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Taxonomic Study of the Tribe Onitini Laporte, 1840 (Coleoptera: Scarabaeidae: Scarabaeinae) from Northern Pakistan

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ABSTRACT

We provide occurrence records of the members of dung beetle's tribe Onitini from the northern parts of Pakistan, including Gilgit-Baltistan, Khyber Pakhtunkhwa Province and Islamabad Capital Territory. This study is based on extensive field sampling from different ecological biomes including Alpine Meadows, the Sub-Alpine Zone, Mountain Temperate Forest, and Subtropical Deciduous Forest. As a result, we report six species under two genera of tribe Onitini: *Onitis falcatus*, *O. lama*, *O. philemon, O. subopacus, O. virens,* and *Cheironitis arrowi*. The genus *Cheironitis* is recorded for the first time from northern parts of Pakistan. We provide photographs of the dorsal and ventral habitus, diagnosis, distribution maps and identification keys to known genera and species in the tribe Onitini from Pakistan.

Keywords: *Onitis*, new record, *Cheironitis*, Scarabaeioidea, dung beetles, Oriental region.

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INTRODUCTION

The tribe Onitini, which is part of the subfamily Scarabaeinae within the family Scarabaeidae, encompasses around 210 species of tunneling beetles belonging to 18 genera that feed solely on feces. The two genera *Cheironitis* and *Onitis* have a relatively high number of species, with *Cheironitis* contains 159 species and *Onitis* having 24 species globally (Krajcik, 2006). Species in these two genera are not only found in Africa, but also have a range that extends into the Palaearctic and Oriental regions. The remaining 16 genera are species poor, consisting of only three species in the Palaearctic (belonging to the genus Bubas) and 15 African endemics (Scholtz, Davis, & Kryger, 2009). The tribe is recognizable by its antennae, which have nine segments, as well as a visible scutellum and pronotum having a pair of noticeable small impressions in middle of the base. The first in-depth study of Onitini in India was conducted by Arrow (1931), where author reported 13 species of *Onitis* and one species of *Cheironitis*. In his monograph, Balthasar (1963b) conducted an investigation of 15 species of *Cheironitis*, 30 species of *Onitis*, and 2 species of *Bubas* from both the Palaearctic and Oriental regions.

Despite their immense diversity, the Scarabaeidae fauna of northern Pakistan has not been investigated due to lack of proper accessibility and research facilities. There are a series of non-coprophagous scarab beetle publications from Pakistan (Abdullah & Roohi, 1968, 1969) and some well-documented taxonomic work on the Oriental dung beetle fauna carried out by Arrow (1931) and Balthasar (1963a, b, c). More than 70 species of Scarabaeinae from Pakistan are listed in Löbl & Smetana (2006)'s "Catalogue of Palaearctic Coleoptera", but not even a single species has been documented from northern Pakistan. However, in the recent decades, new additions to the scarabid fauna of Pakistan has been updated in a number of faunistic, biodiversity, distribution, and ecological studies (Ratcliffe & Ahmed, 2010; Ahmed, Zorn, & Khatri, 2014; Siddiqui, Ahmed, & Khatri, 2014); but unfortunately, the information on northern areas, particularly Gilgit-Baltistan is scarcely sampled or poorly recorded in published literature (Abbas, Bai, & Yang, 2015).

There are at least 18 pronounced climatic regions in Pakistan (Khan, Hassan, & Khan, 2010). The present study areas in the northern parts of Pakistan have diverse macro- and micro-climate zones: the Alpine Zone (alpine meadows, sub-alpine scrub and birch forests, and alpine dry steppe), the Montane Temperate Forest (sub-tropical pine forests, Himalayan moist temperate forests, Himalayan dry temperate forests), and Subtropical Deciduous Forest.

