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COMMUNICATION

***CERIAGRION CHROMOTHORAX* SP. NOV. (ODONATA: ZYGOPTERA: COENAGRIONIDAE) FROM SINDHUDURG, MAHARASHTRA, INDIA**

Shantanu Joshi & Dattaprasad Sawant

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CERIAGRION CHROMOTHORAX SP. NOV. (ODONATA: ZYGOPTERA: COENAGRIONIDAE) FROM SINDHUDURG, MAHARASHTRA, INDIA

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Abstract: *Ceriagrion chromothorax* sp. nov. is described from Western Ghats, India, based on six males and one female collected from Sindhudurg District of Maharashtra.

Keywords: Damselfly, Devgad, new species, Sindhudurg Marsh Dart, taxonomy, Western Ghats.

Marathi Abstract: सिंधुदुर्ग मार्ग डार्ट ही पश्चिम घाटातील विमलेश्वर, जिल्हा सिंधुदुर्ग येथे आढळलेली टाचणीची नवी प्रजाती आहे. गोळा केलेल्या सहा नर आणि एक मादी अशा नमुन्यांच्या आधारे या प्रजातीचे वर्णन करण्यात आले आहे.

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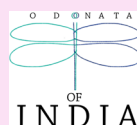
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Author Details: SHANTANU JOSHI is a researcher interested in studying ecology and diversity of odonates in India. He's the founding editor of the website Odonata of India and curator of odonates at Research Collections, National Centre for Biological Collections, Bangalore. Currently, he's pursuing a Master's degree in Biodiversity, Wildlife Conservation and Management from Bhavan's College, Bhartiya Vidya Bhavan, Mumbai. DATTAPRASAD SAWANT is a Doctor by profession and graduated from Grant Govt Medical College & Sir JJ Group of Hospitals, Mumbai. He is pursuing his MD in Preventive and Social Medicine. He is self taught photographer and currently working on documenting biodiversity of Lepidoptera & Odonates of Konkan region.

Author Contribution: DS took all the photographs from field, collected the specimens, made illustrations and helped in writing the manuscript. SJ wrote the manuscript and made the close-up images of anal appendages, genitalia and prothorax.

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INTRODUCTION

Ceriagrion is a diverse and widespread genus of damselflies (Zygoptera) within the family Coenagrionidae with 51 species (Schorr & Paulson 2018). This genus consists of many closely related species, which are difficult to diagnose without thorough examination of the prothorax and male genital ligula (Asahina 1967; Dijkstra 2005). Asahina (1967) provided a review of this genus from the Oriental region, which still remains the most complete account.

Four species of *Ceriagrion* are currently known from the Western Ghats of India (Fraser 1933a; Subramanian & Babu 2017; Subramanian et al. 2018). Here we describe a fifth species—*Ceriagrion chromothorax* sp. nov. from Vimalleshwar, Sindhudurg District, Maharashtra. This species is morphologically similar to *Ceriagrion coromandelianum* (Fabricius, 1798), and *C. indochinense* Asahina, 1967, but can be distinguished from them by its chrome yellow synthorax, structure of the prothorax, and the shape of caudal appendages.

MATERIALS AND METHODS

The new species was first photographed in August 2017. Subsequently, DS collected three males in August and September 2017, a copula along with two more males was collected in August 2018. The collected specimens were examined using Leica (Leica Microsystems, Germany) stereomicroscopes for close up imaging. Multiple images were stacked to generate greater depth of field; scale bars were added using Leica Application Suite (Leica Microsystems, Germany) or ImageJ (Schneider et al. 2012).

The general morphological terms are following Garrison et al. (2010), and Riek & Kukalova-Peck (1984) was referred for wing venation terminology, along with Kennedy (1920) for genital ligula and Asahina (1967) for prothorax.

The holotype has been pinned, while the two paratypes were preserved in ethanol. Specimens are deposited at the Research Collections, National Centre for Biological Sciences, Bangalore.

The following abbreviations are used in the text: FW = fore wing, HW = hind wing, Ax & Px = antenodal and postnodal nervures, Pt = pterostigma, S1:S10 = first to last abdominal segments.

Ceriagrion chromothorax sp. nov.

(Images 1a,b, 2a,b, 3a,b,c, 4a)

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Common name: Sindhudurg Marsh Dart.

Holotype: Male (NCBS-BB921), 4.viii.2017, Vimalleshwar, Devgad, Sindhudurg District, Maharashtra, India, (16.433°N & 73.395°E; elevation ~27m), Dattaprasad Sawant leg.

The locality and collector of the following allotype and paratypes are same as holotype, except date of collection.

Allotype: Female (NCBS-BH969), 16.viii.2018.

Paratypes: 2 males (NCBS-BB922, NCBS-BB923), 27.ix.2017; 1 male (NCBS-BH970, collected in copula with allotype female), 16.viii.2018; 2 males (NCBS-BH971, NCBS-BH972), 19.viii.2018.

Etymology: The name '*chromothorax*' is given for the bright yellow (=chromo) thoracic coloration (Image 1).

Description of holotype male (Images 1–5)

Head: Labium dark brown; labrum, anteclypeus, postclypeus, postfrons yellow, upper half of antefrons brown, rest yellow. Vertex and postocular lobes pale yellow; eyes olive green.

Prothorax (Image 4): Yellow; anterior lobe with paired black marking dorsally, extending from the anterior border of latero-medial lobes; posterior lobe of the prothorax flat at the anterior border and medially, raised at the posterior border and laterally; posterior border trilobate; the posterior border of the central lobe not straight.

