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A study of the genus *Sphex* Linnaeus (Hymenoptera: Sphecidae) from India

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ABSTRACT. The genus *Sphex* Linnaeus (Hymenoptera: Sphecidae) is studied from India and key to Indian species is provided. The state-wise distributions of four species of *Sphex* are augmented here. A new synonymy is proposed: *Sphex zubaidiyacus* Augul, 2013 = *S. obscurus* (Fabricius, 1804).

Key words: Digger wasps, *Sphex*, India, new records, taxonomy, key

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Introduction

Digger wasps of the genus *Sphex* Linnaeus, 1758 are moderate to large wasps of the family Sphecidae (Insecta: Hymenoptera) and subfamily Sphecinae (Bohart & Menke, 1976). They show a variable distribution along various zoogeographical lines with most species reported from the Afrotropics followed by Australia (pers. comm. Thorleif H. Dörfel). However, this speciose group is scarcely reported from India with only nine recorded species till date. They are *Sphex argentatus* Fabricius, 1787; *S. deplanatus* Kohl, 1895; *S. diabolicus* F. Smith, 1858; *S. neoumbrosus* Jha & Farooqi, 1996; *S. obscurus* (Fabricius, 1804); *S. praedator* Smith, 1858; *S. pruinosus* Germar, 1817; *S. sericeus* (Fabricius, 1793); and *S. subtruncatus* Dahlbom, 1843. Female wasps of the genus are powerful predators, in which many species hunt on Orthoptera of the families Tettigoniidae, a few on Gryllacrididae and some on Gryllidae as provision for their larvae (Bohart & Menke, 1976; Evans et al., 1982; Kazenas, 2001; Roche, 2007; Dörfel & Ohl, 2015).

The genus *Sphex* was established by Linnaeus in 1758 based on the type species *S. flavipennis* Fabricius, 1793. Generic revisions were published by Menke & Pulawski (2000), Schmid-Egger (2014, 2019) and Dörfel & Ohl (2015). Taxonomic study of Indian *Sphex* remains scarce and limited. Here we aim to provide a study on the taxonomy and distribution of the *Sphex* species from India. Key characters of the species present in India were studied from relevant literatures (Smith, 1858a, 1858b; Cameron, 1889; Kohl, 1895; Bingham, 1897; Hensen, 1991; Jha & Farooqi, 1996; Dörfel & Ohl, 2015) and working key was prepared for the identification of Indian species which is provided below. *Sphex*

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zubaidiyacu Augul, 2013 described from the Palaearctic region (Iraq, Baghdad) is newly synonymised here with *S. obscurus* Fabricius. *S. fumicatus* Christ, 1791 and *S. ichneumoneus* (Linnaeus, 1758) reported from India and reports of some Indian species from the African region by previous workers are omitted here due to the need of validation.

Material and methods

Specimens from the National Collections of Zoological Survey of India, Western Ghat Regional Centre, Kozhikode (ZSIK) along with fresh specimens collected from various localities in India were examined for the present study. The specimens mounted on entomological pins were studied under LEICA M205 stereoscopic binocular microscope and images were captured using attached LEICADFC 500 camera. Habitus images of the species were captured with digital camera (Canon Power Shot SX540HS). Measurements were obtained using Leica LAS (Leica Application Suite V3.80) microsystems by Leica (Heerburg, Switzerland). Images at varying focal planes were stacked using Leica Automontage Software V3.80 and the final illustrations were processed for contrast and brightness using Adobe® Photoshop® CS5 (Version 6.1) software. After curation, freshly collected specimens are added to the 'National Zoological Collections' of ZSIK. The morphological terminology used in this paper mostly follows [Bohart & Menke \(1976\)](#).

Museum abbreviations: NHMW: Naturhistorisches Museum, Wien, Austria; NHRCM: Natural History Research Center and Museum, University of Baghdad, Iraq; OXUM: Hope Department of Entomology, Oxford, Great Britain; ZMUC: Zoological Museum, University of Copenhagen, Copenhagen, Denmark; ZSIK: Western Ghat Regional Centre, Zoological Survey of India, Kozhikode, India.

Results

Genus *Sphex* Linnaeus, 1758

Sphex Linnaeus, 1758: 569. Type species: *Sphex flavipennis* Fabricius, 1793, designated by International Commission on Zoological Nomenclature, 1946: 571 (Opinion 180) which reversed its earlier designation as type of *Sphex sabulosus* Linnaeus, 1758 (1911: 76, Opinion 32).

[Pulawski \(2021\)](#) gives a list of the synonymy, which is not repeated here.

Diagnosis. Length of basal veinlet of submarginal cell II equal to or (more often) shorter than anterior veinlet; inner orbits straight below but curving towards ocelli above; hind tibial spur closely, usually finely pectinate inside; length of petiole as measured along dorsum less than combined length of hind tarsomeres II-IV ([Bohart & Menke, 1976](#)).

Sphex argentatus Fabricius, 1787 (Figs 1-9, 38)

Sphex argentatus Fabricius, 1787: 274, sex not indicated (as *argentata*, incorrect original termination). Lectotype: ♀, southeastern India: Coromandel coast: no specific locality (ZMUC).

[Pulawski \(2021\)](#) gives a list of the synonymy, which is not repeated here.