To fill the long-due wallacean gap, this study was carried out to find out the occurrences records of the dung beetles from the Gilgit-Baltistan, Khyber Pakhtunkhwa Province and Islamabad Capital Territory. Besides, we also provide all the historic records in literature of the species in tribe Onitini from Punjab and Sindh Provinces and Azad Kashmir. We provide identification keys, distribution maps, and diagnosis for each species collected from all possible localities to add to our knowledge of the faunal composition of scarabs found in Pakistan.

MATERIAL AND METHODS

Besides the specimens housed at Pakistan Museum of Natural History, specimens belonging to tribe Onitini available in different worldwide institutes were examined (abbreviations are as shown in the text):

CABI - Centre for Agricultural Bioscience International Rawalpindi, Pakistan.

IZAS - Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

MNHN - Muséum National d'Histoire Naturelle, Paris, France.

NHML - Natural History Museum, London, UK.

NIM - National Insect Museum, Islamabad, Pakistan.

ISNB - Belgium, Brussels, Institute Royal des Sciences Naturelles de Belgique.

BMNH - British Natural History Museum.

NMPC - National Museum (Natural History), Department of Entomology, Prague, Czech Republic.

PMNH - Pakistan Museum of Natural History, Islamabad, Pakistan.

ZIN - Russian Academy of Sciences, Zoological Institute, St. Petersburg, Russia.

ZMUC - University of Copenhagen, Zoological Museum, København [= Copenhagen], Denmark.

Sampling Areas

The present study was conducted in three broader habitats, viz., the Alpine Zone, Montane Temperate Forest, and Subtropical Deciduous Forest, in northern Pakistan. For a comprehensive investigation, these regions were further divided into sub-regions. (Fig. 1).

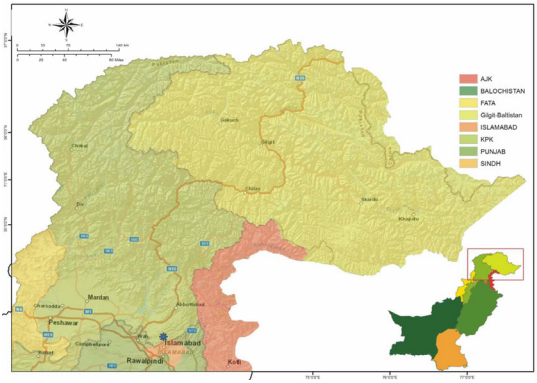

Figure 1. General area sampled for beetle collection for study, Northern Pakistan.

Alpine Zone

The Alpine Zone was typified by continuous grass fields dotted all over with tumbled boulders. The Alpine Zones was subdivided into Alpine meadows, Sub-Alpine scrub and Birch forest, and Alpine dry steppe.

Alpine Meadows

Alpine meadows occurred in the Northern Hazara District, Chitral, Swat, Kohistan, and all regions where mountains extend above the coniferous forest tree line.

Sub-alpine Scrub and Birch Forest

This area consists of upper slopes throughout the higher mountain range of the Himalayas, including the north-eastern corner of Hazara District, Swat, and Kohistan.

Alpine Dry steppe

This is typified by the side valleys of lower Chitral, Kohistan, the western border of Waziristan, and some parts of Safed Koh, Malakand, Swat, and Dir.

Montane Temperate Forest

Montane temperate forests, which are the only real “tall tree” forests in Pakistan, include the following subregions:

Subtropical Pine Forest

This narrow zone ranging from 3000ft to 6500ft is found in the lower Kaghan Valley around Kuwai, Batrassi Pass (Hazara), and lower Swat around Marghazar and Bunair.

Himalayan Moist Temperate Forest

This is predominantly a coniferous forest that gets high rainfall during the monsoon season and has glades of mixed deciduous and broad-leaved species. Parts of eastern Swat, Kohistan, lower Kaghan, Shogran, and Murree Hills are included in this subregion.

Himalayan Dry Temperate Forest

This region consists of the inner and northern ranges of the Himalayas, which are confined to the more sheltered lower slopes, including Jabba Valley in Swat, Dir, Chitral, and the inner valleys of Hazara and Kohistan.

