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Dragonflies and Damselflies (Insecta, Odonata) from the western region of Nepal with new records of four species

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ABSTRACT. Dragonflies and damselflies are bioindicator species belonging to the class Insecta. The research was conducted in the Karnali River basin from April to early October 2022 to contribute and update the Odonata checklist of Nepal including documenting regional new species. From the odonatological survey, four species viz., *Aristocypha spuria* Selys, 1879, *Pseudocopera ciliata* (Selys, 1863), *Aciagrion occidentale* Laidlaw, 1919 and *Zyxomma petiolatum* Rambur, 1842 were recorded for the first time from Nepal. Besides these, *Copera marginipes* (Rambur, 1842), *Copera vittata* (Selys, 1863), *Prodasineura autumnalis* (Fraser, 1922), *Agriocnemis clauseni* Fraser, 1992, *Ceriagrion cerinorubellum* (Brauer, 1865), *Cephalaeschna viridifrons* (Fraser, 1923), *Gynacantha incisura* Fraser, 1935, *Gynacanthaeschna sikkima* (Karsch, 1891), *Lamelligomphus risi* (Fraser, 1922), *Scalmogomphus bistrigatus* (Hagen in Selys, 1854), *Rhodothemis rufa* (Rambur, 1842), *Tetrathemis platyptera* Selys, 1868 and *Urothemis signata signata* (Rambur, 1862) were newly recorded for western region of Nepal.

Keywords: Anisoptera, distribution, diversity, wetlands, Zygoptera

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INTRODUCTION

Odonata are amphibious insects distributed worldwide, having three stages during their entire lifecycle life i.e. eggs, nymph (larva) and adult. Odonata are sensitive to abiotic factors and many species respond more rapidly to changes in vegetation structure than other animals making them valuable bioindicators of riparian habitat integrity (Foote & Hornung, 2005; Villalobos-Jimenez et al., 2016). Therefore, the diversity, distribution and abundance of both larvae and adult Odonata depend on water chemistry (Watson et al., 1982; Dolny et al., 2013). Nepal, located in the Indian subcontinent, possess a diverse wetland habitat that ranges from lowlands to high altitudes, providing a rich habitat for odonates diversity. In Nepal, the study of odonatology was not well known until the 20th century, except for scanty publications. Major contributions were made by Asahina (1955) and St. Quentin (1970) in exploring Nepalese Odonates. Vick (1989) compiled a checklist of 172 species along with their altitudinal distribution in Nepal. To date, 182 species are so far have been reported from Nepal (Kalkman et al., 2020; Conniff et al., 2020; Sharma, 2021; KC & Sapkota, 2022).

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The western region of Nepal is a hotspot of flora and fauna diversity due to variations in the habitat and climatic conditions. The Karnali River basin is located in the western part of Nepal and is abundant in lakes, streams, waterfalls and rivers with high water flow. It also features irrigation channels with riparian vegetation and paddy cultivation during the monsoon season, which serves as a perching site for Odonates. The study aims to explore Odonates in the Karnali river basin to support the long-term conservation of the species and the habitat wetlands in Nepal.

MATERIAL AND METHODS

Nepal is broadly divided into three regions based on three major river basins i.e., the western region (Karnali River basin), the central region (Gandaki River basin) and the eastern region (Koshi River basin) (Khatiwada et al., 2018). An odonatological survey was conducted in the western region of Nepal (Fig. 1). The survey plots included Ramaroshan Lake complex (a wetland within a forested area), a river near Upper Dungeshwar (fast-flowing water channels with hanging shrubby vegetation and partially submerged large stones), Baluwa sangrahi (a paddy field along a river with hanging shrubby vegetation and partially submerged large stones), Kupinde daha (a reservoir with the rocky areas and trees), Kamal Daha (a wetland dominated by shrubs, especially lotus), Bulbule Lake (a shrub-dominated wetland with a slow running water channel), Hurke (a small brook dominated by shrubby vegetation), and Girighat (fast-flowing river with patchy vegetation and submerged large stones) (Fig. 1).