Diagnosis. Female (Figs 1-6). Body entirely black; frons and clypeus with appressed silvery white pubescence and long erect setae of same colour, clypeus slightly convex, anterior margin medially with two indistinct lobes (Fig. 2); pronotal collar and scutum with moderately dense silvery white pubescence, scutum with slightly denser pubescence

laterally than medially; scutellum with shallow median impression near posterior margin; metanotum strongly bituberculate; propodeal enclosure transversely striate and covered with erect silvery white setae (Fig. 4); mesepisternum with silvery white setae (Fig. 5); metasoma finely pubescent (visible as aciculations under low magnification); fore wings hyaline with fuscous patch at apex, base darkened (Fig. 3).

Male (Figs 7–9). Resembles female in most aspects except, free clypeal margin truncate, slightly concave towards center with short median lobe (Fig. 8); antennae of male with placoids on fifth flagellomere.

Male genitalia (Fig. 38). Gonostyle pointed towards apex and covered with thick pubescence subapically; head of digitus in volsella with pyramid-shaped and clothed with moderately dense pubescence, apex of cuspis distinctly acuminate; penis valve long and slender with short head.

Material examined. INDIA: Kerala, Kozhikode district, Madappally, 4♂♂ and 2♀♀, 11.iii.2020, Coll. S. Anagha, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV. 17338–17343; Kozhikode district, Ashokapuram, 1♀, 11.i.2020, Coll. S. Anagha, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17868; Kozhikode district, East Hill, 3♂♂, 14.x.2015, Coll. P. Girish Kumar, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV. 17877–17879; Kozhikode district, Chaliyam, 2♂♂ and 1♀, 7.x.2016, Coll. P. Manju, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV. 17880–17882. Tamil Nadu, Tirunelveli district, Rosemiyapuram, 1♀, 25.ix.2018, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17860; Tirunelveli district, Kalakkad Mundanthurai Tiger Reserve (KMTR), 1♀, 28.ix.2018, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17861; Tirunelveli district, Kodumudiyar dam site, 1♀, 28.ix.2018, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17862; Tirunelveli district, Ramanadi dam site, 1♀, 2.x.2018, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17869. Telangana, Ranga Reddy district, Rajendra Nagar, 1♂ and 4♀♀, 24–25.x.2016, Coll. P. Girish Kumar, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV. 17863–17867; Medak district, 1♀, 27.x.2016, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17870.

Distribution. India: Arunachal Pradesh, Assam, Bihar, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Punjab, Sikkim, Tamil Nadu, Telangana (new record), Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere:* Australia; Cambodia; China (including Hong Kong); Dableeh Island; Indonesia; Israel; Japan; Kazakhstan; Korea; Kuwait; Laos; Malaysia; Myanmar; New Guinea; Pakistan; Philippines; Sri Lanka; Taiwan; Thailand; Vietnam (Jonathan & Kundu, 2003; Kundu et al., 2006; Barthélémy, 2014; Anagha & Girish Kumar, 2020; Gadallah, 2020; Pulawski, 2021).

Sphex deplanatus Kohl, 1895

Sphex deplanatus Kohl, 1895: 53, ♂. Holotype: ♂, Sri Lanka: no specific locality (NHMW).

Diagnosis. Male. Body black except metasoma red on side; head and thorax with silvery white pubescence; scutellum not convex, almost flattened; propodeal enclosure with five transverse wrinkles; fore wings infuscate violaceo-resplendentes.

Note. As no specimens were seen during the present study, the above diagnosis has been based on original description (Kohl, 1895). The description of the female of *S. deplanatus* by Kohl was based on misidentified specimens (pers. comm. Thorleif H. Dörfel) so the diagnosis of female has been excluded.



Figures 1–9. *Sphex argentatus* Fabricius, 1–6 ♀. 1. Habitus, lateral view; 2. Head, frontal view; 3. Fore wing; 4. Mesosoma, dorsal view; 5. Mesosoma, lateral view; 6. Metasoma, dorsal view. 7–9 ♂. 7. Habitus, lateral view; 8. Head, frontal view; 9. Metasoma, dorsal view.

Sphex diabolicus F. Smith, 1858

Sphex diabolicus F. Smith, 1858a: 100, ♀. Lectotype: ♀, Malaysia: Sarawak: no specific locality (OXUM), designated by van der Vecht, 1973: 342.

Pulawski (2021) gives a list of the synonymy, which is not repeated here.

Diagnosis. Body black; head pubescent; scutellum prominent with slight shallow longitudinal furrow; metanotum bituberculate; propodeal enclosure densely pubescent; fore wings strongly yellowish to yellowish brown.

Note. As no specimens were seen during the present study, the above diagnosis has been based on published descriptions (Smith, 1858a; Bingham, 1897; Strand, 1913; Hensen, 1991).

Variability. Vestiture on frons and propodeum of species is found to be variable from black to yellow (Smith, 1858a; Bingham, 1897; Strand, 1913).

Sphex neoumbrosus Jha & Farooqi, 1996

Sphex neoumbrosus Jha & Farooqi, 1996: 13, ♀. Holotype: ♀, India: Karnataka: South Coorg District: Polibetta.