Subtropical Deciduous Forest

Rawalpindi foot-hills, Margalla Hills, Kahota, Lethrar, and Noor Pur Shahan collectively form the subtropical deciduous forest.

From all regions, specimens were collected by hand-picking and using light traps. The collected specimens were stored in vials containing a 70% ethanol solution. All specimens were transferred to the insect repository of the Pakistan Museum of Natural History (PMNH) in Islamabad for systematic study. Specimens were properly prepared and catalogued. Identification were done at the Pakistan Museum of Natural History (PMNH), Islamabad with the help of available literature and determined materials from the IZAS, MNHN, NHML, ZMUC, ZIN, NMPC, PMNH, CABI, and NIM.

The taxonomic characters of the specimens were examined using a Kyowa Optical microscope (Model SDZ-P) Japan. Distributional maps were generated using ArcGIS 10.2 using data from materials examined and information in previous literature from Pakistan.

Taxonomy

Family: Scarabaeidae Latreille, 1802

Subfamily: Scarabaeinae Latreille, 1802

Tribe: Onitini Laporte, 1840

Key to genera of tribe Onitini from Northern Pakistan

1. Scutellum small; base of pronotum not margined (Fig. 5a); protarsi absent; prosternum without any process in both sexes; parameres equal in length to phallobase ..... *Onitis* Fabricius

- Scutellum rather large; base of pronotum margined (Fig. 7a); protarsi present in females, absent in males; in males, prosternum forming a strong bifid process behind procoxae in middle while this process is absent in females; parameres twice as long as phallobase ……..*Cheironitis* van Lansberge

Genus *Onitis* Fabricius, 1798

Onitis Fabricius, 1798: 2. Type species: *Scarabaeus inuus* Fabricius, 1781.

This study recorded five species of *Onitis* from northern areas of Pakistan.

Key to species of genus *Onitis* Fabricius, 1798 from northern Pakistan

1. Pronotum lightly punctured (Fig. 2a) ……..…….…… 2

- Pronotum clearly and deeply punctured (Fig. 5a) ……..…..... 3

2. Pronotum feebly punctuate, punctures shallow and vague (Fig. 2a); pygidium smooth, glabrous; frontoclypeal carina interrupted or with tubercle at middle. ....…..... *O. falcatus* (Wulfen)

- Pronotum lightly punctured, Broad front tibia armed with four external teeth ……..…. *O. lama* van Lansberge

3. Metasternum flat, not grooved ……..……...……...…….. 4

- Metasternum longitudinally grooved in front, ventral surface entirely metallic, upper side rather shining ……..…..…….... *O. philemon* Fabricius

4. Frontoclypeal carina broadly interrupted; frontalcarina with a wide medial gap, base of pronotum not bordered between foveae; protibia with terminal external tooth projecting in front ……..……..……..…….....*O. subopacus* Arrow

- Frontoclypeal carina narrowly interrupted; frontalcarina with only a very short medial gap; protibia with terminal external tooth tapering in front...*O. virens* Lansberge

***Onitis falcatus* (Wulfen, 1786) (Figs. 2a-c)**

Scarabaeus falcatus Wulfen, 1786: 14. Type locality: India.

Onitis himaleyicus Redtenbacher, 1844: 518. Type locality: India (Kashmir: Himalaya).

Onitis kiuchii Masumoto, 1996: 88. Type locality: Thailand.

Diagnosis. The posterior part of the head is irregularly granular. Clypeus is oval moderately strongly and lightly rugulose. Clypeo-frontal carina is widely interrupted in the middle, and there is a short frontal tubercle behind it and in front a short oblique clypeal carina. The base of pronotum is strongly rounded but not distinctly lobed. The pronotum is lightly and rather sparingly punctured without a well-marked median groove or line. The pygidium is thick, unpunctured, and smooth. The elytra are finely striate, with 1, 3, and 5th intervals a little raised and distinctly narrower than the 2nd and 4th, and the meta-sternum sides are densely hairy and also punctured densely.