The specimens were collected from Lakes, ponds, river tributaries, reservoirs and rice fields from April to early October 2022 on sunny days from 08:00 to 17:00 hours. In the field, specimens were captured using an insect-sweeping net and euthanized. Then it is stored in a triangular glassine envelope for identification in the laboratory. The species were also photographed using a DSLR Nikon D3400 camera attached with an 18–55 mm lens in a natural habitat. Identification was done using taxonomic keys (Fraser, 1933, 1934, 1936), field guides (Subramanian, 2009; Nair, 2011; Singh, 2022) and the Odonata of India website (https://www.indianodonata.org). All the specimens were deposited at the museum of the Central Department of Zoology, Tribhuvan University in Kirtipur, Kathmandu, Nepal.

RESULTS

Taxonomic hierarchy

Order Odonata Fabricius, 1793

Suborder Anisoptera Selys, 1854

Family: Aeshnidae Rambur, 1842

***Cephalaeschna viridifrons* (Fraser, 1923)** (Fig. 2)

Material Examined. 1♂, Karnali province, Salyan district, Kupinde Daha (28°24'38.41"N, 82°03'32.33"E, 1127 m a.s.l.), 7-viii-2022. Coll. M. Sharma.

Field diagnosis (♂)**.** Thorax with reddish-brown with pale green to yellow antehumeral stripes. Abdomen cylindrically tapered, black with the fine yellow dorsal stripe from segments 2–8. Laterally, broadly yellow, turning reddish-brown towards the end. Segments 9–10 immaculate. Ovipositor process long, extending beyond the abdominal end.

Distribution. India, and Nepal (Kalkman et al., 2020; Current study).

***Gynacantha incisura* Fraser, 1935** (Figs 3–4)

Material Examined. 1♀, Karnali province, Salyan district, Kupinde Daha (28°24'38.41"N, 82°03'32.33"E, 1127 m a.s.l.), 1-v-2022. Coll. M. Sharma.