Synthorax (Images 1&2a): Mesostigmal plates: lateral carina shaped half-hexagon, pointed anteriorly; anterior carina robust, broader at the meeting point with lateral carina; lateral carina not extending beyond acrotergite; posterior carina rudimentary not extending even halfway from lateral carina to median pit; mesostigmal lamina raised; remus large; anterior carina and anterior 1/3rd of lateral carina black. *Synthorax* bright yellow in live individuals, due to the flash used while photographing dorsum appears olive green in some individuals; slightly darker on dorsum paler yellow ventrally, black spots at the posterior end of meta and mesopleural sutures, small black spot at the junction of mesepimeron and metepisternum, 45 degrees from metastigma. Mesocoxa and metacoxa dull with faint pruinescence. Legs bright yellow, gradually pale brown towards the claws; small black dot at base of femur on the posterior side; base of the claws black; femur and tibia with large black spines. Metascutum

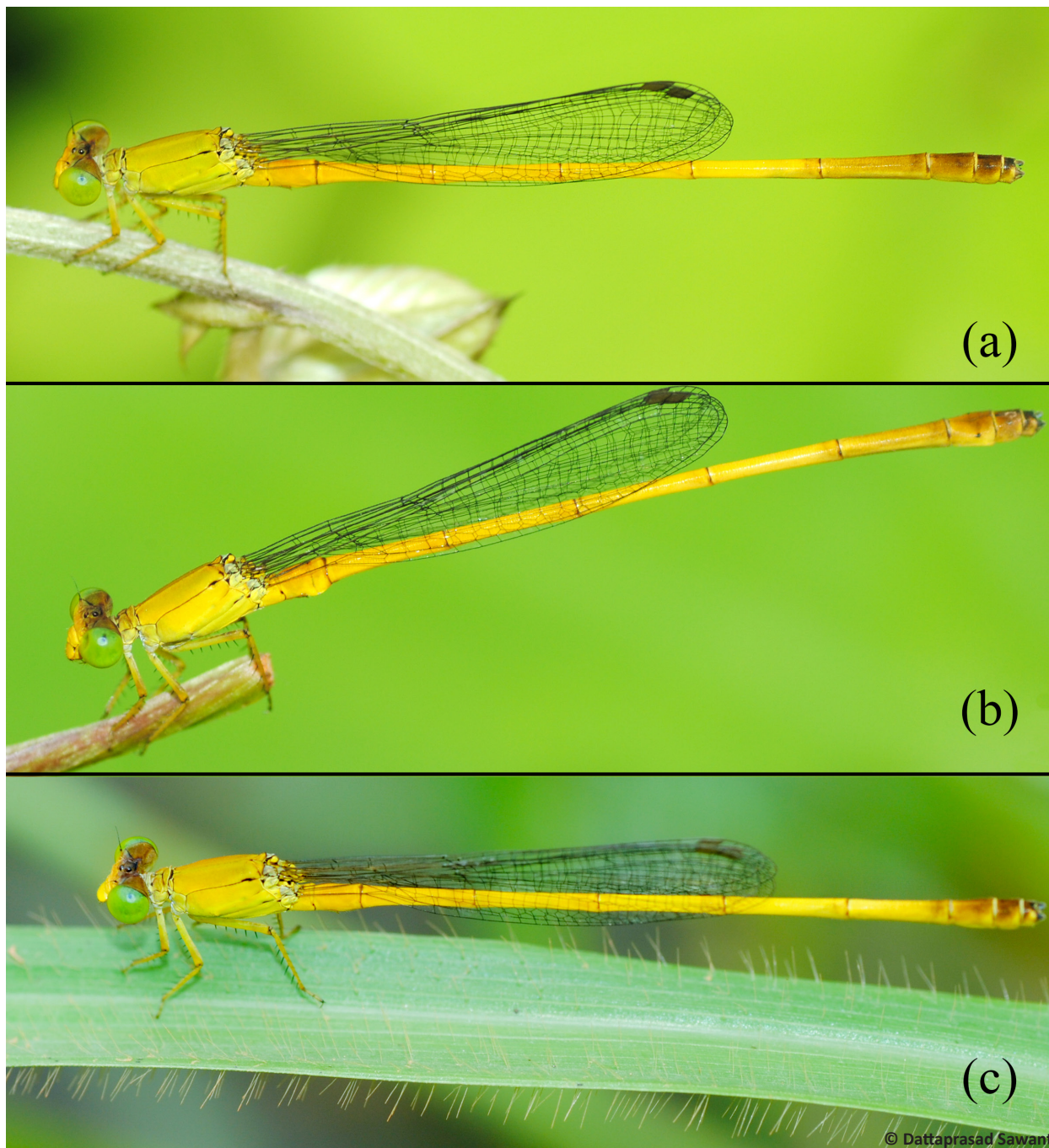


Image 1. *Ceriagrion chromothorax* sp. nov.: (a) & (b) holotype male (NCBS-BB921) in situ | (c) male from Wada Village (not collected), 18.viii.2018.

and mesoscutum yellow with slight pruinescence.

Wings (Image 2b): Hyaline; Ax 2, Px: FW= 11, HW= 10. Pt: dark brown, slightly darker in HW, spanning just more than one cell; arcus lying at the level of second Ax; petiolated from anal vein; radial vein arising at the level of nodus.

Abdomen (Image 2a): Bright yellow; S2–6 posterior

border dorsally faint brown; S7–8 faint brown dorsally, S9–10 dark brown; dorsum of S10 black, extended at the anterior border.

Genital ligula (Image 5): Description of genital ligula mainly based on paratype; genitalia was not dissected from the holotype to keep the specimen intact, but the holotype genitalia was observed under the microscope

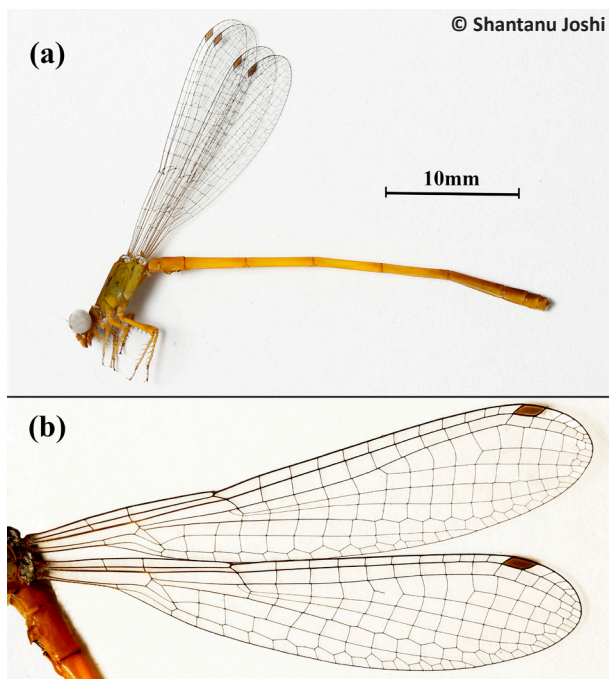


Image 2. Holotype male (BB921): (a) lateral habitus | (b) wings.