Material examined. PAKISTAN. Khyber Pakhtunkhwa: Abbottabad, 14.08.2010, 3♂♂, 1♀; Besham, 25.08.2012, 3♂♂, 2♀♀; Buner, 09.09.2007, 2♂♂, 3♀♀; Swat, 12.07.2012, 1♂; Malakand, 06.08.2013, 3♂♂, 3♀♀; Mansehra, 12.07.2008, 4♂♂, 1♀, leg. M. Abbas.

Distribution. Pakistan. Azad Kashmir: Rawalakot; Khyber Pakhtunkhwa: Dera Ismail Khan; Sindh: Tharparkar (Siddiqui, Ahmed, & Khatri, 2014); Bangladesh, Bhutan, Cambodia, India, Myanmar, China, Philippines, Laos, Malaysia, Vietnam and Thailand (Hanboonsong & Masumoto, 2000; Bai, Yang, & Zhang, 2006; Sewak, 2009; Gupta, Chandra, & Khan, 2017; Cheung et al, 2018; Han, Choi, & Park, 2021).

Remarks. Previously recorded by Arrow (1931) from Pakistan. The species is widely distributed in the Himalayan region and semi-arid zones but so far has not recorded from the trans-Himalaya and coastal areas. This forest-dwelling species is attracted to light and feeds on fresh and old cattle dung, mainly of buffaloes and cows, and is rarely found in accumulated dung.

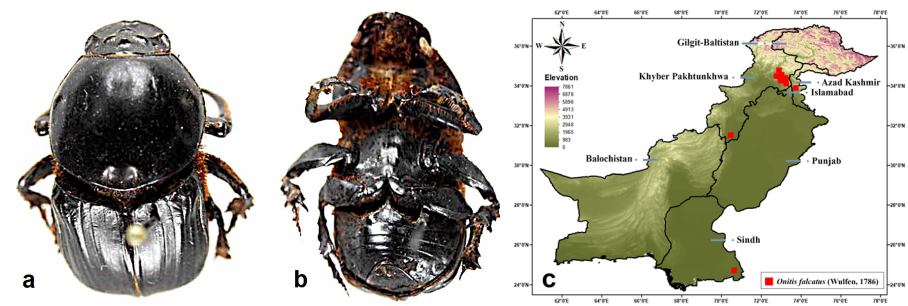

Figure 2. *Onitis falcatus* (Wulfen). a) dorsal, b) ventral habitus, c) regional distribution map in Pakistan.

Onitis lama Lansberge, 1875 (Figs. 3a-c)

Onitis lama Lansberge, 1875: 123. Type locality: India (Himalayas).

Diagnosis. The head is strongly elevated, with a slightly acute frontal carina, with a short straight transverse carina, and a trisinuate vertex carina. Front angles of prothorax blunt sides strongly rounded, base almost completely rounded. Front femur in males have a sharp oblique tooth beyond middle on lower edge and hind femur with a tooth near end of lower edge. Broad front tibia armed with four external teeth.

Material examined. PAKISTAN. Khyber Pakhtunkhwa: Abbottabad, 02.07.2013, 1♂, 3♀♀; Buner, 18.07.2006, 5♀♀; Peshawar, 20.05.2008, 4♂♂; Swat, 14.08.2012, 4♂♂, 1♀; Islamabad: 12.06.2009, 3♂♂, 4♀♀, leg. M. Abbas.

Distribution. Pakistan. Khyber Pakhtunkhwa: Swat (Kanju) (Siddiqui et al, 2014); India (Arrow, 1931; Sewak, 2009; Gupta et al, 2017).

