A new species and new records of cuckoo wasps from Pakistan and India (Hymenoptera, Chrysididae)

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Academic editor: V. Gokhman | Received 3 March 2021 | Accepted 4 April 2021 | Published 24 August 2021

http://zoobank.org/A2FD2F42-C115-4E73-8317-10BABF8A630B

Citation: Rosa P, Baiocchi D, Halada M, Proshchalykin MYu (2021) A new species and new records of cuckoo wasps from Pakistan and India (Hymenoptera, Chrysididae). In: Proshchalykin MYu, Gokhman VE (Eds) Hymenoptera studies through space and time: A collection of papers dedicated to the 75th anniversary of Arkady S. Lelej. Journal of Hymenoptera Research 84: 283–294. https://doi.org/10.3897/jhr.84.65439

Abstract

Chrysis arkadyi sp. nov. from India and Pakistan is herein described in the C. splendidula species group, and C. speculata du Buysson, 1896 is recorded for the first time from Pakistan. The Chrysis autocrata species group, established by Linsenmaier (1997), is synonymised with the C. succincta species group, and the C. serpentula species group, established by Tarbinsky (2002), is synonymised with the C. splendidula species group. C. autocrata Nurse, 1903 syn. nov. and C. euirdica Tarbinsky, 2001 syn. nov. are considered junior synonyms of C. variana du Buysson, 1901. A key to the seven species of the C. succincta species group so far known from Pakistan and India is provided.

Keywords

Chrysidini, distribution, species groups, synonymy, taxonomy

Introduction

The Chrysididae of India were recently reviewed by Rosa et al. (2021), who listed 105 species for the country. The Pakistani fauna of cuckoo wasps is instead quite poorly known and only about fifty species have been recorded for the country. The most active
researcher for this country was Colonel Charles George Nurse (1862–1933) who, as many other entomologists, began by collecting butterflies and moths, and in later years he extended his interest to other orders of insects, in particular to Hymenoptera. Thanks to his studies and collected material, more than 200 new species were added to the Hymenoptera fauna of India, although he described relatively few species himself, the rest being described by Cameron, Bingham and Morley. Nurse (1902, 1903a, b, 1904) described some cuckoo wasps mostly collected in the area of Quetta, along the Jhelum river, and in other localities that are currently located in modern day Pakistan. Besides Nurse’s publications of new taxa, other descriptions of Pakistani species were provided in the fundamental work published by Bingham (1903) ‘The Fauna of British India, including Ceylon and Burma. Hymenoptera, Vol. II. Ants and Cuckoo-wasps’. Since then, only sporadic descriptions of new species, or new distributional records, were published by Linsenmaier (1959, 1968, 1997), Rosa (2018b, 2019) and Rosa et al. (2021).

The aim of the present paper is to describe a strange new species from the _Chrysis splendidula_ species group, to report a new Pakistani record for the _C. succincta_ species group, and to provide a key to the currently known Indian and Pakistani species of the latter species group.

**Materials and methods**

The present study is based on material collected in 2003, 2013 and 2019 during three different entomological surveys in Pakistan (Khyber Pakhtunkhwa) and in India (Uttarakhand).

Examined specimens are deposited in the private collections of the authors: Paolo Rosa (PRC), Marek Halada (MHC) and Daniele Baiocchi (DBC). The holotype of _Chrysis arkadyi_ sp. nov. is deposited in the Museo Civico di Storia Naturale, Milan, Italy (MSNM). Further specimens examined for this study were examined in the following museums: Biological and Geological Institute, Bishkek, Kyrgyzstan (BGIB); British Museum of Natural History, London, UK (NHMUK); Magyar Természettudományi Múzeum, Budapest, Hungary (HNHM); Muséum National d’Histoire Naturelle, Paris, France (MNHN); Naturhistorisches Museum Wien, Austria (HNMW); Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia (ZIN).