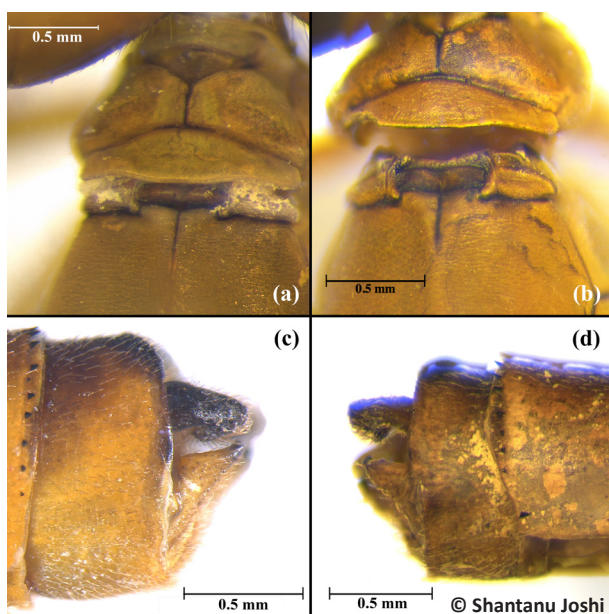


Image 4. Prothorax: (a) holotype male | (b) paratype (BB923) male. Caudal appendages (paratypes): (c) BH970 | (d) BB923.

after relaxing the specimen to confirm characters described here. Laterally, ventral half of first segment one black, rest pale brownish-yellow; anterior 1/4th of second segment black, continued as dark brown; black medial marking faintly visible in ventral view; third segment bi-lobed, folded internally with brown apex,

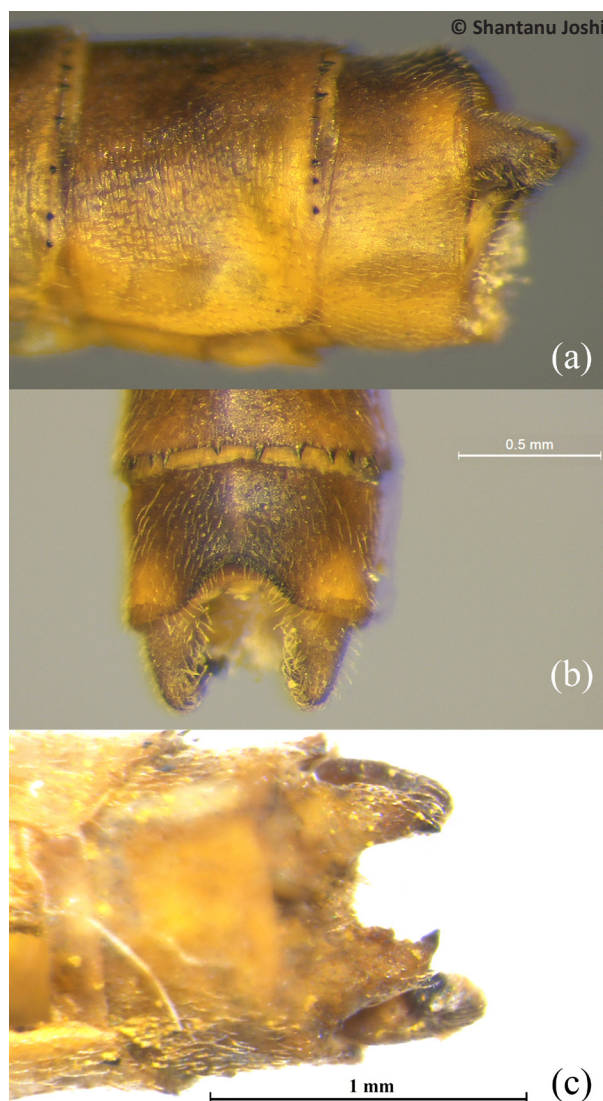
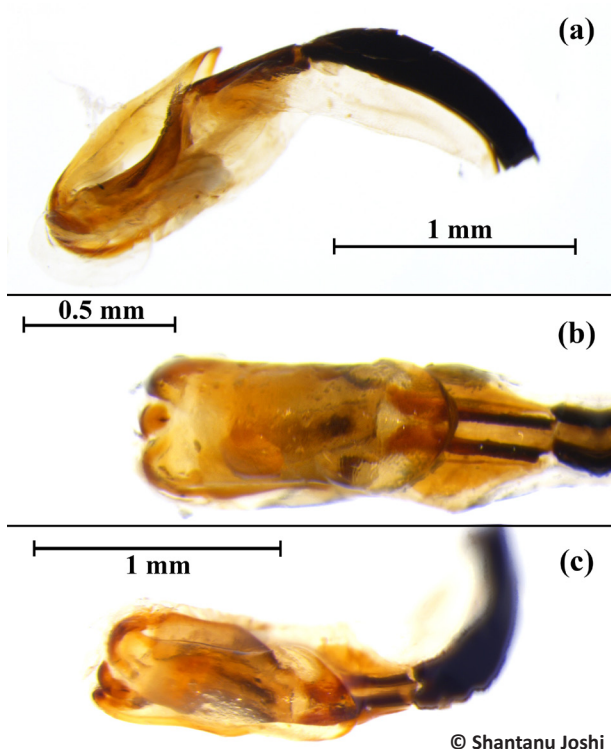


Image 3. Holotype male caudal appendages: (a) lateral | (b) dorsal | (c) ventral.

and darker terminal fold; apex of terminal segment visible between the two lobes in ventral view, lateral margins of lobes straight till midway and expanded thereon.

