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Cover: Common Silverline *Spindasis vulcanus vulcanus* in poster colours adapted from photograph by Kalpesh Tayade. © Pooja R. Patil.

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COMMUNICATION

Desert Carabidae (Insecta: Coleoptera) of India

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Abstract: A checklist, distribution pattern and taxonomic keys to the Carabidae fauna of the Thar Desert (Rajasthan) are provided. Seventeen species belonging to five subfamilies (Anthiinae, Brachininae, Carabinae, Harpalinae, and Licininae) were recorded. Eight species of Carabidae are first records from the state of Rajasthan.

Keywords: Arid region, checklist, distribution, ground beetles, Rajasthan, taxonomic keys, Thar Desert, western India.

Editor: Anonymity requested.

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Author contributions: All the authors contributed equally for this research study/ paper.

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INTRODUCTION

The Thar Desert or the Great Indian Desert is a subtropical hot desert that stretches between the Aravalli Mountains and the Indus River in the northwestern part of the Indian sub-continent with an area of over 4,000 km^2 (Sivaperuman et al. 2009; Dhir &–Singhvi 2012). It is an extension of the Sahara-Arabian and southern Iranian subtropical desert regions and forms an important biogeographical region of India which has unique habitat types of desert grasslands, rocky expanses and sand dunes (Sømme 1995; Sivaperuman et al. 2009) and is the only subtropical desert present in the Oriental realm. The Indian stretch of the Thar Desert is located entirely in the western part of Rajasthan (Image 1). A few invertebrate groups of the region (dung beetles, darkling beetles, spiders, and ants) have been documented (Sewak 2009; Sivaperuman & Rathore 2009; Tak 2009). Except for the report of three carabid species (*Calosoma orientalis* (Hope, 1833) erroneously termed as *Carabus orientalis*; *Anthia sexguttata* (Fabricius, 1775) erroneously termed as *Anthia sexmaculata*; and *Calosoma imbricatum* Klug, 1832 erroneously identified as *Calosoma maderae*) from a regional study (Kazmi & Ramamurthy 2004), no data on the Carabidae fauna of the Thar Desert, exists in contrast to the detailed report of Carabidae from the adjoining Sahara-Arabian and southern Iranian subtropical desert regions (Abdel-Dayem 2012; Assmann et al. 2015; Azadbakhsh & Nozari 2015; Abdel-Dayem et al. 2018, 2019). Desert carabids have to be well adapted to high temperatures and lack of water (Andersen et al. 1986). Carabidae inhabiting the desert are usually of larger size as relative water loss decreases with increasing body size (Andersen et al. 1986; Sømme 1995; Zachariassen 1996). The present effort provides data on the Carabidae of the Thar Desert, which includes the list of species, distribution pattern, images, and a key to the species.

MATERIALS AND METHODS

Collections of Carabidae available in the Zoological Survey of India, Desert Regional Center (ZSI DRC), Jodhpur (Collected between 1962 to 2001) have been identified. Specimens were identified till subfamily and tribe level with the modified Keys prepared from Andrewes (1929, 1935) by the first author. Generic and species level identification were carried out using keys in Chanu & Swaminathan (2017), Akhil (2019), Akhil & Sabu (2019), and Akhil et al. (2020). Identification and imaging were done with the help of a Leica M205C stereo zoom microscope fitted with a Leica MC 170 HD camera and Leica Application Suite (LAS V4.12) software having auto montage feature. All specimens were identified to species level by S.V. Akhil.

RESULTS

Checklist of Carabidae from Thar Desert
(* first records from Rajasthan state)
Subfamily Anthiinae Bonelli, 1813
Tribe Anthiini Bonelli, 1813
Genus *Anthia* Weber, 1801

***Anthia sexguttata* (Fabricius, 1775)**
Image 2A

Specimen examined: 1 ex., male, India: Rajasthan: Jodhpur, 30.xi.1963, coll. R.N. Bhargava

Distribution: India (Himalaya; Rajasthan: Jodhpur; Gujarat: Surat; Maharashtra: Pune; Karnataka: Bangalore; Tamil Nadu: Kalayar kovil, Edaikazhinadu (Gangathakuppam), Kattupakkam, Nemili, Kunnathu pond (Villupuram dt.), Vedanthangal, Karkodai (Theni dt.), Vedur Reservoir (Tindivanam), Palavakal, Thiruvannamalai, Mudumalai, Pachaimalai hills, Manchavadi, Tharangambadi; Pondicherry), Turkmenistan, Iran, Pakistan, Afghanistan, Kazakhstan, Uzbekistan, and Nepal.