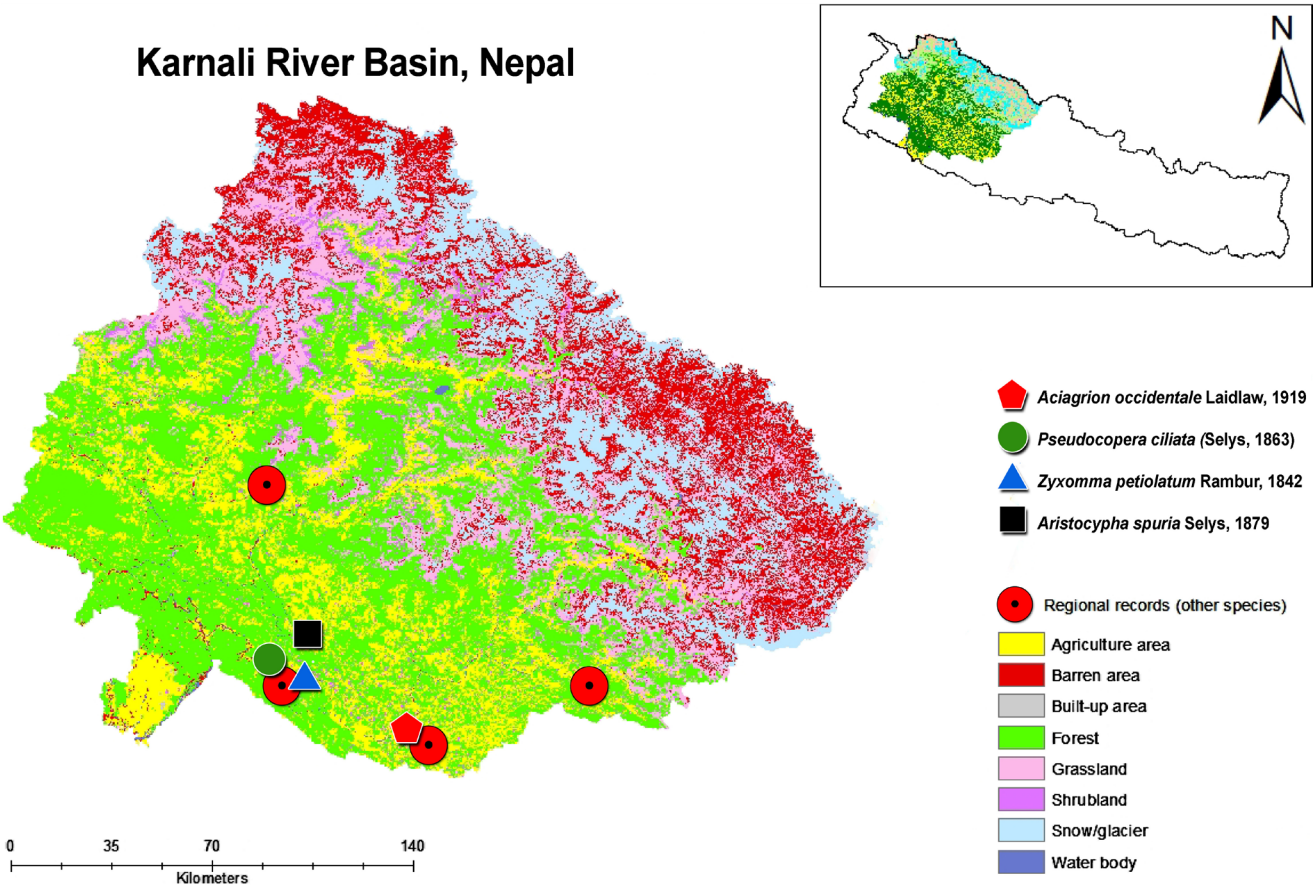


Figure 1. Map of the study area indicating sampling sites and four newly recorded species.

Field diagnosis (♀). Body olivaceous-green. Thorax without well-defined dark stripes. wings hyaline, unmarked at base. Abdomen tumid at base, markedly constricted at segment 3; dark reddish-brown dorsally with olivaceous paired spots on segments 3–8. Segments 9–10 unmarked. Anal appendages deep reddish-brown, narrow at basal region, then gradually expanding to apex. Ventral plate forked.

Distribution. Bhutan, Nepal, and Thailand (Pierce & Makbun, 2020; Kalkman et al., 2020; Current study).

Gynacanthaeschna sikkima (Karsch, 1891) (Fig. 5)

Material Examined. 1♂, Karnali province, Achham district, Ramaroshan Lake (29°13'45.80"N, 81°27'58.86"E, 2404 m a.s.l.), 6-x-2022. Coll. M. Sharma.

Field diagnosis (♂). Thorax dark reddish-brown, marked with grass-green narrow antehumeral stripes. First abdominal segment with a large quadrate green spot laterally, segment 2 with a broad interrupted yellow stripe each side. Segments 3–8 with small baso-lateral spots, small paired jugal spots and apical dorsal lunules. Segment 9 with its apical border very narrowly green and a small baso-lateral spot; segment 10 with a large yellow spot on each side. Cerci narrow at base, dark reddish-brown then markedly dilated, about twice the length of segment 10; epiproct two-thirds the length of cerci, narrowly triangular, curled gently upwards at apex.

Distribution. Bhutan, China, India, Nepal, and Pakistan (Zhang, 2017; Kalkman et al., 2020; Current study).

Family Gomphidae Rambur, 1842

Lamelligomphus risi (Fraser, 1922) (Fig. 6)

Material Examined. 1♂, Karnali province, Surkhet District, Girighat (28°35'58.23"N, 81°32'31.67"E, 422 m a.s.l.), 6-viii-2022. Coll. M. Sharma.