Caudal appendages (Image 3): Cerci longer than paraprocts, broader at base; the apex pointed, curved ventrally and inwards, ending in a black spine often not visible in lateral view (Images 3 & 4); laterally paraprocts appear conical or blunt apically depending on the angle; apex inwardly curved, ending in a spine as seen in ventral and dorsal views; cerci dark brown covered densely with yellow setae especially at the inwardly curved apical spine. Apex of paraprocts black, base pale brown; both covered with setae.

Measurements (in mm): abdomen + anal appendages



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Image 5. Genital ligula of paratype (BB923) male: (a) lateral | (b) ventral | (c) ventro-lateral.

= 37.2, HW= 21.5, FW= 22.5, genital ligula= 2.1, cerci= 0.5.

Variation in paratype males

Px: FW: 11–12, HW: 10–11. The paratypes and holotype show slight variation in the brown markings on dorsum of S5–10, particularly evident living specimens. In some males, the markings are only restricted to the posterior half of segments. Due to the angle and the position of paraprocsts the caudal appendages appear slightly different in paratype males (Image 4c&d).

Description of allotype female (Image 6–7, 10)

Head: Pale olive, frons with paired black spots at the ventral border; vertex and occipital area pale brown; eyes olive green, blue at dorsum in live individuals; faint greenish-yellow in the pinned specimen.

Prothorax (Image 6): Propleuron with a black marking laterally; anterior lobe with a paired black stripe darker at the posterior border; anterior border of anterior lobe raised, bilobed; medial lobes more rounded than in male; posterior lobe tri-lobed similar to the male.

Synthorax (Image 10): Mesostigmal plates similar to male; yellow, except a conspicuously black and large depression below mesostigmal plates; lateral carina

Species	<i>Ceriagrion chromothorax</i>	<i>Ceriagrion indochinense</i>	<i>Ceriagrion coromandelianum</i>
Character			
Caudal Appendages (Lateral)			
Caudal Appendages (Dorsal)			
Prothorax			
Genital Ligula (Lateral)			

Figure 1. Compilation of diagnostic characters of *Ceriagrion* spp. Illustrations of *Ceriagrion chromothorax* sp. nov. hand-drawn by Dattaprasad Sawant, except the genital ligula which is drawn by Paresh churi. Other images edited from Asahina (1967). Compiled by Shantanu Joshi.

slightly curved; anteriorly curved towards the junction with lateral carina on both sides, anterior carina black; rest of the synthorax pale greenish yellow, darker dorsally, especially the mesepisternum. Legs: coxae white; dorsal 2/3rd of femur dirty white, rest pale brown; posterior face of femur dark brown, broader at the ventral margin; tibia and tarsus pale brown; legs covered with black spines.

Wings: Similar to male, hyaline, with black venation, basal veins dark brown; pterostigma dark brown, quadrate; Px: FW: right=10, left=11, Ax: 2 in all wings.

Abdomen (Image 10): S1 pale brown, S2–5 yellow; laterally and ventrally posterior 1/3rd of S5 and S6–10 pale brown; S2–7 and S9 with black marking at the posterior margin, darker sequentially, S7 with a black marking at the anterior margin; S8 black latero-dorsally, anterior half of S9 black laterally; S10 pale with faint dark brown markings at the anterior margin dorsally.

Caudal Appendages (Image 7): Cerci brown, stylus dark brown, valve pale brown; cerci laterally flattened, curved inwards approximately 45 degrees, covered with yellow setae; stylus simple reaching to half the length of cerci posteriorly, in lateral view; slightly tapering in the middle, slightly expanded at the apex.

Differential diagnosis

Ceriagrion chromothorax sp. nov. is similar to *C. coromandelianum*, and *C. indochinense*, the latter has not been recorded from India but could possibly occur

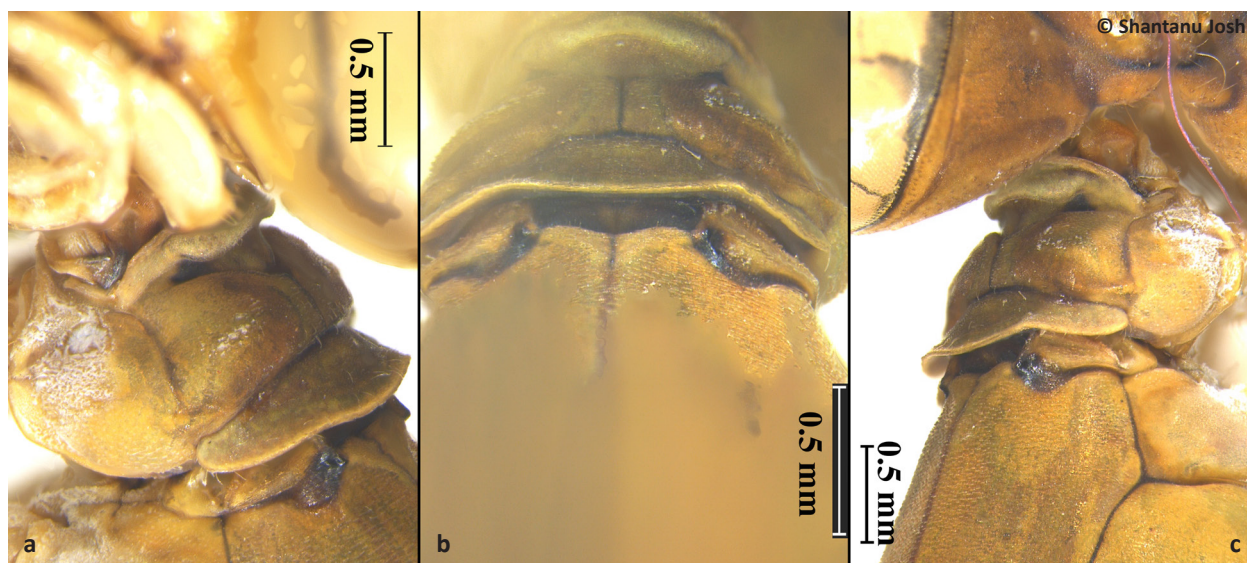
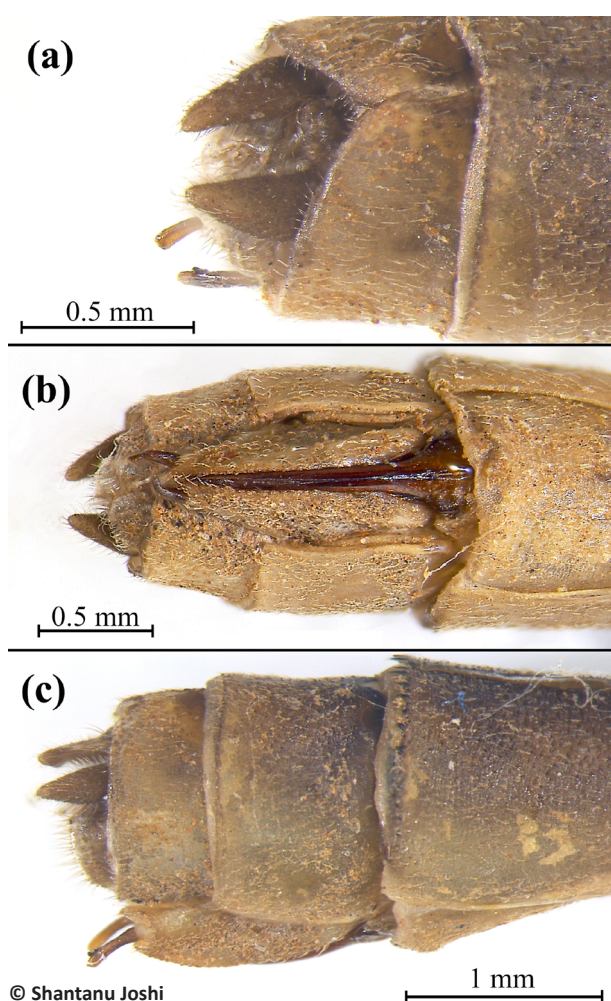