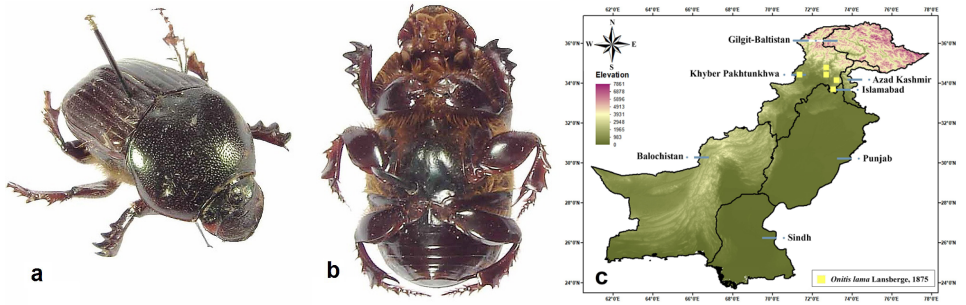

Figure 3. *Onitis lama* (Lansberge). a) dorsal, b) ventral habitus, c) regional distribution map in Pakistan.

Onitis philemon Fabricius, 1801 (Figs. 4a-c)

Onitis philemon Fabricus, 1801: 30. Type locality: India.

Onitis distinctus Lansberge, 1875: 138. Type locality: India.

Diagnosis. Head is rugulose with the ocular lobes. Irregularly punctured pronotum and without clearly marked median lines, in front the lateral margins are straight and in middle strongly rounded. The pygidium is very feebly and sparsely punctured, and the elytra are moderately strongly striate and sparsely punctured. The clypeus is granulate in males, and closely transversely rugose in females. The middle femur has a sharp tooth near the end of the lower edge. Hind trochanter is a little toothed beneath (Figs 4a-b).

Material examined. PAKISTAN. Khyber Pakhtunkhwa: Abbottabad, 01.07.2012, 2♂♂, 4♀♀; Chitral, 20.07.2012, 5♂♂, 4♀♀; Kohat, 21.08.2007, 2♂♂, 5♀♀; Nowshera, 18.08.2013, 4♂♂, 5♀♀; Mansehra, 01.07.2006, 3♂♂, 4♀♀; Peshawar, 11.06.2010, 2♂♂, 3♀♀, leg. M. Abbas. **CHINA.** Fujian: Xiamen, 5-7.06.1980, coll. XIA Shi-Yang, 1♀; Hainan: Ya County, 15-25.04.1982, coll. LIU Zhi-Jin, LI Xue-Feng, 2♀♀; Xinglong, 06.02.1981, coll. LIU Zhi-Jin, LI Xue-Feng, 1♀. **VIETNAM.** Hoa-Binh, date unknown, coll. Cooman, 3♂♂, 1♀; Unknown, 1♂, 2♀♀ (Type) [ZMUC]; Unknown, E. Candeze Coll. 3♀♀. (Type of *Onitis distinctus*) [ISNB]. **INDIA.** Bangalore, S. India, 1♂, 06.03.1903; Cap Comorin, Indes Orientales, R. P. Castats, ?.?.1888, 6♂♂, 1♀.

Distribution. Pakistan. Azad Kashmir: Poonch (Rawalakot); Punjab: Toba Tek Singh (Kamalia) (Siddiqui et al, 2014); China, Bengal and India (Bai et al, 2006; Sewak, 2009; Gupta, Chandra, & Khan, 2014, 2017).

Remarks. Widely distributed species found in loam to heavy loam, pastures with high rainfall regions. It is the most abundant and uniformly distributed species of the genus in the forests. It is attracted towards light and feeds on carnivore and herbivore, dung of human, cow and horse. Active throughout the year, prefers fresh or old dung and is more common in dung heaps accumulated for manure and collected along with *O. subopacus*.