Field diagnosis (♂). First abdominal segment with large inferior lateral spot and a linear transverse apical dorsal spot. Segment 2 broadly yellow laterally and a linear mid-dorsal stripe. Segments 3–6 with basal rings. Segment 7 with rather more than basal greenish yellow, segments 8–10 unmarked; anal appendages about the length of segments 8–9 together, cerci yellowish and curled.

Distribution. Bhutan, China, India, and Nepal (Zhang, 2017; Kalkman et al., 2020; Current study).

Scalmogomphus bistrigatus (Hagen in Selys, 1854) (Fig. 7)

Material Examined. 1♂, Lumbini province, East Rukum district, Kamal Daha (28°36'45.72"N, 82°37'27.05"E, 1564 m a.s.l.), 7-viii-2022. Coll. M. Sharma.

Field diagnosis (♂). Thorax black on the dorsum, marked with yellow hook-like stripes. Abdomen black with yellow markings on Segements 2–7. Segments 8–10 dorsally black, segments 8–9 widened and lateral spots present and cerci longer than epiproct and curled.

Distribution. Bhutan, India, Nepal, and Pakistan (Kalkman et al., 2020; Current study).

Family Libellulidae Rambur, 1842

Rhodothemis rufa (Rambur, 1842) (Fig. 8)

Material Examined. 3♀♀, Karnali province, Surkhet district, Bulbule lake (28°34'56.17"N, 81°37'10.38"E, 646 m a.s.l.), 6-vi-2023. Coll. M. Sharma.

Field diagnosis (♀). Thorax reddish-brown on the sides and more blackish-brown on the dorsum, with citron-yellow stripe markings extending to the first abdominal segment. Rusty brown with a mid-dorsal yellow stripe extending from the base of the head to the segment 4 of the abdomen.

Distribution. Austria, Bangladesh, China, India, Malaysia, Nepal, Pakistan, Papua New Guinea, Philippines, and Sri Lanka (Kalkman & Orr, 2014; Zhang, 2017; Kalkman et al., 2020; Current study).

Tetrathemis platyptera Selys, 1868 (Figs 9–10)

Material Examined. 2♂♂ Karnali province, Surkhet district, Bulbule lake (28°34'56.17"N, 81°37'10.38"E, 646 m a.s.l.), 3-viii-2022; 10♂♂, 5♀♀, Karnali province, Surkhet district, Hurke (28°40'5.66"N, 81°30'49.54"E, 783 m a.s.l.), 6-viii-2022. Coll. M. Sharma.

Field diagnosis (♂♀). Thorax blackish with broad bright yellow stripes marking on sides. Wings transparent, the base of the wings tinted with amber-yellow. Abdomen black with yellow spots on sides up to segment 7 and segments 8–10 unmarked. Female very similar to male, but the amber-coloured areas of the wing much deeper and more robust abdomen.

Distribution. Bhutan, Bangladesh, India, and Nepal (Kalkman et al., 2020; Gurung et al., 2022; Current study).

Urothemis signata signata (Rambur, 1862) (Figs 11–12)