Diagnosis. Female. Body black; clypeus broader than long with paired minute lobes, not delimited by submedian notches, lateral margin slightly wavy (see Fig. 1 of Jha & Farooqi (1996: 14)); dark brown long and short pubescence all over body except on flagellomeres, tibiae, tarsi and metasomal terga; scutellum with median longitudinal furrow; metanotum more or less bituberculate; propodeal enclosure transversely and finely striate; fore wings hyaline with bright yellow fulvescens, apex smoky.

Male. Unknown.

Note. As no specimens were seen during the present study, the above diagnosis has been based on original description (Jha & Farooqi, 1996).

Sphex obscurus (Fabricius, 1804) (Figs 10–22, 39)

Pepsis obscura Fabricius, 1804: 213, sex not indicated, junior secondary homonym of *Sphex obscurus* Schrank, 1802 (now in Pompilidae), valid under Article 59.2 of the Code. Lectotype: ♂, India: no specific locality (ZMUC).

As *Sphex obscurus*: Dalla Torre, 1897: 419.

Sphex zubaidiyacus Augul, 2013: 476, ♀, ♂, misspelled *zubaidiyanic* in Abstract. Holotype: ♂, Iraq: Wasit Province: center of Al-Zubaidiya region (NHRCM). **NEW SYNONYMY.**

Justification of new Synonymy. Analysis of key characters of fresh specimens of *Sphex obscurus* collected from Southern India, lectotype of species available from Zoological Museum Copenhagen (<http://www.daim.snm.ku.dk/digitized-type-collection-details-simple?catno=zmuc00241276>) and from related literature, the authors find it judicious to assign *S. zubaidiyacus* Augul described from Iraq (Augul, 2013) as a junior synonym of *S. obscurus*.

Diagnosis. Female (Figs 10–15). Body black; frons and clypeus with distinct appressed silvery white pubescence and long erect setae of same colour; anterior clypeal margin medially with two lobes (Fig. 11); pronotal collar, scutum and scutellum with moderately dense silvery white pubescence, scutum with slightly denser pubescence laterally than medially; metanotum simple, not bituberculate, with pubescence similar as on scutellum;

propodeal enclosure with erect and appressed silvery white and golden yellow setae ([Fig. 12](#)); mesepisternum with silvery white setae ([Fig. 13](#)); metasoma finely pubescent (visible as aciculations under low magnification) ([Fig. 15](#)); fore wings subhyaline with orange tinge ([Fig. 14](#)).

Male ([Figs 16–22](#)). Resembles female in most aspects, vary in colour of pubescence, pubescence on head and thorax golden yellow ([Figs 18 & 19](#)); clypeus elongate, clearly swollen at middle ([Fig. 18](#)); antennae with placoids on the proximal third of flagellomere five and six ([Fig. 18](#)).

Male genitalia ([Fig. 39](#)). Gonostyle pointed towards apex covered with sparse pubescence; head of digitus in volvella pyramid-shaped (broader than in *Sphex argentatus*) and clothed with moderately dense pubescence, apex of cuspis distinctly acuminate; penis valve long and slender with short head.

Material examined. INDIA: Kerala, Kozhikode district, Madappally, 3♂♂ and 1♀, 6.ii.2020, Coll. S. Anagha, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV. 17871–17874; Kannur district, Kannapuram, 1♂, 17.iii.2019, Coll. C. Charesh, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17875; Kozhikode district, Peruvannamuzhi, 1♂, 20.v.2019, Coll. K. Anju, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17876.

Distribution. India: Kerala (new record), Uttarakhand, West Bengal. *Elsewhere:* Iraq; Sri Lanka; Thailand; Turkmenistan; United Arab Emirates ([Pulawski, 2021](#)).

Sphex praedor F. Smith, 1858

Sphex praedor F. Smith, 1858b: 14, ♂. Holotype or syntypes: ♂, Indonesia: Sulawesi; no specific locality (OXUM).

[Pulawski \(2021\)](#) gives a list of the synonymy, which is not repeated here.

Diagnosis. Body black with black pubescence; frons with silvery white pubescence and black setae; pronotal collar entire; scutellum naked and shining; metanotum simple; propodeal enclosure transversely finely rugulose; fore wings strongly yellowish to dark brown with violaceous effulgence.

Note. As no specimens were seen during the present study, the above diagnosis has been based on published descriptions ([Smith, 1858b](#); [Bingham, 1897](#)).

Sphex pruinosis Germar, 1817

Sphex pruinosis Germar, 1817: 261, ♂ (as *pruinosa*, incorrect original termination). Holotype or syntypes: Dalmatia: Spalatro, now Croatia: Split (depository?).

[Pulawski \(2021\)](#) gives a list of the synonymy, which is not repeated here.

Diagnosis. Body black with metasoma partly or entirely red or ferruginous; head and thorax with silvery white pubescence; scutellum with median furrow; metanotum with indistinct tubercles; propodeal enclosure with broad transverse ridges; fore wings hyaline with smoky apex.

Note. As no specimens were seen during the present study, the above diagnosis has been based on published descriptions ([Kohl, 1885](#); [Cameron, 1889](#); [Nurse, 1903](#); [Roche, 2007](#)).

Variability. Male show variation in colour of metasoma being entirely black or red or ferruginous or partly red or ferruginous ([Kohl, 1885](#); [Cameron, 1889](#); [Nurse, 1903](#); [Roche, 2007](#)).