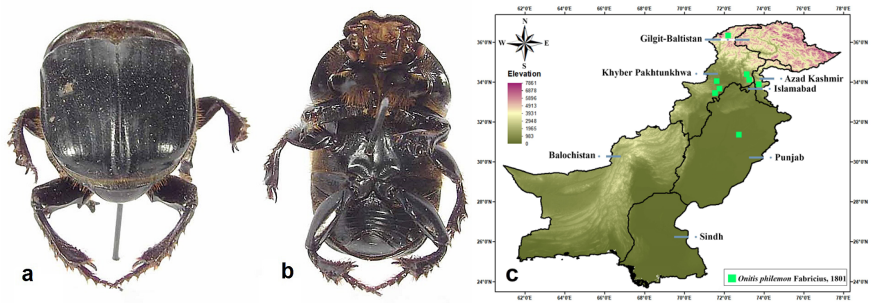

Figure 4. *Onitis philemon* Fabricius. a) dorsal, b) ventral habitus, c) regional distribution map in Pakistan.

Onitis subopacus Arrow, 1931 (Figs. 5a-c)

Onitis philemon Lansberge, 1875: 133. Type locality: Sri Lanka. Junior homonym of *Onitis philemon* Fabricius, 1801.

Onitis subopacus Arrow, 1931: 395. Type locality: Sri Lanka (former name Ceylon). New name for *Onitis philemon* Lansberge, 1875 preoccupied).

Diagnosis. Prothorax and head are reasonably shining and relatively dull elytra. A short transverse clypeal carina is located in front of the pronotum and interrupted carina is somewhat closely but feebly punctured. The pygidium is opaque and un-punctured. The elytra are exceptionally striate, and the 1, 3, and 5th intervals are slightly convex. Middle femur bears a rounded lobe near the middle of the posterior edge and a sharp tooth towards the end, and the middle tibia is slender at the base and strongly and abruptly dilated. Trochanter of the hind leg is sharply toothed (Figs. 5a-b).

Material examined. PAKISTAN. Khyber Pakhtunkhwa: Abbottabad, 11.05.2005, 2♂♂, 5♀♀; Besham, 14.07.2008, 2♂♂, 1♀; Chitral, 21.07.2007, 3♀♀; Dir, 13.04.2014, 2♂♂, 3♀♀; Kohat, 03.07.2013, 4♂♂; Nowshera, 03.07.2010, 7♂♂, 5♀♀; Peshawar, 23.08.2012, 4♂♂, 5♀♀; Swat, 10.06.2012, 2♂♂; Punjab: Murree, 13.06.2006, 1♂, 5♀♀; Islamabad: 02.5.2009, 5♀♀, leg. M. Abbas.

Distribution. Pakistan. Azad Kashmir: Poonch (Rawalakot), Sudhanoti (Palandri); Gilgit-Baltistan: Gilgit (Naltar); Khyber Pakhtunkhwa: Abbottabad, Swat (Marghazar); Punjab: Toba Tek Singh (Kamalia); Sindh: Malir (Siddiqui et al, 2014); India, Myanmar, Thailand, Malaysia, China, Sri Lanka, Afghanistan, Indonesia, Cambodia, Vietnam, Nepal (Hanboonsong & Masumoto, 2000; Bai et al, 2006; Sewak, 2009; Gupta et al, 2014, 2017; Cheung et al, 2018; Han et al, 2021).

Remarks. This species has been reported by Balthasar (1963b) from the foothills of Pakistan. Arrow (1931) recorded this species from Myanmar, Sri Lanka and India. This species is distinct with an elongated middle tibia and a curved single or double tooth near the base beneath. This species shows wide distribution in the country. This species has good tolerance for shade. Good cow dung burial. Widely distributed in the forests. Attracted towards light. Prefers open grasslands and cultivated fields.