Tribe Helluonini Hope, 1838
Genus *Omphra* Dejean, 1825
***Omphra complanata* Reiche, 1843 ***
Image 2B

Specimen examined: 1 ex. female, '304/4', India: Rajasthan: Jodhpur: Ratanada, 20.viii.1984, coll. N.S. Rathore

Distribution: India (Himachal Pradesh: Shimla; Rajasthan: Jodhpur (Ratanada); Odisha: Chilika lake; Maharashtra: Nagpur, Mumbai, Nasik, Sangli, Ratnagiri; Karnataka: Belagavi; Tamil Nadu: Madura; Pondicherry), Nepal (Janakpur).

Subfamily Brachininae Bonelli, 1810
Tribe Brachinini Bonelli, 1810
Genus *Brachinus* Weber, 1801
***Brachinus pictus* (Hope, 1833) ***
Image 2C

Specimens examined: 6 exs.; 1 male, 1 female, '218/I3', India: Rajasthan: Pali Dist.: Hemawas dam, 02.xi.1974, coll. T.G.Vazirani; 1 male, India: Rajasthan:

Image 1. A & B: Location of Thar Desert. (Major Collection Sites: Jodhpur, Bikaner, Jaipur and Udaipur marked). Image Courtesy: Google Earth.

Jodhpur, 25.vii.1972, coll. R.C. Sharma; 1 female, 1 sex undetermined '6928/3', India: Rajasthan: Amar Sagar, 20.vii.1978, coll. N.S. Rathore; 1 sex undetermined, India: Rajasthan: Jodhpur: Bijolai, 30.ix.1962, coll. R.C. Sharma.

Distribution: India (Delhi; Haryana: Kalka; Rajasthan: Pali Dt.: Hemawas dam, Jodhpur (Bijolai), Amar Sagar; Siwaliks; Bengal; Jharkhand: Medininagar; Maharashtra: Pune, Nagpur; Karnataka: Belgavi, Bengaluru; Tamil Nadu: Chennai; Kerala: Thrissur), Sri Lanka (Hambantota), Iran, and Pakistan.

Genus *Pheropsophus* Solier, 1833

***Pheropsophus lissoderus* Chaudoir, 1850 ***

Image 2D

Specimen examined: 1 ex., female, India: Rajasthan: Jodhpur, 06.vi.1963, coll. R.C. Sharma.

Distribution: India (Jammu & Kashmir; Himachal Pradesh; Rajasthan: Jodhpur; Uttarakhand; Sikkim; Arunachal Pradesh; Tamil Nadu: Coimbatore; Kerala: Kalpetta), Sri Lanka (Kandy and Peradeniya), Bhutan, China (Tibet), and Pakistan (Islamabad, Khyber Pakhtunkhwa and Muzaffarabad).

***Pheropsophus sobrinus* (Dejean, 1826) ***

Image 2E

Specimen examined: 1 ex., sex undetermined, India: Rajasthan: Jodhpur: Sardar Samand, 15.i.1963, coll. Motilal.

Distribution: India (Jammu and Kashmir; Himachal Pradesh; Rajasthan: Jodhpur (Sardar Samand); Uttarakhand; Bengal: Kolkata; Sikkim; Arunachal Pradesh; Tamil Nadu: Coimbatore, Tharangambadi, Anaimalai Hills; Puducherry: Karaikal; Kerala: Palakkad), Sri Lanka, Nepal, Bhutan, Taiwan, Pakistan (Rawalpindi, Chakwal, Poonch), and Yemen.

Subfamily Carabinae

Tribe Carabini

Genus *Calosoma* Weber, 1801

***Calosoma imbricatum imbricatum* Klug, 1832**

Image 2F

Specimens examined: 2 exs. 1 male, 'I/873', India: Rajasthan: Jodhpur, 25.ix.1964, coll. R.N. Bhargava; 1 female, '3046', India: Rajasthan: Jodhpur, 10.ix.1969, coll. R.N. Bhargava.

Distribution: India (Rajasthan: Jaipur, Mount Abu, Jodhpur, Thar Desert), Pakistan, Afghanistan, Iran, Iraq, Kazakhstan, Turkmenistan, Uzbekistan, Mongolia, Russia, Syria, Saudi Arabia, Qatar, Kuwait, Oman, United Arab Emirates, Yemen, Algeria, Burkina Faso, Cabo Verde, Canary Islands, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Mali, Niger, Senegal, Somalia, Sudan, Chad, Namibia, and South Africa.