Sphex sericeus (Fabricius, 1793) (Figs 23–31, 40)

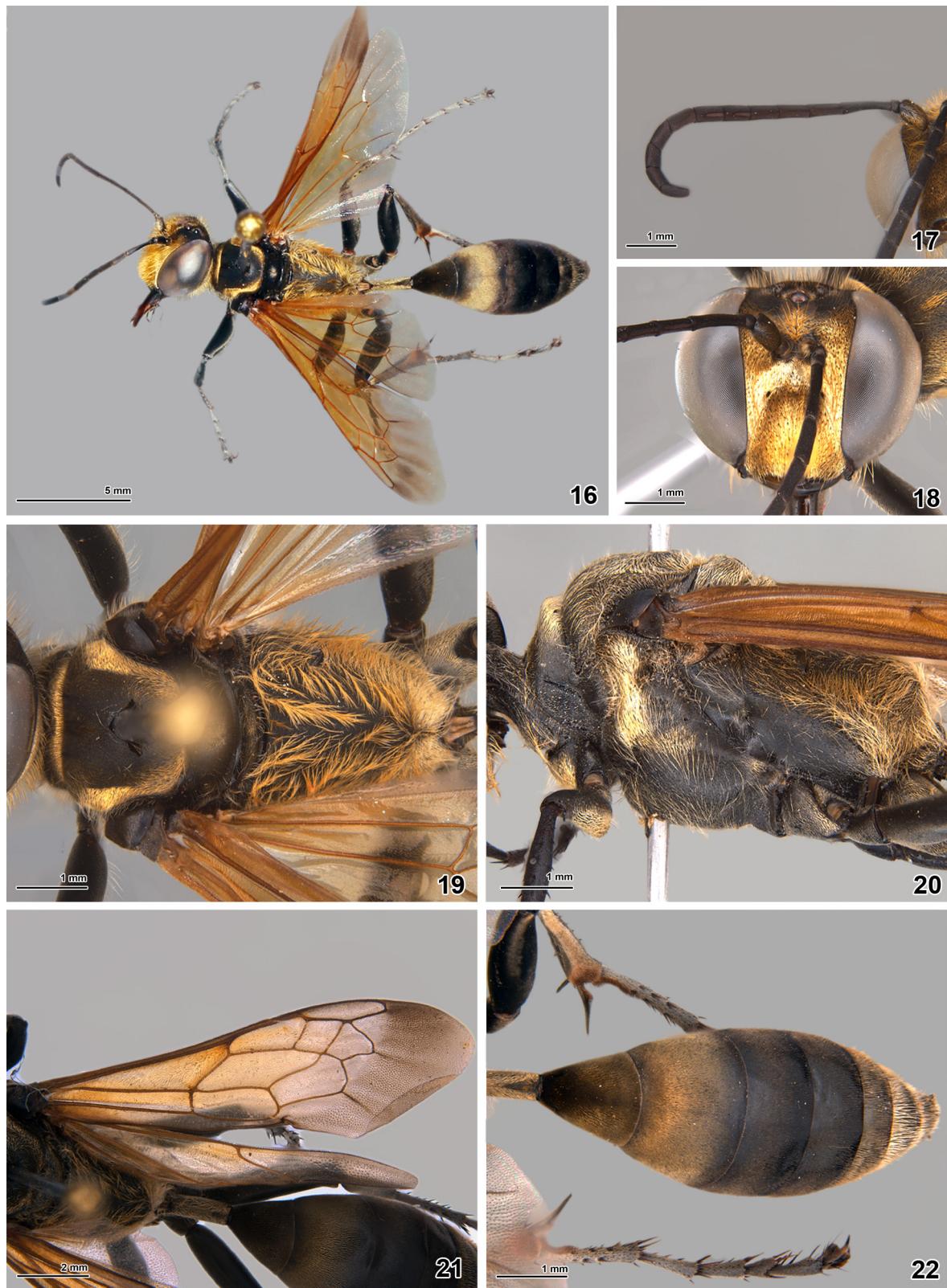
Sphex aurulentus Fabricius, 1793: 201, sex not indicated, junior primary homonym of *Sphex aurulentus* Fabricius, 1787 (now in *Liris*). Holotype or syntypes: India: Tranquebar (depository unknown).

As *Sphex sericeus*: Dahlbom, 1843: 26.

Pulawski (2021) gives a list of the synonymy, which is not repeated here.



Figures 10–15. *Sphex obscurus* (Fabricius), ♀. **10.** Habitus, lateral view; **11.** Head, frontal view; **12.** Mesosoma, dorsal view; **13.** Mesosoma, lateral view; **14.** Fore wing; **15.** Metasoma, dorsal view.



Figures 16–22. *Sphex obscurus* (Fabricius), ♂. **16.** Habitus, lateral view; **17.** Antennae; **18.** Head, frontal view; **19.** Mesosoma, dorsal view; **20.** Mesosoma, lateral view; **21.** Fore wing; **22.** Metasoma, dorsal view.