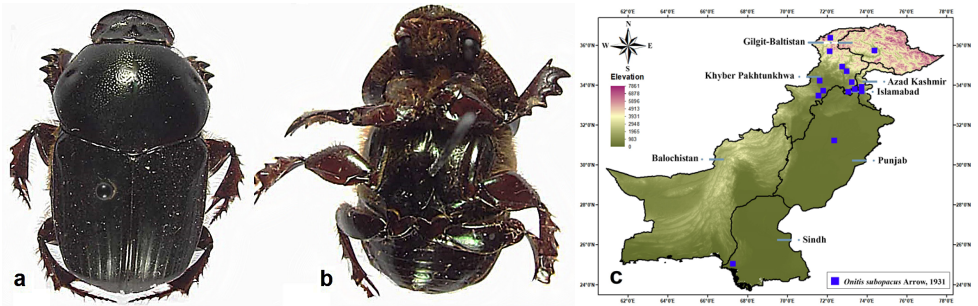

Figure 5. *Onitis subopacus* Arrow. a) dorsal, b) ventral habitus, c) regional distribution map in Pakistan.

Onitis virens Lansberge, 1875 (Figs. 6a-c)

Onilis virens Lansberge, 1875: 135. Type localities: India and Sri Lanka.

Onitis amplectens Lansberge, 1875: 136: Type locality: India.

Diagnosis. Body oval, moderately convex, and smooth in shape. Clypeus is elliptical, and closely transversely rugulose, with an intervallic carina separating it from the frons. Prothorax is fully punctured, with a median line in front, and a narrow median groove behind; there is a deep longitudinal pit on both sites of the middle of the basal margins, and the elytra have distinctly punctured intervals that are flat and striate. The pygidium is flat and punctured, and the metasternal shield is smooth. The front tibia is elongated, slandered curved with a long spine at extremity but short broad.

Material examined. PAKISTAN. Khyber Pakhtunkhwa: Abbottabad, 20.05.2009, 2♂♂, 3♀♀; Kohat, 26.07.2005, 4♂♂; Mansehra, 29.06.2006, 1♂, 5♀♀; Mardan, 03.07.2012, 3♂♂, 4♀♀; Nowshera, 12.05.2010, 2♂♂, 3♀♀; Peshawar, 13.08.2013, 4♂♂, 5♀♀; **I**slamabad: 02.07.2012, 2♂♂, 4♀♀, leg. M. Abbas. **CHINA.** Guangdong: Zhanjiang, 23.05.1984, coll. LIAO Tai-Bai, 1♂; Hainan: Luodai, 05.02.1973, coll. CUI Jing-Hai, 1♀; Guangxi: Wuming, 15.06.1956, coll. Unknown, 1♂; Slam. Cast., 1875-?-17, E. Candeze Coll., 1♀ (Type of *Onitis virens*) [ISNB]; Unknown, E. Candeze Coll., 2♀♀ (Type of *Onitis amplectens*) [ISNB].

Distribution. Pakistan. Khyber Pakhtunkhwa: Swat (Kanju); Sindh: Tharparkar (Siddiqui et al, 2014); Bangladesh, India, China, Myanmar, Belgium, Thailand, Vietnam and Laos (Hanboonsong & Masumoto, 2000; Bai et al, 2006; Sewak, 2009; Gupta et al, 2017).

Remarks. Arrow (1931) reported specimens of this species from the foothills of Pakistan. The identified specimens were distinguished on the basis of elongated front tibia with a blunt spine and the middle femur with a strong, rounded lobe at the middle trochanter on hind leg that was sharply toothed. In open pastures, this species is found in dung, and attract towards light. It lives in sandy, muddy soil; is rare on rocks; dislike human excrement; prefers 2-7 days old dung but occasionally may remain in the dung up to two weeks. Resemblance to *O. subopacus* and can be differentiated from the examining of the characters of protibia in *O. virens* 4th tooth of protibia blunt and joined with 3rd tooth while in *O. subopacus* protibia tridentate with a terminal blunt process.

