectatus* Keith, 2001*, P. schmidti* Keith, 2006, *Pseudopanotrogus* with seven species (*Pseudopanotrogus donckieri* Brenske, 1892, *P. kuluensis* Moser, 1919*, P. lassallei* Keith, 2010*, P. pusillus* Arrow, 1921*, P. rosettae* Frey, 1971, *P. carinifron*s (Moser, 1909) and *P. longiceps* (Moser, 1918)), namely in the Himalayan states, especially Kashmir, Himachal Pradesh, Uttara Pradesh, Sikkim and Darjeeling (Löbl & Löbl, 2016; www.catalogueoflife.org; Keith, 2009). In addition to those already reported species, we record here for the first time the presence of two species of *Panotrogus* and one of *Pseudopanotrogus* from Uttarakhand, thus representing their first record for Indian species biodiversity.

Finally, a brief description of these species is provided based on their available specimens and photographs, to make this data available for relevant people who can contribute to the biodiversity

## MATERIAL AND METHODS

### Data sampling

For the collection of adult beetles, surveys were conducted in different locations of Uttarakhand, Northern state of India, during the summer of 2021-2022 with the aim to collect new species and determine their distribution pattern. The locations of surveys lay between $30.0668^0$ N and $79.0193^0$ E (Fig. 1, Table 1). During May and June of the respective years, when the adult beetles emerge from the soil during dusk and settle on the nearby trees to feed and mate, a strong mercury vapour lamp light trap

(150w) was installed in aforesaid locations in evening hours from 7:15 pm to 10:30 pm. Beetles were then collected and killed with ethyl-acetate and finally brought to the laboratory where they were labelled, pinned and finally placed in insect cabinet for further identification.

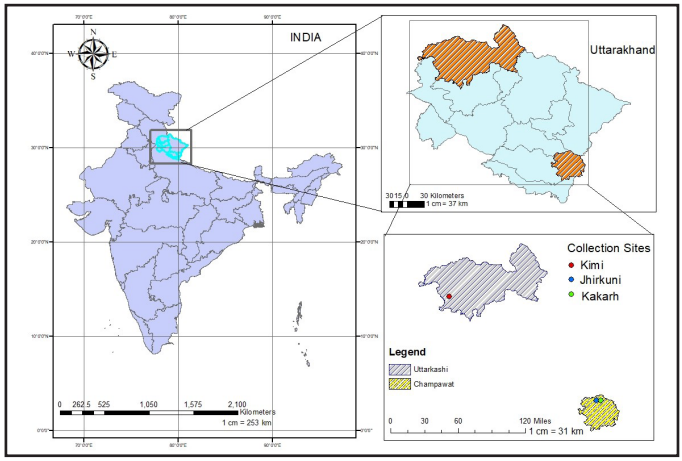


Figure 1. Map with distribution of *Panotrogus* and *Pseudopanotrogus* species in Uttarakhand based on material examined. Colour dots indicate locality in Uttarakhand, India.

Table 1. Surveyed area of white grub species during 2021-2022.

| Sl. No. | Location | Altitude m.a.s.l. | Coordinates | District | Sample collected | |
|---|---|---|---|---|---|---|
| | | | | | ♂ | ♀ |
| 1 | Jhirkuni village Barakot | 1452 | 29.471325°N 80.073617°E | Champawat | 2 | 0 |
| 2 | Kakarh village Barakot | 1453 | 29.466931°N 80.061298°E | Champawat | 1 | 0 |
| 3 | Kimi village Naugaon | 648 | 78.134392°N 30.776683°E | Uttarakashi | 2 | 0 |

Among the various species of chafers, which was identified by available keys and had already been reported, few beetle species remained unidentified. They were identified using Keith 2002, 2003, 2005 keys. The males of unidentified specimens were separated and placed in 70% alcohol for genitalia extraction. Later, the genitalia and speculum gastrale were extracted carefully with forceps from the abdomen and glued on a pointed card and pinned along with the adult male specimen. The external morphological characters of genitalia of specimens were observed through Nikon SMZ745T stereo zoom microscope and adults images were obtained with Nikon D5600 digital camera while genitalia image with attached to the microscope using Leica auto montage software. Length measurements are from anterior margin of clypeus to the apices of the elytra. Photographs from the biotopes were taken with Nikon Coolpix SL9200 camera.