Diagnosis. Female (Figs 23–31). Body black with following parts orange: basal half of mandible, clypeus, scape, pedicel, base of flagellomere I, scutellum, metanotum, first and anterior two third of second metasomal segments, and legs excluding claw; frons and clypeus with appressed orange pubescence and long erect setae of same colour; clypeus swollen at middle with glabrous stripe, anterior margin notched in middle (Fig. 24); pronotal collar and scutum with moderately dense orange pubescence, scutum with slightly denser pubescence laterally than medially; scutellum with shallow median impression near posterior margin; metanotum strongly bituberculate; propodeal enclosure with three to four broad transverse ridges, appressed orange pubescence and sparse, erect setae of same colour (Fig. 26); mesepisternum with orange setae (Fig. 27); metasoma finely pubescent (visible as aciculations under low magnification) (Fig. 28); fore wings fuscous with slight blue iridescence (Fig. 25).

Male (Figs 29–31). Vary largely in colour with female, body black except metasoma; pubescence on head and thorax silvery white; metasoma mixed with red and black colours (Fig. 31); free clypeal margin concave towards center (Fig. 30); antennae of male with placoids on fifth to sixth flagellomere.

Male genitalia (Fig. 40). Gonostyle slightly pointed towards apex, digitus in volsella with short head, apex of cuspis acuminate; penis valve long and slender.

Variability. One female specimen from South Andaman examined here shows colour variation in metasoma being completely black; all the female specimens examined here have petiole black and wings fuscous with blue iridescence while petiole is red or orange and wings subhyaline with yellow tinge according to previous workers (Bingham, 1897; Dörfel & Ohl, 2015).

Material examined. INDIA: Andaman & Nicobar Island, South Andaman, Ranchi Basthi, 1♀, 9.viii.2016, Coll. A.K. Dubey, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17990. Goa, North Goa district, Mhadei Wildlife Sanctuary, 1♂, 15.v.2018, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17892. Kerala, Kozhikode district, Balusseri, 1♀, 7.x.1998, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17345; Thiruvananthapuram district, Peppara Wildlife Sanctuary, Peppara dam site, 1♂, 28.ix.2018, Coll. S. Anagha, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17895; Kozhikode district, Madappally, 1♂, 11.iii.2020, Coll. S. Anagha, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17896; Thrissur district, Vellanikkara, 1♂, 5–16.x.2020, Coll. Anusree Padmanabhan, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17897; Kannur district, Munderi Kadavu, 2♂♂, 10.iii.2016, Coll. Rajesh, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17899–17900. Tamil Nadu, Tirunelveli district, Kalakkad Mundanthurai Tiger Reserve (KMTR), Kalakkad, 1♀, 26.ix.2018, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17887; Tirunelveli district, Courtallam, Shenbegadevi temple, 1♀, 26.iii.2019, Coll. B.H.C.K Murthy & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17889; Kanyakumari district, Kanyakumari Wildlife Sanctuary, Kulashkaram range, 1♀, 19.iii.2020, Coll. S. Sen & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17890; Kanyakumari district, Kanyakumari Wildlife Sanctuary, Alagiyapandipuram range, 1♀, 16.iii.2020, Coll. S. Sen & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17891; Tirunelveli district, Rosemiyapuram, 1♂, 25.ix.2018, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17893; Tirunelveli district, Koothankulam Bird Sanctuary, 1♂, 27.ix.2018, Coll. P. Girish Kumar & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17894; Kanyakumari district, Kanyakumari Wildlife Sanctuary, Boothapandi range, Sengamal Saragam, 1♂, 18.ii.2020, Coll. S. Sen & Party, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17898. Uttarakhand, Dehradun district, Wildlife Institute of India Campus, 1♀, 10–13.viii.2017, Coll. P. Girish Kumar, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17885.



Figures 23–31. *Sphex sericeus* (Fabricius), 23–28 ♀. 23. Habitus, lateral view; 24. Head, frontal view; 25. Fore wing; 26. Mesosoma, dorsal view; 27. Mesosoma, lateral view; 28. Metasoma, dorsal view. 29–31 ♂. 29. Habitus, lateral view; 30. Head, frontal view; 31. Metasoma, dorsal view.

Distribution. India: Andaman & Nicobar Island (new record), Assam, Goa (new record), Karnataka, Kerala, Maharashtra, Meghalaya, Odisha, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere:* Australia; Cambodia; Chagos Archipelago; China (including Hong Kong); Indonesia; Japan; Korea; Laos; Malaysia; Myanmar; New Guinea; Pakistan; Philippines; Sri Lanka; Taiwan; Thailand; Vietnam ([Sudheendrakumar & Narendran, 1989](#); [Jonathan & Kundu, 2003](#); [Barthélémy, 2014](#); [Anagha & Girish Kumar, 2020](#); [Pulawski, 2021](#)).

Sphex subtruncatus Dahlbom, 1843 (Figs 32–37)

Sphex subtruncatus Dahlbom, 1843: 25, ♀ (as *subtruncata*, incorrect original termination). Lectotype: ♀, "Africa": no specific locality but actually Oriental Region according to W. Schulz, 1912: 94 (Lund).

[Pulawski \(2021\)](#) gives a list of the synonymy, which is not repeated here.

Diagnosis. Female. Body black, femora and tibiae orange; frons and clypeus with appressed silvery white pubescence and long erect black setae; clypeus slightly convex, anterior clypeal margin medially emarginate ([Fig. 33](#)); pronotal collar and scutum with brown or black pubescence; scutellum and metanotum with median impression; metanotum simple, not bituberculate; propodeal enclosure transversely ruguloso-striate with median impression and erect black setae ([Fig. 34](#)); mesepisternum with black setae ([Fig. 35](#)); metasoma finely pubescent (visible as aciculations under low magnification) ([Fig. 37](#)); fore wings subhyaline with yellowish tinge and fuscous patch at apex ([Fig. 36](#)).

