

## Diversity of Crabronid wasp fauna (Hymenoptera: Crabronidae: Crabronini) in the spice ecosystem

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### ABSTRACT

Three Crabronid wasp species viz., *Dasyproctus agilis* (F. Smith, 1858), *D. buddha* (Cameron, 1899) and *Crossocerus pusanus* Leclercq, 1956 were recorded for the first time from the spice ecosystem.

**Key words :** Crabronidae, Hymenoptera, India, new record, spice ecosystem.

### INTRODUCTION

Seed spice crops are majorly grown in the arid to semiarid regions of India. Around 44.87 lakh ha area as under spice crop cultivation with 111.25 lakh tonnes production (DASD Report, 2022). In India, Rajasthan and Gujarat are the major seed spices growing states, popularly known as “seed spices bowl” and contribute more than 80% of the total seed spices production in the country. Insect pollinators play an important role in improving the productivity of various spice crops both directly and indirectly. Only a few investigations have been carried out on the insects inhabiting different spice crops (Tiwari and Joshi, 1974; Ali *et al.* 2009).

Crabronidae is a predatory wasp family whose members usually hover on Umbelliferae and Apiaceae plants and preys on small insects. These wasps are popularly called as ‘sand wasps or mustache wasps’. This family comprises of over 200 genera with more than 9000 species worldwide. As per latest classification, family Crabronidae comprises of eight subfamilies including subfamily Crabroninae which is the most diverse, with around 100 genera and more than 1500 species worldwide (Sann *et al.*, 2018; Pulawski, 2023). Although these wasps are efficient predators but the Indian Crabronid fauna is poorly known especially so of the spice ecosystem. More than 100 species of crabronid wasps were described from India so far

(Pulawski, 2023). Recently, Saini and Dey (2021a, b and 2022a, b, c, d, e) has described several species from Indian subcontinent. In this paper, we have discussed about the crabronid wasp fauna found in spice ecosystem with their diagnosis.

### MATERIALS AND METHODS

The research fields of ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer and Mount Abu, Rajasthan were explored for the collection of crabronid wasps during 2018 and 2019. The wasps were collected with the help of yellow pan traps and sweep net and brought to Insect biosystematics laboratory at National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute (NPC-IARI), New Delhi-110012 for identification. External morphological characters of specimens were studied under Leica S8APO microscope. The photographs of adults were captured in various magnifications with the help of LEICA DFC 425C attached to LEICA 205FA stereozoom automontage microscope. The photographs were processed, labelled and edited with Adobe Photoshop® 7.0. The specimens were identified using key and descriptions by Leclercq (2015), Binoy *et al.* (2021a and b) and Yue *et al.* (2021). The terminology used follows that of Bohart and Menke (1976). New locality records of the species studied have been marked with an asterisk (\*). References in the synonymy are not included in the manuscript.

**Abbreviations used :** BL = Body length, FWL = Fore wing length, MGL = Male genitalia length, HL = Head length dorsally, HW = Head width dorsally,

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Gt<sub>1</sub>-Gt<sub>6</sub> = Gastral terga 1 to 6, OOL = Ocello-ocular distance, POL = Distance between lateral ocelli, NPC-IARI = National Pusa Collection-Indian Agricultural Research Institute, New Delhi.

## RESULTS AND DISCUSSION

Total three species of crabronid wasp's viz., *Dasyproctus agilis* (F. Smith, 1858), *D. buddha* (Cameron, 1899) and *Crossocerus pusanus* Leclercq, 1956 were collected and identified from the spice ecosystem. The diagnosis of all identified species are as follows:

1. Genus *Dasyproctus* Lepeletier de Saint Fargeau and Brullé, 1835

*Type species* : *Dasyproctus bipunctatus* Lepeletier de Saint Fargeau and Brullé, 1835; Holotype lost; Neotype location: Muséum National d'Histoire Naturelle, Paris, France (MNHN).

*Diagnosis* : The diagnostic characteristics of this genus are, presence of pedunculated abdomen, broader ocellar triangle, elongate verticulus and narrowed pygidial plate in females (Bohart and Menke, 1976).