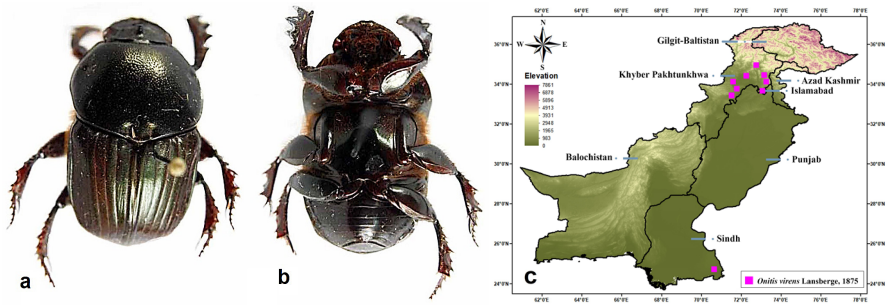

Figure 6. *Onitis virens* Lansberge. a) dorsal, b) ventral habitus, c) regional distribution map in Pakistan.

Genus *Cheironitis* Lansberge, 1875

Cheironitis Lansberge, 1875: 18. Type species: *Scarabaeus furcifer* Rossi, 1792.

Cheironitis arrowi Janssens, 1937 (Figs. 7a-c)

Cheironitis arrowi Janssens, 1937: 159. Type locality: India.

Diagnosis. Body oblong and somewhat depressed shape. Anterior margin of the clypeus strongly bilobed, reflexed, and separated from the frons by a short, transverse, clypeo-frontal carina with another carina behind it. Frons with some short erect setae. Pronotum is broader than elytra, unevenly rugose with very irregular punctures, coarsely and partly confluent in middle, finely and sparsely at lateral sides. Elytra are very lightly striate; the 2nd and 4th intervals are broad and rather flat; and the 3rd and 5th intervals are narrow, raised, and rather sharply carinate. Pygidium is lightly and sparsely punctate. Metasternum is longitudinally grooved, anteriorly clothed with erect hairs, punctuate very minutely and sparingly, and the lateral sides of metasternum and abdomen are clothed with fine setae (Figs. 7a-b).

Material examined. PAKISTAN. Khyber Pakhtunkhwa: Mardan, 27.06.2012, 3♂♂, 4♀♀; Malakand, 26.02.2005, 2♂♂; Mansehra, 29.08.2006, 3♀♀; Swat, 20.07.2010, 2♂♂, 3♀♀; Islamabad: 02.09.2012, 3♂, 3♀♀; Murree, 13.08.2013, 4♂♂, 5♀♀, leg. M. Abbas.

Distribution. Pakistan. Sindh: Karachi (Siddiqui et al, 2014); India, Afghanistan, Saudi Arabia, Nepal (Gupta et al, 2017).

Remarks. Sexually dimorphic species. Clypeus shiny and is finely and sparsely punctuated. The specimens were found in fresh cow and buffalo dung in the mountainous environments. Specimens were previously recorded from Pakistan, India, Afghanistan and Arabia (Balthasar, 1963).

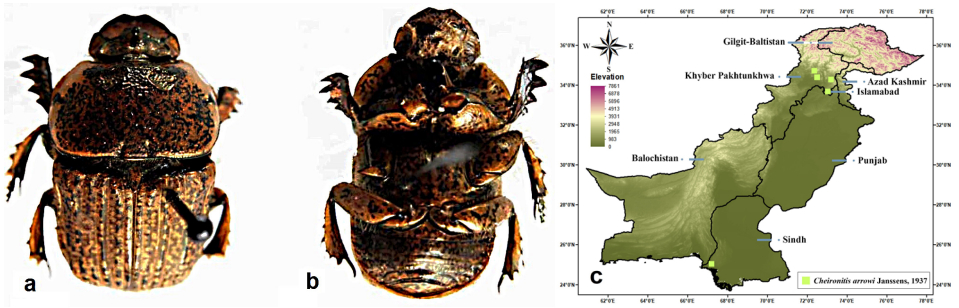

Figure 7. *Cheironitis arrowi* Janssens. a) dorsal, b) ventral habitus, c) regional distribution map in Pakistan.

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