Male. Not seen in the present study. Similar to female except smaller size; wings darker; clypeus longer, anterior margin slightly arched, almost truncate ([Bingham, 1897](#)).

Variability. Colour of wings and legs of species is found to be variable. Wings in certain specimens are dark fuscous with a brilliant purple effulgence, and have very little of the yellow tinge on the disc; femora and tibiae of the intermediate and posterior pair, or of the posterior pair only, may be wholly or partially red or orange ([Bingham, 1897](#)).

Material examined. India: Kerala, Kozhikode district, Nadakkavu, 1♀, 6.viii.2020, Coll. J.B. Terine, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17908; Kozhikode district, Madappally, 1♀, 6.vii.2020, Coll. S. Anagha, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17909; Kozhikode district, Jaferkhan Colony, ZSI Campus, 1♀, 3.ix.2019, Coll. K.P. Hanima Raveendran, ZSIK Regd. No. ZSI/WGRC/I.R.-INV. 17910. Uttarakhand, Dehradun district, Wildlife Institute of India Campus, 5♀♀, 10–13.viii.2017, Coll. P. Girish Kumar, ZSIK Regd. Nos. ZSI/WGRC/I.R.-INV. 17903-17907.

Distribution. India: Arunachal Pradesh, Himachal Pradesh, Karnataka, Kerala, Meghalaya, Sikkim, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere:* Bhutan; China (including Hong Kong); Indonesia; Japan; Korea; Laos; Myanmar; Nepal; Philippines; Singapore; Sri Lanka; Taiwan; Thailand; Vietnam ([Barthélémy, 2014](#); [Dollfuss, 2008](#); [Kundu et al., 2006](#); [Anagha & Girish Kumar, 2020](#); [Pulawski, 2021](#)).

Note. [Girish Kumar et al. \(2018\)](#) misidentified the species as *Sphex praedator* F. Smith, 1858.



Figures 32–37. *Sphex subtruncatus* Dahlbom, ♀. 32. Habitus, lateral view; 33. Head, frontal view; 34. Mesosoma, dorsal view; 35. Mesosoma, lateral view; 36. Fore wing; 37. Metasoma, dorsal view.

Key to Indian species of *Sphex* (except *S. deplanatus* Kohl, 1895 due to unavailability of key characters)

1. Metanotum with medially raised tubercles (Figs 4 & 26). 2
- Metanotum without medially raised tubercles (Figs 12, 19 & 34) (indistinct tubercles in *S. pruinosus* Germar, 1817). 5
2. Propodeal enclosure with broad transverse ridges (Fig. 26). *Sphex sericeus* (Fabricius, 1804)
- Propodeal enclosure without broad transverse ridges (Fig. 4). 3

3. Cellular wing area clearly hyaline without yellow tinge (Fig. 3).
 *Sphex argentatus* Fabricius, 1787
 – Cellular wing area subhyaline with yellow tinge.4
4. Pubescence on propodeal enclosure concealing sculpture.
 *Sphex diabolicus* F. Smith, 1858
 – Pubescence on propodeal enclosure not concealing sculpture.
 *Sphex neoumbrosus* Jha & Farooqi, 1996
5. Propodeal enclosure with broad transverse ridges. *Sphex pruinosus* Germar, 1817
 – Propodeal enclosure without broad transverse ridges.6
6. Legs entirely or partly red or orange. *Sphex subtruncatus* Dahlbom 1843
 – Legs entirely black.7
7. Pubescence on propodeal enclosure silvery white or golden yellow (Figs 12 & 19).
 *Sphex obscurus* (Fabricius, 1793)
 – Pubescence on propodeal enclosure light brown or black.
 *Sphex praedor* F. Smith, 1858



Figures 38–40. Male genitalia. 38. *Sphex argentatus* Fabricius; 39. *Sphex obscurus* (Fabricius); 40. *Sphex sericeus* (Fabricius)

Discussion

Wasps of genus *Sphex* are cosmopolitan in distribution with 132 species worldwide. Of these, *Sphex neoumbrosus* Jha & Farooqi, 1996 is the last Indian species to be reported from the Indian subcontinent and of the Oriental region. The scarcity of studies most likely points to a shortage of accessible taxonomic resources (Forbes et al., 2018) and the present paper aims in providing one such comprehensive study to understand *Sphex* fauna of India. Key and figures of species included may help in the easy identification of the group in future and it is expected that further integrated studies and collection methods may help in identifying more species from the area.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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References