*Dasyproctus agilis* (F. Smith, 1858)

*Crabro agilis* F. Smith, 1858b: 18; *Dasyproctus ceylonicus* de Saussure, 1867: 85; *Crabro indicus* de Saussure, 1892: 582; *Crabro infantulus* Kohl, 1894: 294; *Crabro revelatus* Cameron, 1898b: 34; *Crabro impetuosus* Cameron, 1901a: 28; *Dasyproctus philippinensis* Ashmead, 1904d: 129; *Dasyproctus funestus* R. Turner, 1917e: 188; *Crabro palmerii* Cameron: Leclercq, 1950b: 11.

*Holotype location* : Hope Department of Entomology, Oxford, Great Britain (OXUM).

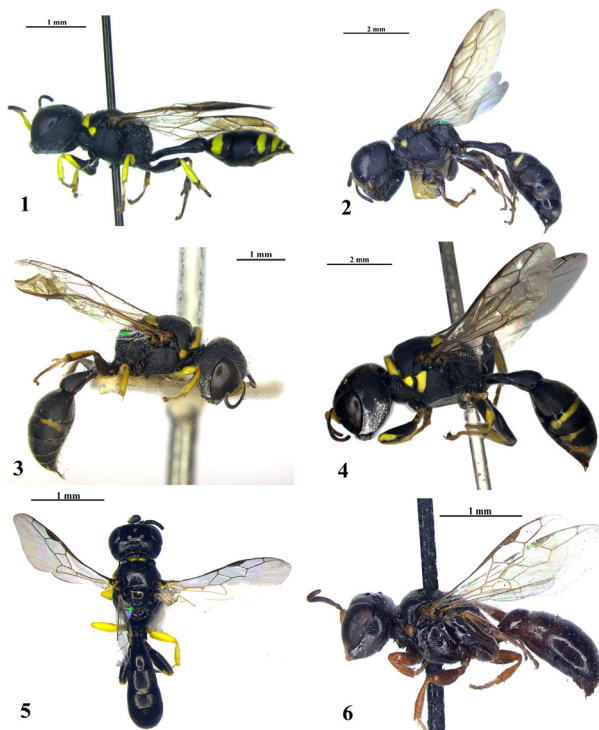
*Diagnosis male* (Fig. 1) : Medium to large size wasp, body black except yellow following: scape, pedicel, flagellomeres I and II ventrally, mandible basally, pronotum completely, pronotal lobe, forefemur apically up to middle ventrally, apical end of midfemur, fore- and midtibiae except laterally, hindtibia dorsally, basitarsus of all legs, anterior border of scutellum, axilla, dorso-lateral spot on terga II, IV and V, transverse band on tergum IV; mandible at apex, tegula, ferruginous; flagellum, pterostigma and wing veins dark brown.

*Female* (Fig. 2) : Black. Larger than male, similar to male except yellow following: tergum I apically,

mandible except at apex; head finely punctate dorsally, mandible tridentate; clypeus transverse, median lobe bifid apically, semi-circular space between them; interocular carina small compared to male; orbital fovea elliptical, antenna 12 segmented, last flagellomere elongate; scutellum smooth, immaculate; anterior propodeal surface dorsally with fine longitudinal striae along with elongate slivery setae, posterior surface dorsally with fine transverse striae along with elongate slivery setae, median sulcus distinct, lateral propodeal carina dorsally with large foveae; distance between spots on tergum V larger than male; pygidial plate narrow, elongate, testaceous, dorsally coriaceous, laterally carinate.

*Materials examined* : 1♀1♂. Rajasthan: Ajmer, Tabiji, 18-19.iii.2019, host: dill, yellow pan trap, coll. Varun Saini (NPC-IARI).

*Distribution* : Bihar, Delhi, Himachal Pradesh, Karnataka, Karnataka, Kerala, Meghalaya, Mizoram, Odisha, Nagaland, Rajasthan\* (Ajmer), Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand and West Bengal.



**Figs. 1-6.** (1) Habitus of *Dasyproctus agilis* male, (2) Habitus of *Dasyproctus agilis* female, (3) Habitus of *Dasyproctus buddha* male, (4) Habitus of *Dasyproctus buddha* female, (5) Habitus of *Crossocerus pusanus* male, (6) Habitus of *Crossocerus pusanus* female.

*Dasyproctus buddha* (Cameron, 1889)

Synonym: *Rhopalum buddha* Cameron, 1889b: 18; *Crabro brookii* Bingham, 1896c: 444; *Crabro taprobanae* Cameron, 1898b: 30; *Crabro idrieus* Cameron, 1901d: 53; *Crabro musaeus* Cameron, 1901d: 53; *Dasyproctus testaceipalpis* Cameron, 1908b: 305; *Dasyproctus buddha* Leclercq, 1956: 147; 1972: 104, 105, 109, 113 and Tsuneki, 1974: 644; Holotype location: Hope Department of Entomology, Oxford, Great Britain (OXUM).