Image 6. Prothorax of *Ceriagrion chromothorax* sp. nov. allotype female (BH969). a - right lateral | b - dorsal; c - left lateral views.



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Image 7. Caudal appendages of *Ceriagrion chromothorax* sp. nov. allotype female (BH969): a - dorso-lateral | b - ventral | c - lateral.

in the northeast. The above three species share the character of yellow or olivaceous thoracic and abdominal coloration, but they differ with respect to the shape of their anal appendages, structure of prothorax and mesostigmal plate. *Ceriagrion fallax*, occurs in northern India but not in western India, it is similar to the three above-mentioned in terms of the yellow abdominal coloration, but is readily distinguishable using the following characters: a) S7–10 extensively black, b) shape of posterior lobe of prothorax and mesostigmal plates, and c) shape of anal appendages.

Ceriagrion chromothorax males can be distinguished from *C. coromandelianum* and *C. indochinense* by: a) shape and length of cerci and paraprocts (paraprocts shorter than cerci in *C. chromothorax*, while longer than cerci in the two latter species, Fig. 2, Images 3,4,10), b) shape of the prothorax and mesostigmal plates (Images 4; Fig. 2), and c) completely yellow thorax (Image 1–2: green in *C. coromandelianum* and *C. indochinense* (Image 8). The genital ligula is similar in these three species, but in *C. chromothorax* the third segment is conspicuously bi-lobed (Image 5b&c).

Ceriagrion chromothorax is very similar to *C. indochinense* in the following characters: a) thoracic coloration, b) larger size (in relation to *C. coromandelianum*) and shape of paraprocts; but these two species differ most conspicuously in the structure of the mesostigmal plate of the thorax. The caudal appendages of *C. chromothorax*, although similar to *C. indochinense*, can be differentiated by the longer cerci, and the inwardly curved, apical spine of the paraprocts.



Image 8. Males of: (a) *Ceriagrion chromothorax* sp. nov. | (b) *C. coromandelianum* | (c) *C. indochinense*.

The structure of mesostigmal plates is unique in *C. chromothorax*, especially the shape of the lateral carina (Fig. 1). The posterior lobe of the prothorax in *C. chromothorax* differs in shape from *C. coromandelianum* and *C. indochinense* (the posterior margin of medial lobe is straight, not curved, posterior margin of lateral lobes less curved (Images 4,10 & Fig. 1).

Ceriagrion chromothorax is a larger species with a slimmer abdomen as compared to the widespread *C. coromandelianum*. Cerci are almost as long as paraprocts in *C. chromothorax*, while cerci are much shorter than paraprocts in *C. coromandelianum* (Fig. 2). These two characters along with the shape of the mesostigmal plates can be used to separate these two sympatric *Ceriagrion* species. The female of this species is more difficult to distinguish from *C. coromandelianum*, and is also similar to another co-occurring species, *C. olivaceum*. Females of these three species have olive green thorax and pale brown abdominal coloration; however, the female of *C. chromothorax* can be distinguished from similar *Ceriagrion* species by: a) shape of its mesostigmal plates (especially the lateral carina, Image 6), and b) dark markings at the posterior border of S2-7 (Image 9).