- Anagha, S. & Girish Kumar, P. (2020) A checklist of Sphecidae (Insecta: Hymenoptera: Apoidea) of India. Version 1.0. Available from: www.zsi.gov.in, Updated till June 2020. (Online only).
- Augul, R.S. (2013) A new species of the genus *Sphex* Linnaeus, 1850 (Hymenoptera: Sphecidae; Sphecinae) from Iraq. *International Journal of Advanced Research*, 1, 475–484.
- Barthélémy, C. (2014) Provisional distributional checklist of Hong Kong Sphecidae (Apoidea). *Hong Kong Entomological Bulletin*, 6, 3–10.
- Bingham, C.T. (1897) *The Fauna of British India, including Ceylon and Burma, Hymenoptera, I - Wasps and Bees*. Taylor and Francis, London. 579 p. <https://doi.org/10.5962/bhl.title.100738>
- Bohart, R.M. & Menke, A.S. (1976) *Sphecid wasps of the world. A generic revision*. University of California Press, Berkeley, Los Angeles and London. 695 p. <https://doi.org/10.1525/9780520309548>
- Cameron, P. (1889) Hymenoptera Orientalis [sic]; or contributions to a knowledge of the Hymenoptera of the Oriental Zoological Region. *Memoirs and Proceedings of the Manchester Literary & Philosophical Society*, 2, 91–152. <https://doi.org/10.5962/bhl.title.8802>
- Dahlbom, A.G. (1843) *Hymenoptera Europaea praecipue borealia; formis typicis nonnullis Specierum Generumve Exoticorum aut Extraneorum propter nexus systematicus associatis; per Familias, Genera, Species et Varietates disposita atque descripta. Tomus: Sphex in sensu Linneano. Officina Lundbergiana*. Lund. 1, 1–172. <https://doi.org/10.5962/bhl.title.15890>
- Dalla Torre, K.W. von (1897) *Catalogus Hymenopterorum hucusque descriptorum systematicus et synonymicus, Volumen VIII: Fossores (Sphegidae)*. Guilelmi Engelmann, Lipsiae. 749 p.
- Dollfuss, H. (2008) The Spheciini wasps of the genera *Chilosphex* Bohart & Menke, *Isodontia* Patton, *Palmodes* Kohl, *Prionyx* Vander Linden and *Sphex* Linnaeus of the “Biologiezentrum Linz” collection in Linz, Austria, (Hymenoptera, Apoidea, Sphecidae). *Linzer Biologische Beiträge*, 40, 1399–1434.
- Dörfler, T.H. & Ohl, M. (2015) A revision of the Australian digger wasps in the genus *Sphex* (Hymenoptera, Sphecidae). *Zookeys*, 521, 1–104. <https://doi.org/10.3897/zookeys.521.5995>
- Evans, H.E., Hook, A.W., & Matthews, R.W. (1982) Nesting behaviour of Australian wasps of the genus *Sphex* (Hymenoptera, Sphecidae). *Journal of Natural History*, 16 (2), 219–225. <https://doi.org/10.1080/00222938200770181>

- Fabricius, J. Ch. (1787) *Mantissa insectorum sistens eorum species nuper detectas adiectis characteribus genericis, differentiis specificis, emendationibus, observationibus*. Vol. 1. Christ. Gottl. Proft, Hafniae. 348 p.
<https://doi.org/10.5962/bhl.title.11657>
- Fabricius, J.Ch. (1793) *Entomologia systematica emendata et aucta. Secundum classes, ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus*. Vol.2. Christ. Gottl. Proft, Hafniae. 519 p.
<https://doi.org/10.5962/bhl.title.122153>
- Fabricius, J.Ch. (1804) *Systema Piezatorum secundum Ordines, Genera, Species adiectis Synonymis, Locis, Observationibus, Descriptionibus*. Carolum Reichard, Brunsvigae [= Braunschweig]. 470 p.
<https://doi.org/10.5962/bhl.title.10490>
- Forbes, A.A., Bagley, R.K., Beer.M.A., Hippie, A.C. & Widmayer, H.A. (2018) Quantifying the unquantifiable: why Hymenoptera, not Coleoptera, is the most speciose animal order. *BMC Ecology*, 18, 21. <https://doi.org/10.1186/s12898-018-0176-x>
- Gadallah, N.S. (2020) Biodiversity of the aculeate wasps (Hymenoptera: Aculeata) of the Arabian Peninsula: Apoidea (Spheciformes), Sphecidae (*sensu stricto*). *Zootaxa*, 4754 (1), 77–90.
<https://doi.org/10.11646/zootaxa.4754.1.8>
- Germar, E.F. (1817) *Reisenach Dalmatien und in das Gebiet von Ragusa*. F.A. Brockhaus, Leipzig und Altenburg. Xii + 323 p.
- Girish Kumar, P., Jafer Palot, M. & Charesh, C. (2018) Wasp diversity of Kannapuram mangroves of Kannur district, Kerala. *Trogon articles*, 15 (3), 9–25.
- Hensen, R.V. (1991) Review of Malesian Sphecina (Hymenoptera, Sphecidae, Sphecinae). *Tijdschrift voor Entomologie*, 134, 9–30.
- International Commission of Zoological Nomenclature (1911) Opinion 32. The type of the genus *Sphex*. Opinions Rendered by the International Commission on Zoological Nomenclature. Smithsonian Institution Washington Publication 2013, 76–77. [*Sphex sabulosus* ruled to be the type species].
- International Commission of Zoological Nomenclature (1946) Opinion 180. On the status of the names *Sphex* Linnaeus, 1758, and *Ammophila* Kirby, 1798 (Class Insecta, order Hymenoptera). Opinions and Declarations Rendered by the International Commission on Zoological Nomenclature 2, 571–585.
- Jha, B.S. & Farooqi, S.J. (1996) Descriptions of two new species of Indian Sphecinii (Sphecidae: Hymenoptera). *Shashpa*, 3, 13–16.
- Jonathan, J.K. & Kundu, B.G. (2003) Insecta: Hymenoptera: Sphecidae. *Zoological Survey of India, Fauna of Sikkim, State Fauna Series*, 9 (4), 417–446.
- Kazenas, V.L. (2001) *Fauna i biologiya rojushchikhos (Hymenoptera, Sphecidae) Kazakhstana i Sredney Azii* [= Fauna and biology of sphecid wasps (Hymenoptera, Sphecidae) of Kazakhstan and Central Asia]. Kazgos INTI, Almaty. 333 p.
- Kohl, F.F. (1885) Die Gattungen der Sphecinen und die paläarktische *Sphex*-Arten. *Természetrajzi Füzetek*, 9, 154–207.
- Kohl, F.F. (1895) Zur Monographie der natürlichen Gattung *Sphex* Linné. *Annalen des k.k. Naturhistorischen Hofmuseums*, 10, 42–74. <https://doi.org/10.5962/bhl.part.17608>
- Kundu, B.G., Ghosh, S.N. & Tiwari, R.N. (2006) Insecta: Hymenoptera: Aculeata: Sphecidae. *Zoological Survey of India, Fauna of Arunachal Pradesh, State Fauna Series*, 13(2), 399–426.
- Linnaeus, C. (1758) *Systema naturae*. Editio Decima. Salvius, Holmiae. 824 p.
- Menke, A.S. & Pulawski, W.J. (2000) A review of the *Sphex flavipennis* species group (Hymenoptera: Apoidea: Sphecidae: Sphecinii). *Journal of Hymenoptera Research*, 9, 324–346.