***Calosoma orientale* (Hope, 1834)**

Image 2G

Specimen examined: 1 ex., male, '8880/5', India: Rajasthan: Jodhpur: ZSI campus, 17.viii.2001, coll. R. Sewak.

Distribution: India (West Bengal; Bihar: Chapra; Rajasthan: Jodhpur (ZSI Campus); Gujarat: Bhavnagar, Godhra; Madhya Pradesh: Khandwa; Maharashtra: Pune, Nasik; Karnataka: Bengaluru, Chikamagaluru; Tamil Nadu: Coimbatore, Kodaikanal, Madura, Manaparai), Sri Lanka, China? (Häckel 2017), and Pakistan? (Häckel 2017).

Subfamily Harpalinae Bonelli, 1810

Tribe Anisodactylini Lacordaire, 1854

Genus *Pseudognathaphanus* Schauberger, 1932

Pseudognathaphanus punctilabris* (W.S. Macleay, 1825)

Image 2H

Specimens examined: 4 exs., sex undetermined, '304/4', India: Rajasthan: Jodhpur: Ratanada, 20.viii.1984, coll. N.S. Rathore.

Distribution: India (Himachal Pradesh: Kulu; Rajasthan: Jodhpur (Ratanada); Assam: Kohora; Odisha: Ganjam (Surada); Tamil Nadu: Anamalai Hills; Puduchery; Andaman and Nicobar Islands), Sri Lanka, Myanmar, Thailand, Indonesia (Java, Sumatra, Sulawesi) Vietnam, Nepal, Philippines, and China.

Subfamily Licininae, Bonelli, 1810

Tribe Chlaenini Brulle, 1834

Genus *Chlaenius* Bonelli, 1810

***Chlaenius germanus* Chaudoir, 1876**

Image 2I

Specimens examined: 2 exs., 1 sex undetermined, India: Rajasthan: Jodhpur: Mandore, 05.v.1965, coll. V.C. Agarwal; 1 female, India: Rajasthan: Jodhpur: Kailana, 12.ix.1979, coll. K.V. Rama Rao.

Distribution: India (Rajasthan: Jaipur (Durgapura), Jodhpur (Kailana, Mandore); Uttarakhand: Bhatkot, Kumaon; Karnataka: Kerwadi; West Bengal: Kolkata), Myanmar, Bangladesh, and Laos.

***Chlaenius laeviplaga frater* Chaudoir, 1876 ***

Image 3A

Specimens examined: 3 exs., 1 male, '3152', India: Rajasthan: Jodhpur: Kailana, 24.ix.1964, coll. K.V.S Rao; 1 male, '8260/3', India: Rajasthan: Jodhpur: Kailana, 21.ix.1979, coll. N.S. Rathore; 1 female, '4128', India: Rajasthan: Jodhpur, 15.iv.1965, coll. V.C. Agarwal.

Distribution: India (Rajasthan: Jodhpur (Kailana); Gujarat: Kathiawar: Sasan; Bihar: Pusa; Jharkhand: Singhbhum; Madhya Pradesh: Mhow, Hoshangabad, Motinala; Maharashtra: Nagpur, Pune; Tamil Nadu: Teppukadu, Chennai; Kerala: Malabar), Pakistan, and China.