### Study area

Uttarakhand is one of the state of India located in North West Himalaya region. At present, the total geographical area of the state is 53483 sq. km, i.e. 1.6 % of country's geographical area, out of which 46, 035 sq. km are hilly. Topographically, the state can be divided into three belts, namely the Himalaya, the Shiwalik and the Terai Region. Most of the area under state has a temperate climate, which is cold, humid, but it varies with the altitude. Its valley are found hot in summer and much cooler in winter. In the plains like Haridwar and Udham Singh Nagar climate is tropical (Chauhan, Gautam, & Negi, 2018). The annual temperature varies from 0°C to 43°C while average annual rainfall is 1550 mm.

Finally, a systematic account of the species along with material examined, description and distribution in India as well as outside India with the description of male genitalia are discussed and illustrated here.

## RESULTS

Survey and collection from aforesaid locations reveal the first record of *Panotrogus expansus*, *Panotrogus pakistanus* and *Pseudopanotrogus extrarius* from India. The description of these species are as follow:

### *Panotrogus expansus* Keith, 2003

**Material examined:** Uttarakhand, Champawat, Barakot, Kakarh village, 1453m, 24.06.2022, 1♂.

**Distribution:** Pakistan (Keith 2003) and India (Uttarakhand)) (new country record).

**Male:** Adult length 11.5mm (Fig. 2a).

**Head:** Dark reddish brown rectangular clypeus with clear sinuosity in a strongly raised incoming triangle with fine punctuation. Fronto-clypeal suture flat not evident, vertex with large punctuations bearing a distinct reclined pilosity. Antennae of 10 antennomeres including 3 on club, longer then funicle. Antennomeres 3rd, 4thand 5th elongated, 6th obconic and 7th transverse (Fig. 2b).Apical segment of maxillary palp elongated fusiform, with frosted dorsal area.

**Pronotum:** Anterior and posterior margins are without ciliation and base without rim. Lateral margins are crenulated with small bristle between crenulations. Punctuation anteriorly dense with reclined pilosity. Width of pronotum greatest at the middle. Anterior and posterior angles rounded, obtuse. Scutellum with punctuation and pilosity similar to the pronotum.

**Elytra:** Provided with uniform punctuations and reclined pilosity. Pygidium large, with pupillate, dense punctuation and erect pilosity. Protibia tridentate on the external border, the basal tooth situated towards the middle of the protibia. Apical spur inserted behind the external median tooth. Metatarsomeres with three strong teeth on the upper side, basimetatarsomere shorter than second one. Claws toothed at the base (Fig. 2c).

**Aedeagus:** Main branch of the parameres very thick with a fairly short obtuse secondary branch, not perpendicular to the main branch (Fig. 2d).


Figure 2. *Panotrogus expansus* Keith 2003 (Male): a) habitus, b) antennae, c) claws, d) aedeagus.

### *Panotrogus pakistanus* Keith, 2002

**Material examined:** Uttarakhand, Uttarakashi, Naugaon, Kimmi village, 648m, 6.06.2022, 2 ♂♂.

**Distribution:** Pakistan (Keith 2002) and India (Uttarakhand) (new country record).

**Male:** Adult length between 10-11 mm, wholly brownish red (Fig. 3a).

**Head:** Clypeus rectangular, two times wider then length. Strong punctures with regular setigerous, small hairs tilted backward. Clypeo-frontal suture bisinuate and evident (Fig. 3b). Forehead slightly concave, punctuation very sparse near the suture then becoming denser on vertex.

Antennae of 10 antennomeres including 3-jointed club, longer then funicle. Antennomere 6 transverse, 7 more transverse, stretched in lamella (Fig. 3c). Apical section of maxillary palp dilated with frosted area on dorsal surface.