- Nurse, C.G. (1903) New species of Indian Hymenoptera. *The Journal of the Bombay Natural History Society*, 15, 1-18.
- Pulawski, W.J. (2021) Catalog of Sphecidae. San Francisco, CA: California Academy of Sciences. Available from: http://research.calacademy.org/ent/catalog_sphecidae/ (Accessed 15th May 2021).
- Roche, G.C. (2007) Conspectus of the sphecid wasps of Egypt (Hymenoptera: Ampulicidae, Sphecidae, Crabronidae). *Egyptian Journal of Natural History*, 4, 12-149. <https://doi.org/10.4314/ejnh.v4i1.70967>
- Schmid-Egger, C. (2014) Order Hymenoptera, families Crabronidae and Sphecidae. Further records and descriptions of new species. *Arthropod Fauna of the UAE*, 5, 521-631.
- Schmid-Egger, C. (2019) A review of *Sphex flavipennis* species group (Hymenoptera, Sphecidae) in northwest Africa with description of two new species and discussion of species from Sardinia. *Linzer Biologische Beiträge*, 51 (1), 459-471.
- Schrink, F. von P. (1802) *Fauna Boica. Durchgedachte Geschichte der in Baiern einheimischen und zahmen Thiere. Zweyter Band. Zweyte Abtheilung.* Johann Wilhelm Krüll, Ingolstadt. 412 p.
- Schulz, W.A. (1912) Aelteste und alte Hymenopteren skandinavischer Autoren. *Berliner Entomologische Zeitschrift*, 57, 52-102. <https://doi.org/10.1002/mmnd.19120570109>
- Smith, F. (1858a) Catalogue of the hymenopterous insects collected at Sarawak, Borneo; Mount Ophir, Malacca; and at Singapore, by A.R. Wallace. *Journal of the Proceedings of the Linnean Society, Zoology*, 2, 89-130. <https://doi.org/10.1111/j.1096-3642.1858.tb02548.x>
- Smith, F. (1858b) Catalogue of hymenopterous insects collected at Celebes by Mr. A.R. Wallace. *Journal of the Proceedings of the Linnean Society, Zoology*, 3, 4-27. <https://doi.org/10.1111/j.1096-3642.1858.tb02506.x>
- Strand, E. (1913) H. Sauter's Formosa-Ausbeute. Crabronidae und Scoliidae. I. (Die Gattungen *Sphex*, *Sceliphro* n und *Ammophila*, nebst Literaturverzeichnis als Nachtrag zu Dalla Torres Katalog.). *Archiv für Naturgeschichte, Abteilung A*, 79 (3), 76-87.
- Sudheendrakumar, V.V. & Narendran, T.C. (1989) Sphecoid wasps of Kerala, India. *Sphecos*, 18, 11-12.
- van der Vecht, J. (1973). Contribution to the taxonomy of the Oriental and Australian Sphecini (Hymenoptera, Sphecidae). *Proceedings. Koninklijke Nederlandse Akademie van Wetenschappen*, 76, 341-353.

مطالعه جنس (Hymenoptera: Sphecidae) *Sphex* Linnaeus از هند

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چکیده: جنس (Hymenoptera: Sphecidae) *Sphex* Linnaeus در هند مورد مطالعه قرار گرفت و کلید گونه‌ها ارایه شد. پراکنش چهار گونه از جنس *Sphex* تکمیل گردید. گونه *Sphex zubaidiyacus* Augul, 2013 به عنوان متراff کم سابقه نام پیشنهاد شد. *S. obscurus* (Fabricius, 1804)

واژگان کلیدی: زنبورهای حفار، *Sphex* هند، گزارش‌های جدید، رده‌بندی، کلید شناسایی