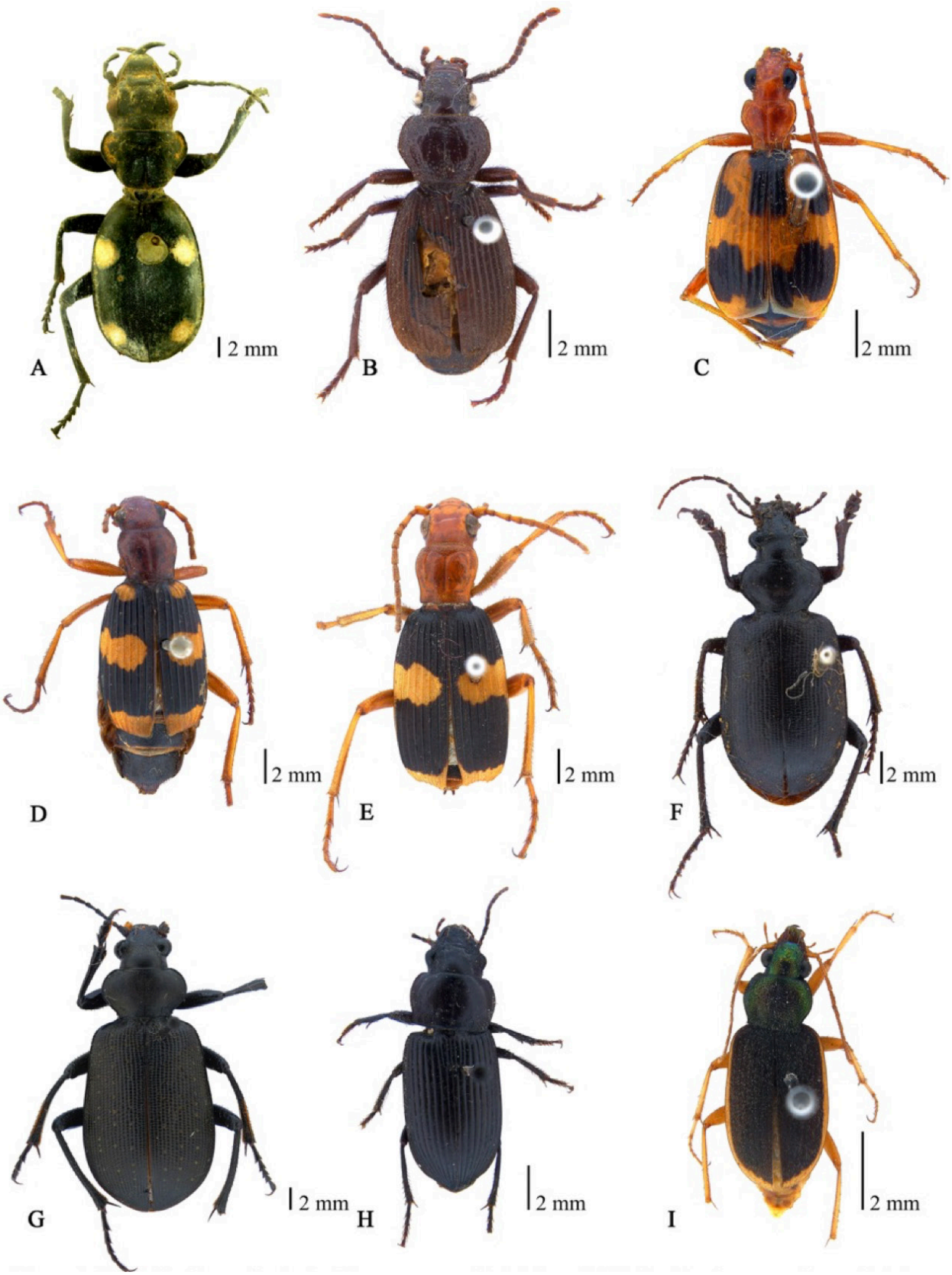

Image 2. Dorsal habitus of: A—*Anthia sexguttata* (Fabricius, 1775) | B—*Omphra complanata* Reiche, 1843 | C—*Brachinus pictus* Hope, 1833 | D—*Pheropsophus lissoderus* Chaudoir, 1850 | E— *Pheropsophus sobrinus* (Dejean, 1826) | F—*Calosoma imbricatum imbricatum* Klug, 1832 | G— *Calosoma orientale* Hope, 1834 | H—*Pseudognathaphanus punctilabris* (W.S.Macleay, 1825) | I—*Chlaenius germanus* Chaudoir, 1876.

Key to Carabidae of Thar Desert

(Modified from Andrewes 1929, 1935; Chanu & Swaminathan 2017; Akhil 2019)

1. Venter with six visible segments 4
- Venter with seven or eight visible segments (mandibles with setae in the scrobe, elytra truncate and with a narrow membranous border at apex) ..... 2 (Tribe Brachinini)

2. Mandibular scrobe unisetose ..... *Brachinus pictus* (Genus *Brachinus*)
- Mandibular scrobe plurisetose ..... 3 (Genus *Pheropsophus*)

3. Head entirely reddish yellow, or reddish brown with frons reddish yellow; pronotum with sides of disc convex anteriorly and straight posteriorly; elytral humeral spot if present very small .... *Pheropsophus sobrinus*
- Head entirely reddish brown; pronotum with sides of disc almost straight throughout; elytra with large humeral spot ..... *Pheropsophus lissoderus*