Abbreviations used in the descriptions are as follows: _cat._ = catalogue; _descr._ = description; _diagn._ = diagnosis; _F1, F2, F3, etc._ = flagellomeres 1, 2, 3, etc., respectively; _MOD_ = median ocellus diameter (measured in frontal view); _MS_ = malar space, the shortest distance between base of mandible and lowest margin of compound eye; _OOL_ = oculo-ocellar line, the shortest distance between posterior ocellus and compound eye; _P_ = pedicel; _POL_ = posterior ocellar line, the shortest distance between posterior ocelli; _S_ = metasomal sternum; _T_ = metasomal tergum.

Images were taken with a Nikon D700 (specimens) and Nikon D3200 (internal segments) photocameras connected to a Togal SCZ stereoscope. Images were stacked with CombineZP software.
Taxonomy

*Chrysis splendidula* species group

*Chrysis splendidula* group: Linsenmaier 1959: 124 (key), 127 (diagn.). Kimsey and Bohart 1991: 328 (key), 362 (diagn.).

*Chrysis splendidula* s.str. subgroup: Kimsey and Bohart 1991: 332 (key), 362 (diagn.).

*Chrysis serpentula* group: Tarbinsky 2002: 18 (diagn.), syn. nov.

**Diagnosis.** The *splendidula* species group includes Palaearctic species recognizable by the last metasomal tergum which is coloured blue or green, usually contrasting with metasomal terga I–II which are red. However, exceptions to this colouration pattern are five Central Asian species with terga I–II blue or blue with green to light blue stripes (*Chrysis centralis* Semenov-Tian-Shanskij, 1967; *C. circassica* Mocsáry, 1893; *C. hyacinthus* Semenov-Tian-Shanskij, 1967; *C. kokandica* Radoszkowsky, 1877; *C. serpentula* Semenov-Tian-Shanskij, 1967) and a Japanese one (*C. nohirai* Tsuneki, 1952).

Members of the *splendidula* species group can be recognised by the combination of the following characters: transverse frontal carina distinct and raised; apical margin of metasomal tergum III with four sharp teeth, and black spots on sternum II elongate, connected to lateroterga and widely separated in the middle (Fig. 1F).

**Description.** Face with distinct and raised transverse frontal carina, M-like or biconvex, recurved below; scapal basin medially polished to finely wrinkled; malar spaces usually 1.0–1.5 × MOD; second flagellomere usually slightly shortened; carina on metasomal tergum II indistinct or as an impunctate line, rarely raised and sharp; tergum III with distinct row of small, round to slightly elongate pits; apical margin of tergum III with four sharp, triangular teeth; black spots on sternum II widely separated and elongate, adjacent to lateral margin.

**Hosts.** Vespidae: Eumeninae (Martynova and Fateryga 2015).

**Remarks.** Kimsey and Bohart (1991) subdivided the *splendidula* species group into two subgroups: the *splendidula* s.str. subgroup and the *splendidula-senegalensis* subgroup. We here consider these two groups as separated because of the different shape of female internal terga that form the telescopic ovipositor (Rosa et al., in preparation).

*Chrysis arkadyi* sp. nov. is the only known member of the *splendidula* group from India and Pakistan so far. Conversely, four species of the *senegalensis* group are known for India (Rosa et al. 2021), namely: *Chrysis disparilis* Cameron, 1897, *C. hecate* Mocsáry, 1889, *C. ionophris* Mocsáry, 1893, and *C. sikkimensis* Mocsáry, 1912.