*Diagnosis male* (Fig. 3) : Medium to large in size, body black except yellow following: scape, entire pronotum, pronotal lobe, most part of fore- & mid femora, tibiae of all legs dorsally, hindfemur at apex, trochanter ventrally; most part of scutellum, axilla sometimes; large lateral spots on tergum III, small spots on tergum IV; mandible at apex, tegula, dorsal stripe on fore and mid femora basally, ferruginous; hind femur entire, pedicel, flagellum, pterostigma and wing veins dark brown.

*Female* (Fig. 4) : Body black, similar to male except: yellow spot on tergum V conspicuous, trochanter black, head smooth, mandible tridentate, clypeus transverse, median lobe with longitudinal carina, truncate apically, preapical margin toothed; interocular carina not prominent compared to male; orbital fovea elliptical, POD equal to 1.1 × of OOD; antenna 12 segmented; anterior pronotal carina not curved back towards pronotal lobe; scutum smooth; spots on scutellum not coalesced; propodeum surface not alveolate, dorsally covered with oblique longitudinal and transverse striae; mesopleuron with large yellow spot, episternal sulcus indistinct; fore basitarsus shorter than mid- and hind basitarsus, fore- and mid basitarsus with surface row of spines, spines absent on hind basitarsus, mid- and hind tibiae with dorsal row of spines, foretibia without dorsal spines; gaster covered with fine pubescence, slightly punctate; pygidial plate present, triangular, elongate, testaceous, depressed apically, carinate laterally.

*Materials examined* : 2♀♀3♂♂. India: Rajasthan: Ajmer, Tabiji, 20.x.2018, host: dill, yellow pan trap, coll. Varun Saini (NPC-IARI).

*Distribution* : Andhra Pradesh, Arunachal Pradesh, Assam, Delhi, Gujarat, Maharashtra, Rajasthan\*(Ajmer), Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal.

2. Genus *Crossocerus* Lepeletier de Saint Fargeau and Brullé, 1835

*Type species* : *Crabro scutatus* Fabricius, 1787 [= *Sphex palmipes* Linnaeus, 1767], designated by Westwood, 1839: 80. Holotype location: Zoological Museum, University of Copenhagen, Copenhagen, Denmark (ZMUC).

*Diagnosis* : The diagnostic feature of this genus is the presence of omaulus, equilateral ocellar triangle, absence of verticulus, male flagellum usually with ventral hair fringe and scape without carina (Bohart and Menke, 1976).

*Crossocerus pusanus* Leclercq, 1956

Synonym: *Crossocerus pusanus* Leclercq, 1956e: 224. Holotype location: The Natural History Museum, formerly British Museum (Natural History), London, Great Britain (BMNH).

*Diagnosis female* (Fig. 6) : Medium size wasps. Body black except yellow following: scape completely, pronotal collar medially, pronotal lobe, mandible except apically, forefemur apically up to middle, fore and midtibiae completely, midfemur large apical spot, hindtibia except dorsal stripe; clypeus, mandible at apex, ferruginous; tegula, antenna, pygidial plate, dark brown; wing veins, pterostigma, brown.

*Male* (Fig. 5) : Similar to female except antenna with ventral hair fringe, scape unicarinate; POD equal to 0.84 × of OOD; pedicel, FI and FII broadened; gena completely yellow; scutellum with yellow spot; fore- and midfemora yellow completely, fore- and midtibiae yellow completely, hindtibia yellow except dorsal stripe; clypeus yellow completely.

*Material examined* : 2♀♀2♂♂. Indian: Rajasthan: Ajmer, Tabiji, 20.x.2018, host: dill, yellow pan trap, coll. Varun Saini (NPC-IARI).

*Distribution* : Bihar, Chhattisgarh, Delhi, Rajasthan\* (Ajmer) and Murree Hills (now in Pakistan).

**AUTHORS' CONTRIBUTION**

Formulated, experiment and wrote the manuscript (V.S.); Finalized the results and reviewed the manuscript (D.D. and N.K.M.).

**DECLARATION**

The authors declare that they have no conflict of interests. These crabronid wasps species reported

as new records in spice ecosystem are already exist in other ecosystem in India.

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