4. Head with two supraorbital seta on each side 5
- Head with one supraorbital seta on each side 6

5. Antennae inserted immediately beneath the preocular ridges .... *Omphra complanata* (Tribe Helluonini)
- Antennae inserted far below the preocular ridges, level with the lower margin of the eyes .... *Anthia sexguttata* (Tribe Anthiini)

6. Mesocoxal cavities not entirely enclosed by sterna, mesepimera reaching the coxae ....7 (Tribe Carabini)
- Mesocoxal cavities entirely enclosed by sterna, mesepimera not reaching the coxae 8

7. Lateral margins of pronotum bisetose ..... *Calosoma imbricatum imbricatum* (Subgenera *Caminara*)
- Lateral margins of pronotum unisetose ..... *Calosoma orientale* (Subgenera *Ctenosta*)

8. Epipleura with preapical plica. Antennae with first three antennomeres glabrous ..... 9 (Tribe Chlaeniini)
- Epipleura without preapical plica. Antennae with first two antennomeres glabrous .... *Pseudognathaphanus punctilabris*

9. Elytra pubescent ..... 10 (Genus *Chlaenius*)
- Elytra glabrous ..... *Harpaglossus opacus* (Genus *Harpaglossus*)

10. Elytra with distinct pale lateral longitudinal band from base to apex, or with fascia or spots 11
- Elytra without distinct pale longitudinal band or fascia or spots ..... *Chlaenius pretiosus*

11. Elytra with distinct pale longitudinal band but without spots or fascia 12
- Elytra without distinct pale longitudinal band but with spots or fascia 16

12. Pronotum coarsely punctate and pubescent ..... *Chlaenius germanus*
- Pronotum sparsely punctate and pubescent 13

13. Elytral lateral longitudinal band very narrow, with or without broad apical region 14
- Elytral lateral longitudinal band broad, without broad apical region 15

14. Elytral longitudinal band broadening at apex forming an apical band ..... *Chlaenius laeviplaga frater*
- Elytral longitudinal band not broadening at apex ..... *Chlaenius velocipes*

15. Form large; elytral intervals coarse with dense punctures ..... *Chlaenius propinquus*
- Form small; elytral intervals smooth without punctures ..... *Chlaenius nitidicollis*

16. Elytra with distinct inverted comma like fascia near the apex ..... *Chlaenius virgulifer*
- Elytra with two distinct rounded spots near the apex ..... *Chlaenius posticus*

***Chlaenius nitidicollis* Dejean, 1826**

Image 3B

Specimen examined: 1 ex., male, '3152', India: Rajasthan: Jodhpur: Kailana, 24.ix.1964, coll. K.V.S Rao.

Distribution: India (Haryana: Kalka; Rajasthan: Jodhpur (Kailana), Udaipur, Durgapura, Ajmer, Bhilwara; West Bengal; Maharashtra: Pune)**,** Myanmar, and Pakistan.

***Chlaenius posticus* (Fabricius, 1798)**

Image 3C

Specimen examined: 1 ex., male, India: Rajasthan: Jodhpur: Mandore, 09.ix.1964, coll. V.C. Agarwal.

Distribution: India (Rajasthan: Mandore, Udaipur, Kota; Uttarakhand: Dehra Dun, Kalsi; Bengal: Kolkata; Assam: Brahmaputra river above Jorhat; Bihar: Pusa; Odisha: Puri; Maharashtra: Bhandara, Pune, Sangli; Karnataka: Gundelpet; Kerala: Tholpetty, Muthanga, Silent Valley, Nilambur), Pakistan (Jhelum), Bangladesh (Dhaka), Myanmar (Rangoon, Teinzo), Nepal, Vietnam (Annam), Indonesia (Java, Sumatra), and China.

***Chlaenius pretiosus* Chaudoir, 1856**

Image 3D

Specimens examined: 5 exs., 1 male, India: Rajasthan: Jodhpur: Kailana, 12.ix.1979, coll. K.V. Rama Rao; 1 female, 'I/720', India: Rajasthan: Jodhpur: Kailana, 04.ix.1964, coll. V.C. Agarwal; 1 female, 'I/728', India: Rajasthan: Jodhpur: Thakat Sagar, coll. V.C. Agarwal; 1 female, '3152', India: Rajasthan: Jodhpur: Kailana, 24.ix.1964, coll. K.V.S. Rao; 1 female, '304/4', India: Rajasthan: Jodhpur: Ratanada, 20.viii.1984, coll. N.S. Rathore.