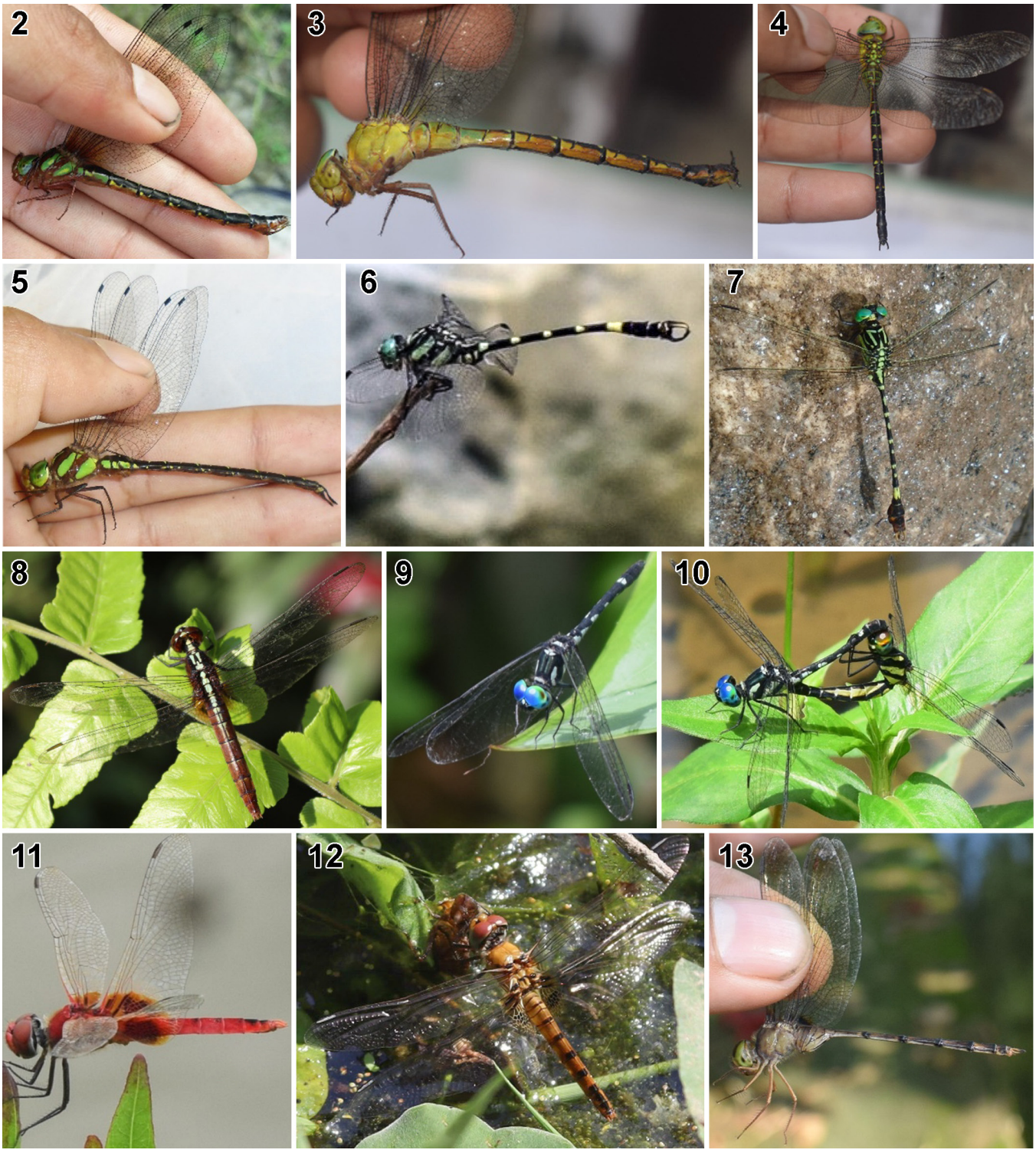
Material Examined. 2♂♂, 5♀♀, Karnali province, Surkhet district, Bulbule lake (28°34'56.14"N, 81°37'10.38"E, 646 m a.s.l.), 3-viii-2022.

Field diagnosis (♂♀). Thorax reddish dorsally and olivaceous with reddish suffusion laterally. Wings transparent with crimson reticulation and base of wings has a golden amber-yellow spot. Abdomen bloody red with some black markings on segments 8–9. Female with yellowish-olivaceous abdomen bearing black spots on segments 3–7; segments 8 and 9 with black dorsal marks.

Distribution. India, Malaysia, Myanmar, Nepal, Pakistan, and Sri Lanka (Kalkman et al., 2020; Current study).