Habitat, habits and notes on congeneric species

A total of 14 visits were made to the type locality by

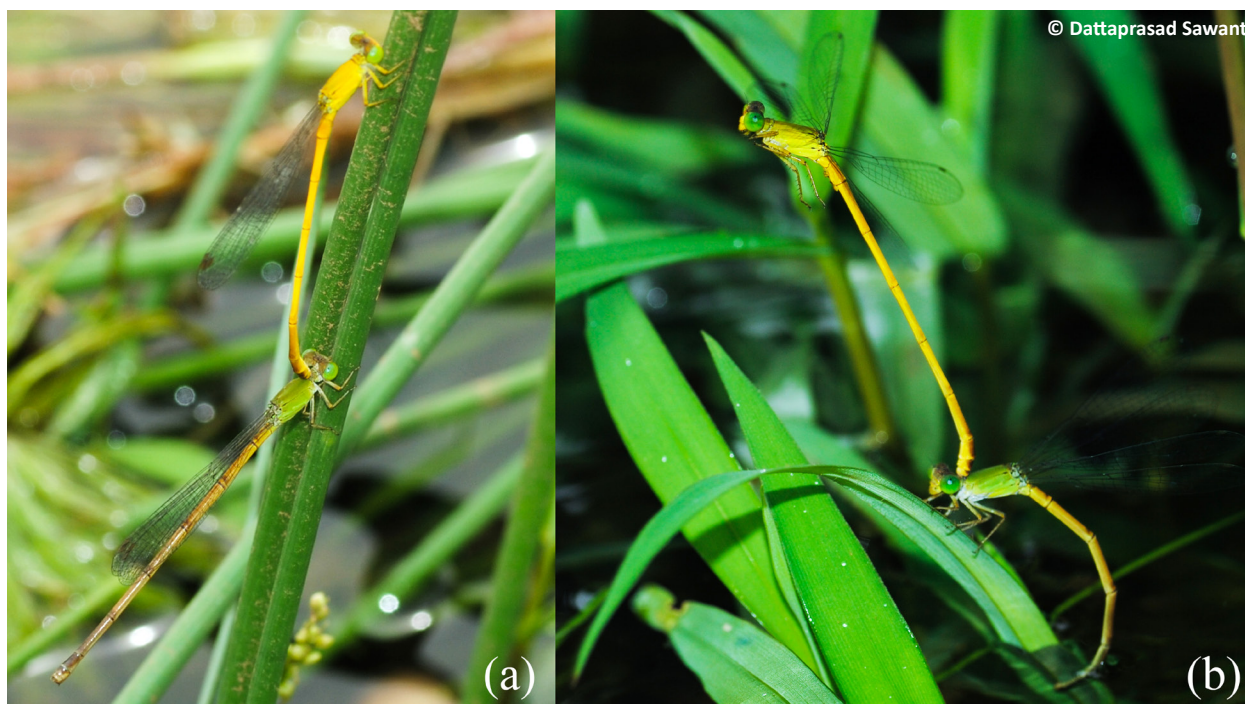


Image 9. Copulae of *Ceriagrion chromothorax* sp. nov. observed at the type locality on 16.viii.2018.

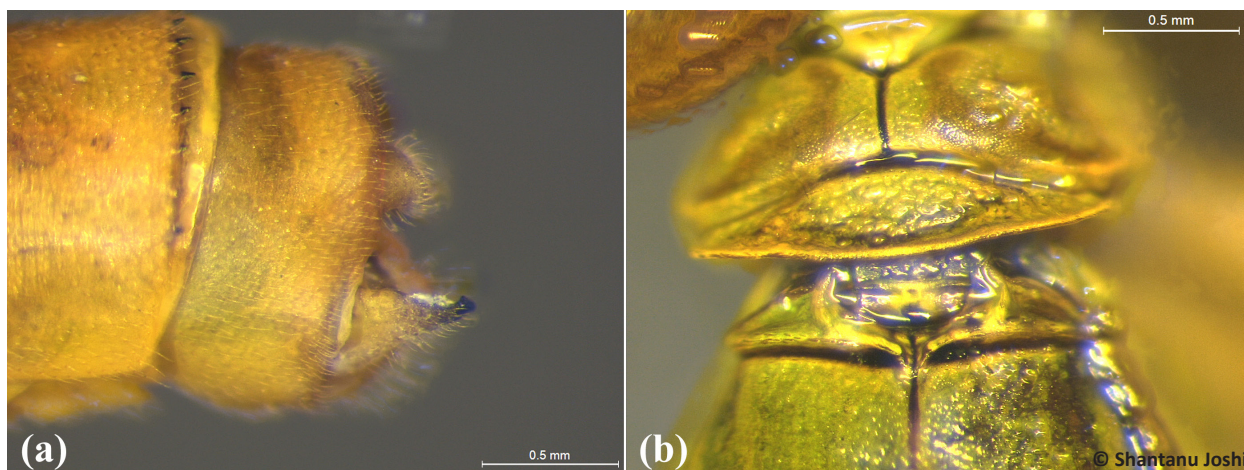


Image 10. *Ceriagrion coromandelianum* male collected on 15.viii.2018 from National Centre for Biological Sciences, Bangalore, Karnataka: (a) - Anal appendages | (b) prothorax.

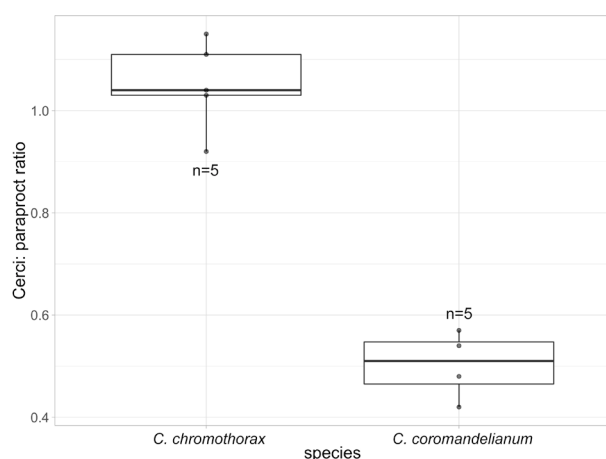


Figure 2. Cerci: paraproct ratio in *Ceriagrion chromothorax* vs. *C. coromandelianum*. For *C. coromandelianum*, the ratio was calculated using illustrations from Asahina 1967, Lahiri 1987, Fraser 1933a, and two males collected on 15.viii.2018 from National Centre for Biological Sciences, Bangalore, Karnataka. A ratio of 0.5 indicates that cerci and paraprocts are of equal length.

DS, from July 2017 to November 2018. Two individuals of *C. chromothorax* were first observed in July 2017, in the bushes near a banyan tree (*Ficus benghalensis*) at a weir dam (locally known as 'Bandhara') on a stream (Image 11). On two subsequent visits conducted on 4 and 10 August two males were observed, the holotype male (Images 2–4) was collected on fourth. On the next visit to the same locality on 27 September 2017, DS observed three *C. chromothorax* males out of which two were preserved as paratypes (with no sign of the female). In the month of November and December no individuals of *C. chromothorax* were observed, while density of *C. coromandelianum* increased. More than

15 males were observed along with three copulae on 16 August 2018, one copula was collected, from which the female allotype is described. *C. chromothorax* was observed at an additional locality in Wada Village (Image 12), Sindhudurg District, Maharashtra (GPS coordinates: 16.443946, 73.392725), approximately two kilometers from the type locality. Habitat where the species was observed in Wada was an isolated muddy pond, surrounded by rice paddy fields and coconut plantations around it. Four males, but no females were observed at the pond on 18 August 2018

Both the type locality and the other locality at Wada (Image 12) are seasonal. Water starts building up from June with the start of monsoon. July–September the water levels remain high, aquatic vegetation is most abundant during this period (see Image 11a). From the end of September water levels start reducing, high fluctuations in water levels can be seen during this period dictated by infrequent storms and rain. February onwards there was almost no flowing water (see Image 11b&g, Image 12), with only a few puddles left along with some odonate species such as *Amphilagma parvum* and *Tramea* sp.