Tarbinsky (2002) established the *serpentula* species group, based on misidentified specimens of *Chrysis serpentula* Semenov-Tian-Shanskij, 1967. After type examination (Rosa et al. 2017, fig. 122) we include this species in the *splendidula* species group and we here synonymize the *serpentula* species group with the *splendidula* species group.
Chrysis arkadyi sp. nov.  
http://zoobank.org/2B70C10C-B0A5-43D1-A141-C5BD0A4CBDA6  

Figs 1, 2

Material examined. Holotype. ♀, India: Uttarakhand: Haldwani, Kathgodam, ca 800 m, 21.–22.vii.2003, Z. Kejval & M. Trýzna leg. (MSNM). Paratypes: Pakistan: 1♂, Khyber Pakhtunkhwa: NE of Mansehra, ca 1200 m, Barhadi env., 34°24'00"N, 73°19'48"E, 20.v.2019, D. Baiocchi leg. (DBC); 2♀♀, NE of Mansehra, ca 1200 m, Barhadi env., 34°24'00"N, 73°19'48"E, 20.v.2019, M. Kafka leg. (MHC, PRC).

Diagnosis. Chrysis arkadyi sp. nov. is recognised by the following characters: body blue with light blue and greenish reflections (Fig. 1), with black median area of mesoscum, and with wide green bands laterally and posteriorly on terga I–II; metapostnotum T-like, reduced to a small median area, with punctures smaller than those on metascutellum; metasoma with terga I–II extremely elongated compared to other species in the splendidula species group; tergum III with polished and elongate post pit row area; black spots on sternum II elongate and sub–ovoid. This new species can be distinguished from other blue coloured Central Asian species of the same species group by reduced metapostnotum, elongated metasomal terga and elongate post pit row area. This species is more closely related to Chrysis nohirai Tsuneki, for the elongate shape of metasomal tergum II (type examination based on pictures taken by T. Mita). However, C. arkadyi sp. nov. is easily distinguished by: transverse frontal carina M-shaped; dense body punctation, in particular on mesonotum, mesopleuron and second tergum; structure of metasomal tergum I elongate, 0.6 × as long as length of tergum II and structure of tergum III with post pit row distinctly elongate (1.5 MOD) (vs. transverse frontal carina medially straight and laterally downcurved; body sparsely punctate, with wide impunctate interspaces on lateral areas of mesoscum, mesopleuron and second tergum, and unmodified structure of tergum I, 0.4 × as long as length of tergum II and of tergum III, with post pit row not distinctly elongate (1.0 MOD) in C. nohirai).

Description. Holotype: Female. Body length 6.6 mm. Head. Scapal basin medially striate and laterally micropunctate (Fig. 1B). Transverse frontal carina broadly M-shaped. Anterior margin of clypeus medially not emarginate, with thickened brownish rim. Face with large and coarse punctures between transverse frontal carina and scapal basin; vertex with smaller punctures. Genal carina sharp, present from temple posteriorly to mandible. Relative length of P:F1:F2:F3 = 1.0:1.3:0.9:0.8; OOL = 2.0 × MOD; POL = 2.3 × MOD; MS = 1.3 × MOD; subantennal space 1.0 × MOD. Mesosoma. Pronotum slightly shorter than mesoscum (Fig. 1C); antero–median pronotal line deep, broad and reaching half of pronotum length; punctuation double, coarse along anterior and lateral margins, with smaller punctures on antero–median pronotal line and along posterior margin. Median area of mesoscum in posterior half with larger punctures and broader polished intervals; lateral areas of mesoscum with irregularly sized punctures and corrugated interspaces; parapsidal furrow distinctly engraved; notaui as line of sub–square pits, decreasing towards anterior margin of mesoscum. Mesoscum with larger punctures and broad, polished interspaces, locally with tiny punctures; laterally with smaller, dense punctures along metanotal trough. Metanotum slightly convex, with large, polygonal and
uneven punctures; anterior margin of metanotum with large impunctate and depressed median area. Mesopleuron almost without trace of episternal sulcus, with large punctures and densely, minutely punctate intervals; scrobal sulcus as deep, polished line (Fig. 1A); metasternum reduced, triangular, T-shaped, with small punctures and with two largely expanded lateral areas, with raised transverse carinae; posterior propodeal projections lat-
erally expanded and downward directed, with basal margin slightly concave. **Metasoma.** Metasoma densely punctate; puncture diameter about 1/2 to 1/3 of largest punctures on mesoscutellum; metasomal terga elongate (Fig. 1C–F), tergum I 0.6 × as long as length of tergum II; tergum III slightly longer than tergum I; tergum II with weak median ridge; pit row of tergum III deep, with elongated, large pits; post pit row distinctly elongate (1.5 MOD); apex of T3 with four short, triangular teeth; intervals between median and lateral teeth almost equal; black spots on sternum II sub-ovoid, narrow and connected to lateral margins, widely separated medially (Fig. 1F). **Colouration.** Body blue to deep blue, almost black on ocellar area, median area of mesoscutum and basally on metasomal tergum II; green on scape, pedicel, first flagellomere, postero-laterally on terga I–II, on tergum III pre pit row, and on sternites (Fig. 1C–F); other flagellomeres black; tegula light blue; post-tegula bright metallic blue; forewing slightly infuscate, with darkened radial cell.