**Pronotum:** Base without rim, anterior and posterior margins glabrous. Margins crenellated with interposed cilia. Punctuation pupillate, unevenly dense, laterally especially in the anterior angles, more sparse on the disk. Pronotum widest at middle; sides converging, slightly concave anteriad, much more weakly converging posteriad, anterior angles acute and posterior obtuse. Scutellum pilosity and punctuation similar to the pronotum, except only base which is bare.

**Elytra:** With clear punctuation, with whitish short erect pilosity, and longer laterally. Epipleura with thin pilosity on apical third. Sternites with poorly developed smooth area. Pygidium convex with large punctuations, simple erect pilosity, long at apex, short elsewhere.

**Legs:** Protibia tridentate externally, latter with three equidistant dents, basal one located towards middle, apical one very strong, internal apical spur inserted in front of the median dent; metatarsomeres longer than the metatibiae with several teeth on the upper side, basimetatarsomere shorter than second one. Claws toothed at the base (Fig. 3d).

**Aedeagus:** ♂ genitalia lateral view (Fig. 3e).

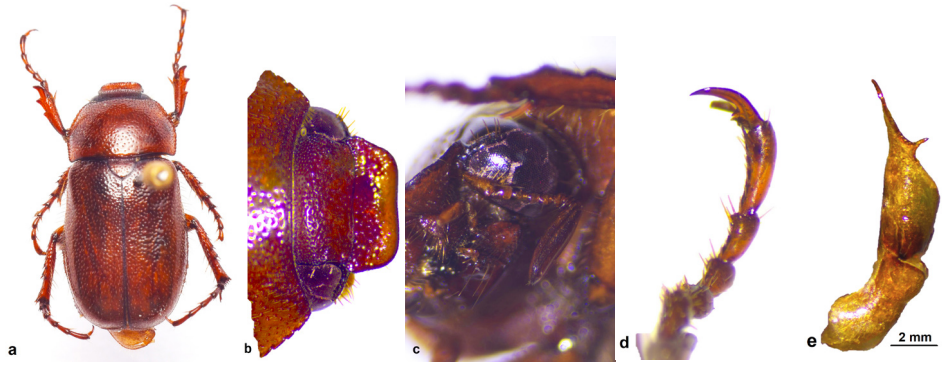


Figure 3. *Panotrogus pakistanus* Keith, 2002 (Male): a) habitus, b) clypeus, c) antennae, d) claws, e) aedeagus.

### *Pseudopanotrogus extrarius* Keith, 2005

**Material examined:** Uttarakhand, Champwat, Jhirkuni village, 1452m, 23.07.2022, 2 ♂♂.

**Distribution:** Nepal (Keith 2005) and India (Uttarakhand) (new country record).

**Male:** Length almost 12mm (Fig. 4a), entirely dark brown.

**Head:** Clypeus apparently rectangular shape, 3 times wider than long, anterior margin slightly sinuate and strongly raised, only with sparse punctuation. Clypeo-frontal suture almost flat and evident with larger and denser punctuation set with erect pilosity. Antennae 10-jointed including a 3-jointed club, and antennomeres 6 and 7 very transverse (Fig. 4b).

**Pronotum:** Convex, disc bare, punctuation rather coarse, somewhat irregular, lateral and anterior margins with long cilia. Lateral margins crenelated with interspaced pilosity, greatest width of the pronotum towards middle. Scutellum smooth in the middle with margin parallel punctuations. Elytra with similar punctuation to the pronotum, integument very slightly irregular near base, pilosity microscopic on disc; epipleural ciliation made of a row of long strong hairs tapering from the base. Pygidium with dense pupillate punctuation, pilosity short, reclined, except on apical margin.

**Legs:** Forelegs with strong protibiae, tridentate on the external border, dents equidistant. Internal spur inserted behind the outer middle tooth; metatarsomeres longer then the metatibiae, basimetatarsomere shother than second one. Strong denticles on their upper surface. Carinae of metatibiae obsolete. Claws cleft at base (Fig. 4c).