Four *Ceriagrion* species, viz., *C. cerinorubellum* (Brauer, 1865), *C. olivaceum* (Laidlaw, 1914), *C. rubiae* (Laidlaw, 1916), and *C. coromandelianum* were observed co-occurring with *C. chromothorax* at the type locality. All five *Ceriagrion* species were observed simultaneously from July–September, whilst October–November onwards only *C. coromandelianum* and *C. cerinorubellum* were present. *C. chromothorax* males were observed aggressively interacting with *C. coromandelianum*, *C. cerinorubellum*, *Pseudagrion rubriceps*, and *Pseudagrion*

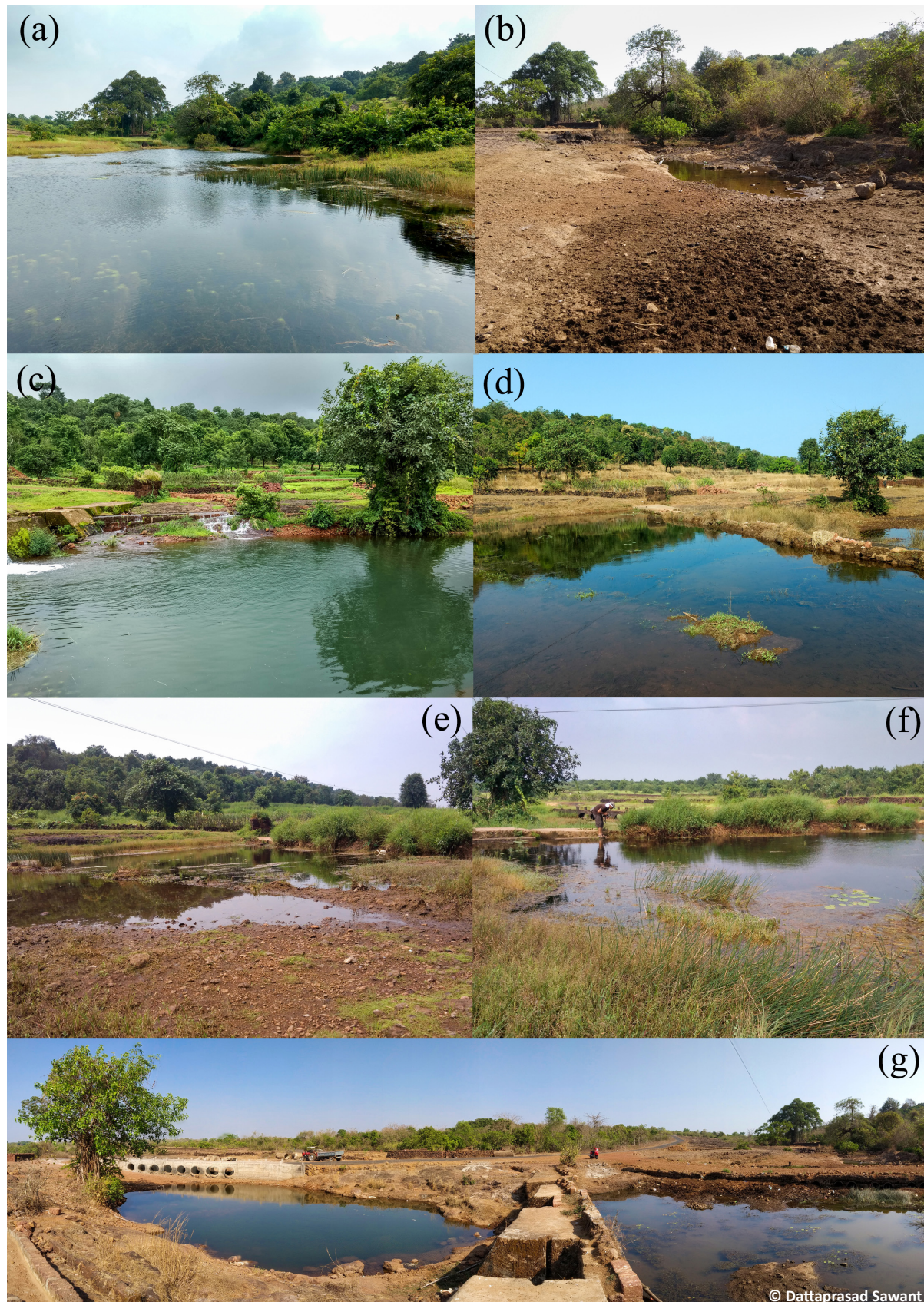


Image 11. Type locality: Vimalleshwar, Devgad, Sindhudurg District, Maharashtra, India (16.433 N, 73.395 E) on (a) 30.ix.2017 | (b) 14.ii.2019 | (c) 16.viii.2018 | (d) 24.xi.2018 | (e) 27.ix.2017 | (f) 27.ix.2017 | (g) 14.ii.2019.



Image 12. Habitat at Wada (16.443°N & 73.392°E), the second locality where *Ceriagrion chromothorax* sp. nov. was observed. Image captured on 25.iii.2019.

malabaricum. *C. chromothorax* males were observed feeding six times, following prey species were observed: a) a small white moth, b) a teneral *Pseudagrion microcephalum*, and c) *C. coromandelianum* (on four separate occasions). This species prefers aquatic vegetation/grasses along the edges and wasn't observed in the deeper parts of the water body.