Distribution: India (Delhi; Rajasthan: Jaipur, Ajmer, Jodhpur (Kailana, Thakat Sagar, Ratanada); Uttar Pradesh: Sitapur, Mughal Sarai, Lucknow; Uttarakhand: Dehra Dun, Almora)**,** Pakistan, and Sri Lanka.

***Chlaenius propinquus* Csiki, 1931 ***

Image 3E

Specimens examined: 2 exs., 1 female, '8884/5', India: Rajasthan: Jodhpur; ZSI Campus, 24.viii.2001, coll. R. Sewak; 1 sex undetermined, India: Rajasthan: Jodhpur: Kailana, 10.iv.1964, coll. V.C. Agarwal.

Distribution: India (Rajasthan: Jodhpur (ZSI campus, Kailana); Gujrat) and Bangladesh.

***Chlaenius velocipes* Chaudoir, 1876**

Image 3F

Specimen examined: 1 ex. female, '3/443', India: Rajasthan: Jodhpur: Tiwari village, 05.i.1963, coll. K.C. Kansal.

Distribution: India (Himachal Pradesh: Kangra; Rajasthan: Jaipur (Durgapura), Jodhpur, Udaipur (Udai Sagar, RCA Campus), Bhilwara, Banswara; Uttarakhand: Someshwar, Nainital, Almora, Bhimtal, Haldwani; Bengal: Purulia; Manipur; Maharashtra: Kasara; Tamil Nadu: Kodaikanal, Nilgiri Hills; Kerala: Cardamom hills, Periyar Lake), Sri Lanka (Dikoya), and Nepal.

***Chlaenius virgulifer* Chaudoir, 1876 ***

Image 3G

Specimens examined: 2 exs., 1 male, '8260/3', India: Rajasthan: Jodhpur: Kailana, 21.ix.1979, coll. N.S. Rathore; 1 male, '3/283', India: Rajasthan: Jodhpur: Bijolai tank, date unknown, coll. R.C. Sharma.

Distribution: India (Rajasthan: Jodhpur (Kailana, Bijolai tank); Maharashtra: Pune, Koyna Wildlife Sanctuary, Satara)**,** China, Japan, North Korea, and South Korea.

Genus *Harpaglossus* Motschulsky, 1858

***Harpaglossus opacus* Chaudoir, 1857**

Image 3H

Specimens examined: 46 exs., 1 sex undetermined, '1335', India: Rajasthan: Jodhpur: Paota, 19.ix.1963, coll. R.N. Bhargava; 9 males, 5 females, 'I/608', India: Rajasthan: Jodhpur: Kailana, 22.vii.1964, coll. V.C. Agarwal; 1 female, 'I/635', India: Rajasthan: Jodhpur: Agolai village, 28.vii.1964, coll. V.C. Agarwal; 2 females, '3048', India: Rajasthan: Jodhpur, 10.ix.1964, coll. R.N. Bhargava; 1 female, 'I/805', India: Rajasthan: Jodhpur: Agolai Tank, 18.ix.1964, coll. R.N. Bhargava; 1 sex undetermined, India: Rajasthan: Jodhpur: Poata, 29.vii.1961, coll. K.C. Kansal; 2 females, 'I2142', India: Rajasthan: Jodhpur: Agolai, 19.vii.1965, coll. P.D. Gupta; 1 male, 2 females, '3039', India: Rajasthan: Jodhpur: Mandore, 09.ix.1964, coll. V.C. Agarwal; 1 female, 'I/660', India: Rajasthan: Jodhpur: Paota (Patodi House), 15.viii.1964, coll. R.N. Bhargava; 2 males, 9 females, '8877/5', India: Rajasthan: Jodhpur: ZSI Campus, 11.viii.2001, coll. R. Sewak; 3 females, 'I2170', India: Rajasthan: Jodhpur: Bariganga, 03.viii.1965, coll. V.C. Agarwal; 2 males, 'I/871', India: Rajasthan: Jodhpur: Paota, 25.ix.1964, coll. K. V. S. Rao; 1 male, India: Rajasthan: Jodhpur: Khandia tank, 13.ii.1963, coll. K.C. Kansal; 1 male, 'I/841', India: Rajasthan: Jodhpur: Danjur, 22.ix.1964, coll. K.K.S. Rao; 1 male, '1419', India: Rajasthan: Jodhpur: Mandore, 04.x.1963, coll. K.C. Kansal; 1 male, 'I/1775', India: Rajasthan: Jodhpur: Mandore, 09.ix.1964, coll. V.C. Agarwal,