**Adeagus:** It has a very special shape (Fig. 4d)

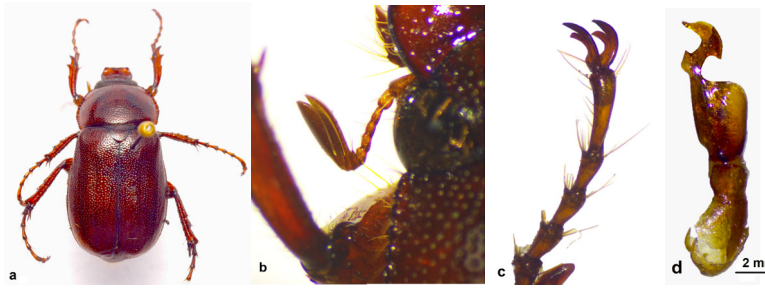


Figure 4. *Pseudopanotrogus extrarius* Keith, 2005 (Male): a) habitus, b) antennae, c) claws, d) aedeagus.

## CONCLUSIONS AND DISCUSSION

In the study of genus *Panotrogus* Reitter, 1902, *P. expansus* Keith, 2003 and *P. pakistanus* Keith, 2002 were reported for the first time from India. Currently, the genus contains 22 species from Palearctic region including parts of Himalayan region of India (Löbl & Löbl, 2016). Genus *Pseudopanotrogus* Petrovitz, 1969 comprises about 13 species, mostly from the Palearctic region (www.catalogueoflife.org). They were first described by Reitter, 1902 and Petrovitz, 1969 with type species *Rhizotrogus myschenkovi* Ballion, 1871 and *Pseudopanotrogus kashmirensis* Petrovitz, 1969 respectively. Table 2 gives an account of the history of their distribution in India. With the new records of *P. expansus*, *P. pakistanus* and *Pseudopanotrogus extrarius*, both genera are now known from India by 6 and 8 species respectively.

Table 2. List of species of genus *Panotrogus* and *Pseudopanotrogus* under Himalayan states.

| Sl.No | Species | Indian Distribution | References |
|---|---|---|---|
| 1 | *Panotrogus batillinus* | Himachal Pradesh | Bates ,1891 |
| 2 | *P. hisutus* | Himachal Pradesh, Sikkim and Darjeeling | Moser, 1913 |
| 3 | *P. inexpactatus* | Himachal Pradesh | Keith, 2001 |
| 4 | *P. schmidti* | Uttar Pradesh | Keith, 2006 |
| 5 | *Pseudopanotrogus donkieri* | Kashmir, Sikkim and Darjeeling | Brenske, 1892 |
| 6 | *P. kuluensis* | Himachal Pradesh | Moser, 1919 |
| 7 | *P. lassallei* | Himachal Pradesh | Keith, 2010 |
| 8 | *P. pusillus* | Kashmir, Uttar Pradesh | Arrow, 1921 |
| 9 | *P. rosettae* | Uttar Pradesh | Frey, 1971 |
| 10 | *P. carinifrons* | Sikkim and Darjeeling | Moser, 1909 |
| 11 | *P. longiceps* | Oriental | Moser, 1918 |

The genus *Pseudopanotrogus* can be differentiated with its strikingly elongated quadrangular clypeus, deep incised claws from apex, bald pygidium and fusiform maxillary palpus. *P. extrarius* differs from other species by its clypeus less incised in the middle. The shape of its aedeagus is also rather unique within genus *Pseudopanotrogus* (Fig. 4d). A light trap and manual scouting based survey during 2021-2022 from different locations of Uttarakhand, India revealed for the first time the presence of *Panotrogus expansus*, *Panotrogus pakistanus* and *Pseudopanotrogus extrarius* in India.

Further regular monitoring will certainly reveal more about the huge biodiversity in other unexplored parts of Uttarakhand and elsewhere.

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