DISCUSSION

Ceriagrion is a genus of small to medium-sized generally brightly coloured damselflies with 51 species found across Africa, Asia and Australia and with a single representative in Europe. Most species are widespread, but certain groups have incredible cryptic diversity, which remains understudied especially in Asia. One such group comprises seven species (including *C. chromothorax*), which are found in mainland southern and southeastern Asia and are similar in appearance, having yellow abdominal coloration together with a yellow or olive thorax.

Of the seven species *C. coromandelianum* is undoubtedly the most widespread. In Western Ghats two 'yellow' *Ceriagrion* occur: *C. coromandelianum* and *C. chromothorax* sp. nov. (*C. chromothorax* being the only endemic representative of the genus in Western Ghats and India). *Ceriagrion coromandelianum*, *C.*

fallax, and *C. indochinense* are widespread, whilst *C. nigroflavum*, *C. melanurum*, and *C. pallidum* have comparatively restricted distributions. *Ceriagrion nigroflavum* is closely related to *C. fallax* with which it occurs in Myanmar, Thailand and Laos. Although *C. nigroflavum* appears to be widely distributed, it is the only Asian *Ceriagrion* whose female remains unknown (Dow 2010). In addition, it is known from only a handful of specimens with no records since 1952. *Ceriagrion pallidum* was described from Laos and remains poorly known. Although, Fraser (1933b) mentions it as "similar to *C. azureum* and *C. olivaceum*" (two very different species), this species resembles immature or teneral coloration in *C. coromandelianum* and *C. indochinense* (Farrell 2016). *Ceriagrion melanurum*, another species similar to *C. fallax*, is distributed in China including Taiwan, the Korean Peninsula and Japan.

This description of a new species from the Western Ghats, a reasonably well studied region in terms of Odonata, is surprising and suggests that it has been misidentified as *C. coromandelianum* in the field by previous workers. This is the first new *Ceriagrion* species to be described from Asia in more than 50 years (Schorr & Paulson 2018). The type locality of this species is a non-protected area rich in odonate diversity, with more than 60 odonate species (Dattaprasad Sawant, pers. comm. 28 March 2019).

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Articles

Cats, canines, and coexistence: dietary differentiation between the sympatric Snow Leopard and Grey Wolf in the western landscape of Nepal Himalaya

– Anil Shrestha, Kanchan Thapa, Samundra Ambuhang Subba, Maheshwar Dhakal, Bishnu Prasad Devkota, Gokarna Jung Thapa, Sheren Shrestha, Sabita Malla & Kamal Thapa, Pp. 13815–13821

Genetic diversity among the endemic barb *Barbodes tumba* (Teleostei: Cyprinidae) populations from Mindanao, Philippines

– Onaya P. Abdulmalik-Labe & Jonas P. Quilang, Pp. 13822–13832

The importance of conserving fragmented forest patches with high diversity of flowering plants in the northern Western Ghats: an example from Maharashtra, India

– Amol Kishor Kasodekar, Amol Dilip Jadhav, Rani Babanrao Bhagat, Rakesh Mahadev Pawar, Vidya Shrikant Gupta & Narendra Yeshwant Kadoo, Pp. 13833–13849

Communications

First assessment of bird diversity in the UNESCO Sheka Forest Biosphere Reserve, southwestern Ethiopia: species richness, distribution and potential for avian conservation

– Mattias Van Opstal, Bernard Oosterlynck, Million Belay, Jesse Erens & Matthias De Beenhouwer, Pp. 13850–13867

Roadkill of animals on the road passing from Kalaburagi to Chincholi, Karnataka, India

– Shankerappa Shantveerappa Hatti & Heena Mubeen, Pp. 13868–13874

***Ceriagrion chromothorax* sp. nov. (Odonata: Zygoptera:**

Coenagrionidae) from Sindhudurg, Maharashtra, India

– Shantanu Joshi & Dattaprasad Sawant, Pp. 13875–13885

The diversity and distribution of polypores (Basidiomycota: Aphyllophorales) in wet evergreen and shola forests of Silent Valley National Park, southern Western Ghats, India, with three new records

– C.K. Adarsh, K. Vidyasagar & P.N. Ganesh, Pp. 13886–13909

Short Communications

Recent photographic records of Fishing Cat *Prionailurus viverrinus* (Bennett, 1833) (Carnivora: Felidae) in the Ayeyarwady Delta of Myanmar

– Naing Lin & Steven G. Platt, Pp. 13910–13914

Rediscovery of Van Hasselt's Mouse-eared Bat *Myotis hasseltii* (Temminck, 1840) and its first genetic data from Hanoi, northern Vietnam

– Vuong Tan Tu, Satoru Arai, Fuka Kikuchi, Chu Thi Hang, Tran Anh Tuan, Gábor Csorba & Tamás Görföl, Pp. 13915–13919

Notes on the diet of adult Yellow Catfish *Aspistor luniscutis* (Pisces: Siluriformes) in northern Rio de Janeiro State, southeastern Brazil

– Ana Paula Madeira Di Beneditto & Maria Thereza Manhães Tavares, Pp. 13920–13924

Waterbirds from the mudflats of Thane Creek, Mumbai, Maharashtra, India: a review of distribution records from India

– Omkar Dilip Adhikari, Pp. 13925–13930

Moths of the superfamily Tineoidea (Insecta: Lepidoptera) from the Western Ghats, India

– Amit Katewa & Prakash Chand Pathania, Pp. 13931–13936

Winter season bloomer Hairy *Bergenia* *Bergenia ciliata* (Haw.) Sternb. (Saxifragales: Saxifragaceae), an important winter forage for diverse insect groups

– Aseesh Pandey, Ravindra K. Joshi & Bhawana Kapkoti Negi, Pp. 13937–13940

Notes

Kerala state bird checklist: additions during 2015 – May 2019

– Abhinand Chandran & J. Praveen, Pp. 13941–13946

What is in a name? The birthright of *Oxyopes nilgircus* Sherriffs, 1955 (Araneae: Oxyopidae)

– John T.D. Caleb, P. 13947

Book Review

Study on biological and ecological characteristics of mudskippers

– Ali Reza Radkhah & Soheil Eagderi, Pp. 13948–13950

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