**Male.** Similar to female (Fig. 2A–D), with deep blue body colour and fewer greenish hints. Paratype body length 6.2 mm. The main dimorphic difference is observed in the metasomal tergum III for shorter post pit area and apical margin with median teeth shorter and closer to each other, compared to apical teeth of female.

**Ecology.** The Pakistani specimens of *Chrysis arkadyi* sp. nov. described herein were captured by means of yellow pan traps positioned along one of the roads through the forest zone of the Manshera district, about one kilometer NE of the village of Barhadi. The forest is mainly composed of *Pinus roxburghii* Sargent (Fig. 4).

**Etymology.** The specific epithet *arkadyi* is a patronym honouring Prof. Dr. Arkady Stepanovich Lelej on the occasion of his 75th birthday and in recognition of his numerous contributions to the study of the Hymenoptera and of the Russian Chrysididae.

**Chrysis succinecta species group**

*Chrysis succinecta* group: Linsenmaier 1959: 92 (key), 106 (diagn.). Kimsey and Bohart 1991: 324 (key), 363 (diagn.).

*Chrysis succinecta* s.str. subgroup: Kimsey and Bohart 1991: 362 (diagn.).

*Chrysis autocrata* group: Linsenmaier 1997: 275, syn. nov.

**Diagnosis.** The *succinecta* species group includes more than a hundred species distributed worldwide, with a large majority known in the Palaeartic region, and subdivided into *succinecta* s.str. subgroup and *leachii* subgroup (or *leachii* group according to Linsenmaier 1959). Usually, Palaeartic species are easily recognised by their slender habitus and by their peculiar colouration, with the body largely red coloured. The most diagnostic feature is anyhow the prominent brow, often ridge-like, and the transverse frontal carina which is usually only partially developed; females scapal basin is always polished medially in the *succinecta* s.str. subgroup, whereas it is finely striated in the *leachii* subgroup, while in males it is finely punctate in both subgroups. The apical margin of tergum III is highly variable, bearing from none to four teeth or two median teeth almost fused together and projecting medially.

**Hosts.** Crabronidae (Pauli et al. 2019).
**Remarks.** Linsenmaier (1997) established the *autocrata* species group, based on *Chrysis autocrata* Nurse, 1903. After type examination of the latter, we propose the new synonymy *Chrysis variana* du Buysson, 1901 = *Chrysis autocrata* Nurse, 1903, syn. nov. *Chrysis variana* (see pictures of the type in Rosa et al. 2020) is a widespread Central Asian species of the *succincta* group (known from Kazakhstan, Kyrgyzstan, Tadjikistan, Turkmenistan and Pakistan), and apparently unknown to Linsenmaier, as it is not listed in his papers and was not found in his collection. Consequently, we synonymize the *autocrata* species group with the *succincta* species group, because it is not sufficiently supported by morphological diagnostic characters. During the examination of the Palaearctic types of cuckoo wasps, the first author also observed that the holotype of *Chrysis ewridica* Tarbinsky, 2001 (described from Kyrgyzstan, Jalal-Abad) is a female of *Chrysis variana* and therefore we here propose also the new synonymy *Chrysis variana* du Buysson, 1901 = *Chrysis ewridica* Tarbinsky, 2001, syn. nov.