Zyxomma petiolatum Rambur, 1842 (Fig. 13)

Material Examined. 3♂♂, 2♀♀, Karnali province, Surkhet district, Bulbule lake (28°34'56.14"N, 81°37'10.38"E, 646 m a.s.l.), 3-viii-2022. Coll. M. Sharma.



Figures 2–13. Anisoptera. **2.** *Cephalaeschna viridifrons*, female; **3.** *Gynacantha incisura,* female; **4.** *Gynacantha incisura*, dorsal view; **5.** *Gynacanthaeschna sikkima*, male; **6.** *Lamelligomphus risi*, male; **7.** *Scalmogomphus bistrigatus*, male; **8.** *Rhodothemis rufa*, female; **9.** *Tetrathemis platyptera*, male; **10.** *Tetrathemis platyptera*, mating; **11.** *Urothemis signata signata*, male; **12.** *Urothemis signata signata*, teneral, female; **13.** *Zyxomma petiolatum*, male.

Field diagnosis (♂♀). Abdomen relatively enormously dilated from the first segment to the base of third segment then abruptly contracted, slim and cylindrical to the end. Cerci as long as segments 9–10 combining, slim and sinuous, acuminate at apex. Wings transparent with broad brown apices (Fig. 13).

Ecology. These are crepuscular species meaning they fly shortly before dusk or in the late afternoon. Two males were chasing each other near the edge of the water outlet canal of the Lake on date 3-viii-2022. The next morning, a single female was perching on tangled vegetation at the edge of the Lake.

Distribution. This species is currently known from Bangladesh, Cambodia, China, India, Pakistan, Sri Lanka, Thailand, and Vietnam (Kalkman et al., 2020), and Nepal (**new record**).

Suborder Zygoptera Selys, 1854

Family Chlorocyphidae Cowley, 1937

Aristocypha spuria Selys, 1879 (Figs 14–16)

Material Examined. 1♂, 3♀♀, Karnali province, Dailekh district, River near Upper Dungeshwar (28°46'8.22"N, 81°37'41.19"E, 626 m a.s.l.), 6-v-2022. Coll. M. Sharma.

Field diagnosis (♂)**.** This species closely resembles the *Aristocypha quadrimaculata* (Selys, 1853). It can be diagnosed by an apical vitreous spot large, lying almost entirely proximal to the line of pterostigma; mid row of spots consisting of well separated four spots (vs apical vitreous spot moderately large lying partly proximal to line of pterostigma (Fig. 14); mid row of spots well separated, almost always three in number in *Aristocypha quadrimaculata*).

Ecology. A single male was observed in fast-flowing river stream in May 2022. It was perching on broken twigs of tree. Later on in August 2023 two males and a single female were perching on stone. This species was observed during May–August.

Distribution. China, India, Myanmar (Mitra, 2018; Kalkman et al., 2020), and Nepal (**new record**).

Family Platycnemididae Jacobson & Bianchi, 1905

Copera marginipes (Rambur, 1842) (Figs 17–19)

Material Examined. 3♂♂, 2♀♀, Karnali province, Surkhet district, Bulbule lake (28°34'56.14"N, 81°37'10.38"E, 646 m a.s.l.), 3-viii-2022. 2♂ Karnali province, Surkhet district, Hurke (28°40'5.66"N, 81°30' 49.54"E, 783 m a.s.l.), 6-viii-2022. Coll. M. Sharma.

Field diagnosis (♂♀)**.** Thorax bronze black with fine yellow lines on the sides. The stripe on the sides narrow and pale greenish-yellow. Legs bright yellowish-orange. Abdomen bronzed black above, segments 3–6 have a pale stripe along the side and a narrow pale greenish-white ring at the end of each segment. Cerci half of segment 10 and tip strongly pointed curled ventral; paraproct half four times longer than cerci, broad at the base, and tapers to a round tip. Female, with brown abdomen above and broad rings towards the end. Half of the segment 8 and the entire segments 9–10 pale brownish white. Anal appendages shorter than segment 10, vulvar scales brown.