Distribution: India (Rajasthan: Jodhpur (Paota,

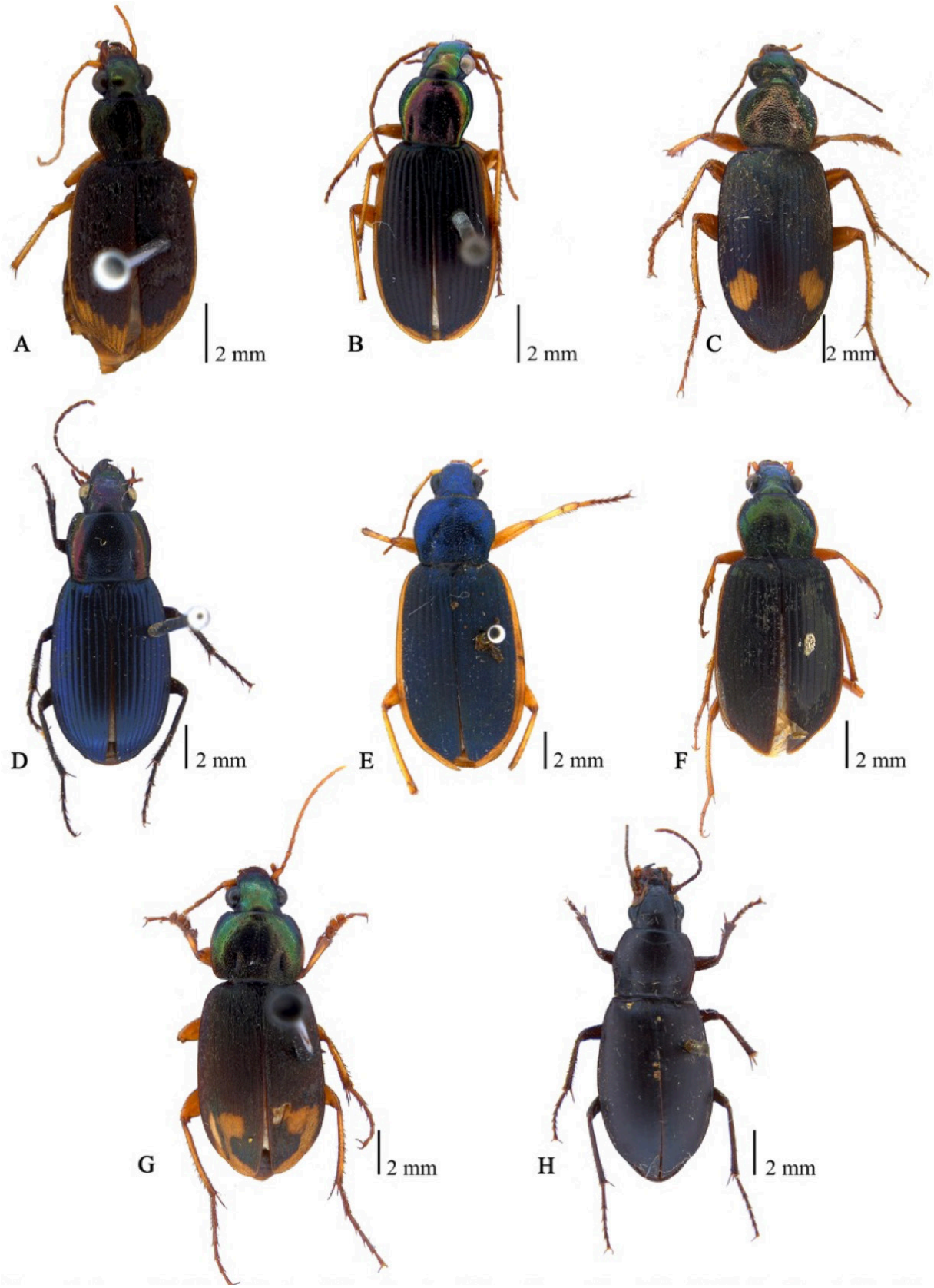

Image 3. Dorsal habitus of: A—*Chlaenius laeviplaga frater* Chaudoir, 1876 | B—*Chlaenius nitidicollis* Dejean, 1826 | C—*Chlaenius posticus* (Fabricius, 1798) | D—*Chlaenius pretiosus* Chaudoir, 1856 | E—*Chlaenius propinquus* Csiki, 1931 | F—*Chlaenius velocipes* Chaudoir, 1876 | G—*Chlaenius virgulifer* Chaudoir, 1876 | H—*Harpaglossus opacus* (Chaudoir, 1857).