*Chrysis speculata* du Buysson, 1896

Fig. 3A–F

*Chrysis speculata* du Buysson, 1896: 473. Holotype: ♀; India: Maharashtra: Bombay: Poona [= Pune] (471 (key), 473–474 (descr.), pl. III (fig. 4)) (MNHN) (examined). Bingham 1903: 437 (key), 465 (descr., Bombay: Poona [= Pune]); Kimsey

![Figure 3. Chrysis speculata du Buysson, female, from Pakistan A habitus, dorsal view B habitus, lateral view C head, frontal view D metasoma, dorso-lateral view E metasoma, ventral view. Scale bars: 1.0 mm.](image)
Material examined. Pakistan: 1♀, Khyber Pakhtunkhwa: NE of Mansehra, ca 1200 m, Barhadi env., 34°24′00″N, 73°19′48″E, 20.v.2019, M. Kafka leg. (MHC).

Distribution. Pakistan (Khyber Pakhtunkhwa, first record), India (Maharashtra), Nepal (Chhumchaur, 29°21′30″N, 82°23′46″E, 16.vi.1997 (PRC)) (new record).

List of the recorded species of the succincta s.s. subgroup from India and Pakistan

Chrysis begam Mocsáry, 1912: 554. Holotype: ♀; India: Sikkim (HNHM).

Chrysis chavanae Nurse, 1902: 308. Holotype: ♀; Pakistan: Quetta (NHMUK).

Chrysis kokuevi Semenov-Tian-Shanski, 1967: 178. Holotype: ♂; n China: Dyn-yuan-in oasis (ZIN). Kimsey and Bohart 1991: 428 (Pakistan).

Chrysis paria Bingham, 1903: 455. Holotype: ♂; Pakistan: Baluchistan, Quetta (NHMUK) [= C. sara Nurse, 1904: 20. Holotype: ♂ (not ♀); Pakistan: Baluchistan, Quetta (NHMUK). Included in the genus Allochrysis by Kimsey and Bohart 1991, transferred to the succincta species group by Rosa (2018a)].

Chrysis speculata du Buysson, 1896: 473. Holotype: ♀; India: Maharashtra: Bombay: Poona [= Pune] (MNHN).

Chrysis urana Nurse, 1904: 22. Lectotype: ♀, designated by Bohart in Kimsey and Bohart 1991; Pakistan: Quetta (NHMUK).

Chrysis variana du Buysson, 1901: 103. Holotype: ♀; Turkmenistan: Imam Baba (NHMW) [= C. autocrata Nurse, 1903b: 40. Lectotype: ♀, designated by Bohart in Kimsey and Bohart 1991; Pakistan: Quetta (NHMUK), syn. nov.; = C. ewridica Tabinsky, 2001. Holotype: ♀; Kyrgyzstan: Jalal-Abad (BGIB), syn. nov.].

Key to the Indian and Pakistani species of the succincta s.str. group

1 Apical margin of tergum III edentate.................. Chrysis chavanae Nurse
– Apical margin of tergum III with three or four teeth..............................2

2 Apical margin of tergum III with three aligned teeth and median one apically rounded in male, or with protruding median tooth in female; small species (body length 3.0–5.0 mm)................................. Chrysis paria Bingham
– Apical margin of tergum III with four teeth; medium to large species (body length 5.5–8.5 mm).........................................................................................3

3 Body colour entirely blue or blue with light blue to greenish reflections.....4
– Body bicoloured, with head and mesosoma green to blue, with mesonotum concolour or golden-red, and red metasoma, or with head and mesosoma green to blue and with tergum I greenish, contrasting with red terga II–III .......................................................................................................................................................... 5

and Bohart 1991: 464 (cat., India: Bombay: Poona [= Pune], succincta s.s. group); Rosa et al. 2021: 29 (cat., India, Sikkim), 30 (fig. 23).

Chrysis (Tetrachrysis) speculata: Bischoff 1913: 59 (cat., India).
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4 Large sized species, body length 6.8 mm. Female scapal basin largely polished; with four large teeth on apical margin of tergum III, and with two median ones larger and distinctly protruding; black spots on sternum II almost medially fused, subsquare, with straight posterior margin, covering more than half segment (male unknown).................................................Chrysis urana Nurse

– Medium sized species, body length 5.3 mm. Female scapal basin largely punctate, with narrow polished median line; with four spiniform teeth on apical margin of tergum III, with two median ones slightly larger than lateral ones and slightly distinctly protruding; black spots on sternum II rounded, medially very close to each other, yet with arcuate posterior margin; black spots covering less than half segment (currently known only from India – Sikkim, male unknown).........................................................Chrysis begam Mocsáry

5 Multicoloured species, with head and mesosoma green to blue, with mesoscutum golden-red and median area black; metasoma red with wide blue stripes on terga I–II postero-laterally, and on apex of tergum III; terga I-II dark to black medially (Fig. 3) ....................... Chrysis speculata du Buysson

– Bicoloured species, with head and mesosoma green to blue and metasoma entirely red or with tergum I greenish..........................................................6

6 Large sized species, body length 8.0–8.5 mm. Metasoma bicoloured with tergum I greenish, with large, deep, and spaced punctures; tergum III with small pits of pit row, almost indistinguishable from other punctures of tergum; medially, before pit row, with outstanding bump; lateral teeth spine-like; black spots on sternum II small, subrectangular and medially widely separated........
........................................................................Chrysis variana du Buysson

– Small to medium sized species, body length 4.5–5.5 mm. Metasoma concolourous with small, shallow and dense punctures; tergum III with unmodified pit row; pre-pit area unmodified; lateral teeth angled; black spots on sternum II large, medially fused and covering large part of segment...............Chrysis kokuevi Semenov-Tian-Shanskij

Conclusions

Indian cuckoo wasp fauna is now updated to 106 species in 20 chrysidid genera and four subfamilies. On the other hand, the Pakistani fauna is still too poorly known and under-studied, and any tentative estimate of its richness and composition cannot be carried out at this moment. It currently includes only members of the Chrysidinae subfamily, specifically 37 species belonging to four genera of Chrysidini (86% species in the genus Chrysis Linnaeus, 1761), two species of two genera of Parnopini, and nine species of five genera of Elampini. From future field studies in Pakistan, we expect records of the subfamily Cleptinae, whereas we do not expect any record of Amiseginae and Loboscelidiinae, being egg parasitoids of Phasmatodea and therefore related to
their occurrence in the area. Moreover, the Pakistani fauna is currently mostly related to the Palaeartic one, based on the limited material available for inspection in museum collections, predominantly consisting of types.

**Acknowledgements**

We are thankful to Zbyněk Kejval, Miloš Trýzna and Marek Kafka (all from Czech Republic) for providing the type material of *Chrysis arkadyi*, Toshiharu Mita (Fukuoka, Japan), Villu Soon (Tartu, Estonia) and Bogdan Wiśniowski (Rzeszów, Poland) for reviewing the manuscript, Thomas Wood (Mons, Belgium) for English proofreading, and Vladimir Gokhman (Moscow, Russia) for editing.

Maxim Proshchalykin, a co-author of this study, was funded by RFBR and MECSS, project number 20-54-44014. The authors have declared that no competing interests exist.
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