Kailana, Agolai Village, Mandore, ZSI campus, Khandia tank, Bariganga), Ajmer; Gujarat: Kathiawar, Ghogha; West Bengal; Uttar Pradesh: Sitapur; Tamil Nadu: Thiruchirapally) and Sri Lanka.

DISCUSSION

Seventeen species of Carabidae belonging to five subfamilies (Anthiinae, Brachininae, Carabinae, Harpalinae, and Licininae) were recorded from Thar Desert in contrast to the record of 32 species belonging to 10 subfamilies (Brachininae, Carabinae, Dryptinae, Harpalinae, Lebiinae, Licininae, Platyninae, Pterostichinae, Scaritinae, and Trechinae) (Ghahari et al. 2012; Azadbakhsh & Nozari 2015) from southern Iran subtropical desert region to which Thar Desert is connected. Eight species (*Brachinus pictus* (Hope, 1833); *Chlaenius laeviplaga frater* Chaudoir, 1876; *C. propinquus* Csiki, 1931; *C. virgulifer* Chaudoir, 1876; *Omphra complanata* Reiche, 1843; *Pheropsophus lissoderus* Chaudoir, 1850; *P. sobrinus* (Dejean, 1826) and *Pseudognathaphanus punctilabris* W.S. Macleay, 1825) are first records from Rajasthan.

Among the two species of *Calosoma* (*C. imbricatum* Klug, 1832; *C. orientale* Hope, 1834) recorded from the Thar Desert, *C. imbricatum* is a desert specialist showing a distinct distributional pattern along the Saharo-Arabian desert belt. Globally, seven subspecies of *Calosoma imbricatum* (*C. imbricatum andrewesi* Breuning, 1928; *C. imbricatum augustasi* Obydov, 2005; *C. imbricatum deserticola* Semenov, 1897; *C. imbricatum hottentottum* Chaudoir, 1852; *C. imbricatum imbricatum* Klug, 1832; *C. imbricatum linnavuorii* Mandl, 1968; *C. imbricatum loeffleri* Mandl, 1953) were recorded (Mandl 1970; Lorenz 2020) so far, with only one subspecies, *C. imbricatum andrewesi* Breuning, 1928 with distribution outside a desert environment (recorded from Assam; and north of old Bengal Presidency which could be part of current Rajasthan state) (Breuning 1928; Andrewes 1929). *Calosoma imbricatum loeffleri* Mandl, 1953 was synonymised with *Calosoma imbricatum imbricatum* Klug, 1832 by Bruschi (2013).

Of the 17 species recorded from the Thar Desert, only two species (*Anthia sexguttata* and *Calosoma imbricatum*) had desert adaptations like large size and flattened body (fused elytra is an additional desert adaptation in *Anthia sexguttata*) which help in reducing the respiratory water loss (Cloudsley-Thompson 1964; Ahearn & Hadley 1969; Andersen et al. 1986). *Calosoma imbricatum* does not have fused elytra but have strong flight ability (Farkač & Häckel 2012) which help them to avoid low humidity and dry air (Andersen et al. 1986). These two species are recorded only from arid and semi-arid regions at global level. They are widely present and are large non-subterranean/ surface dwelling carabid species in the Thar Desert habitat. Thus, these two species should be taken as the flagship predatory Carabidae of the Indian Thar Desert region.

Of the 17 species recorded, nine species are of subfamily Licininae (eight species of *Chlaenius* and one species of *Harpaglossus*). While analysing the collections and labels of Licininae from the desert region, it was observed that each species was collected in multiple numbers from a single locality, which points towards its previous reports (Bonacci et al. 2004) of showing aggregation behaviour. Members of both *Chlaenius* and *Harpaglossus* show aggregation behaviour, which is a desert adaptation, by which the relative humidity of the habitat could be increased thus decreasing the collective cuticular transpirational water loss (Andersen et al. 1986; Bonacci et al. 2004). Also, most *Chlaenius* are seen near available water bodies in deserts (Bonacci et al. 2004; Kataev pers. comm. 2021), as observed during the present study also. It is apparent from the distribution that other than the two large species – *Anthia sexguttata* and *Calosoma imbricatum* – most species are widely distributed in India and do not have any specific adaptation for desert habitat.

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