Distribution. Bangladesh, China, Pakistan, Sri Lanka, India, and Nepal (Zhang, 2017; Kalkman et al., 2020).

Copera vittata (Selys, 1863) (Fig. 20)

Material Examined. 2♂♂, 2♀♀, Karnali province, Surkhet district, Hurke (28°40'5.66"N, 81°30'49.54"E, 783 m a.s.l.), 6-viii-2022. Coll. M. Sharma.

Field diagnosis (♂♀)**.** Thorax black and chocolate brown with a few coarse yellow spots. Legs reddish-yellow. Abdominal segments 1–2 reddish-yellow. Pale blue rings are present at the front end of the segments 3–7. Segment 9 has a blue spot, and segment 10 entirely blue. Paraproct twice the length of the cerci, broad at the base and tapers towards the end. In females, abdomen pale brown with dark purplish-black. Segments 1–2 pale yellowish-brown. Segments 3–7 bear pale brown anterior rings. The 9th segment has a broad, pale brown T-shaped mark. Segment 10 pale brown.

Distribution. Bangladesh, Bhutan, China, India, and Nepal (Zhang, 2017; Kalkman et al., 2020; Current study).

***Prodasineura autumnalis* (Fraser, 1922)** (Fig. 21)

Material Examined. 1♂, Karnali province, Surkhet district, BaluwaSangrahi (28°27'28.65"N, 82°00' 4.36"E, 544 m a.s.l.), 7-viii-2022. Coll. M. Sharma.

Field diagnosis (♂)**.** Thorax black on the dorsum, with black sides and a whitish band. Abdomen black, segments 3–7 with paired creamy white spots.

Distribution. Bangladesh, India, and Nepal (Kalkman et al., 2020; Current study).

***Pseudocopera ciliata* (Selys, 1863)** (Figs 22–24)

Material Examined. 2♂♂, 3♀♀, Karnali province, Surkhet district, Hurke (28°40'05.66"N, 81°30'49.54"E, 783 m a.s.l.), 6-viii-2022. Coll. M. Sharma.

Field diagnosis (♂♀)**.** Thorax black with pale blue stripe. Abdomen black with bronze tinge, segments 9—10 pale blue. Whitish legs with black bands at the joint of the femur and tibia, and the tip of cerci is blackish in males (Fig. 22). Adult female are similar to male but in teneral females, legs and thorax are light reddish, reddish-orange or pinkish (Fig. 23).

Ecology. An adult male, an adult female and an immature female were observed perching in a small brook by shrubby vegetation. The vegetation provides a shady environment.

Distribution. Bangladesh, Cambodia, China, Hong Kong, India, Malaysia, Myanmar, Taiwan, Thailand, Vietnam (Dow, 2018; Kalkman et al., 2020), and Nepal (**new record**).

Family Coenagrionidae Kirby, 1890

***Aciagrion occidentale* Laidlaw, 1919** (Fig. 25)

Material Examined. 1♀, Karnali province, Surkhet district, Bulbule lake (28°34'56.14"N, 81°37'10.38"E, 646 m a.s.l.), 3-viii-2022; 3♀♀, Karnali province, Surkhet district, Baluwa Sangrahi (28°27'28.65"N, 82°00' 4.36"E, 544 m a.s.l.), 7-viii-2022. Coll. M. Sharma.

Field diagnosis (♀)**.** Thorax pale yellow to bluish antehumeral stripes. Abdomen slender, with segments 1–7 black dorsally, and segments 8–10 blue, with a black triangle on the dorsum of segment 8 (Fig. 25).

Ecology. A single female was seen in the Lake's marshes. Later, three females were observed perching in paddy near the fast-flowing river in August 2022.

Distribution. Bangladesh, Cambodia, India, Sri Lanka, Thailand, Vietnam (Mitra, 2010; Kalkman et al., 2020), and Nepal (**new record**).

***Agriocnemis clauseni* Fraser, 1992** (Fig. 26)

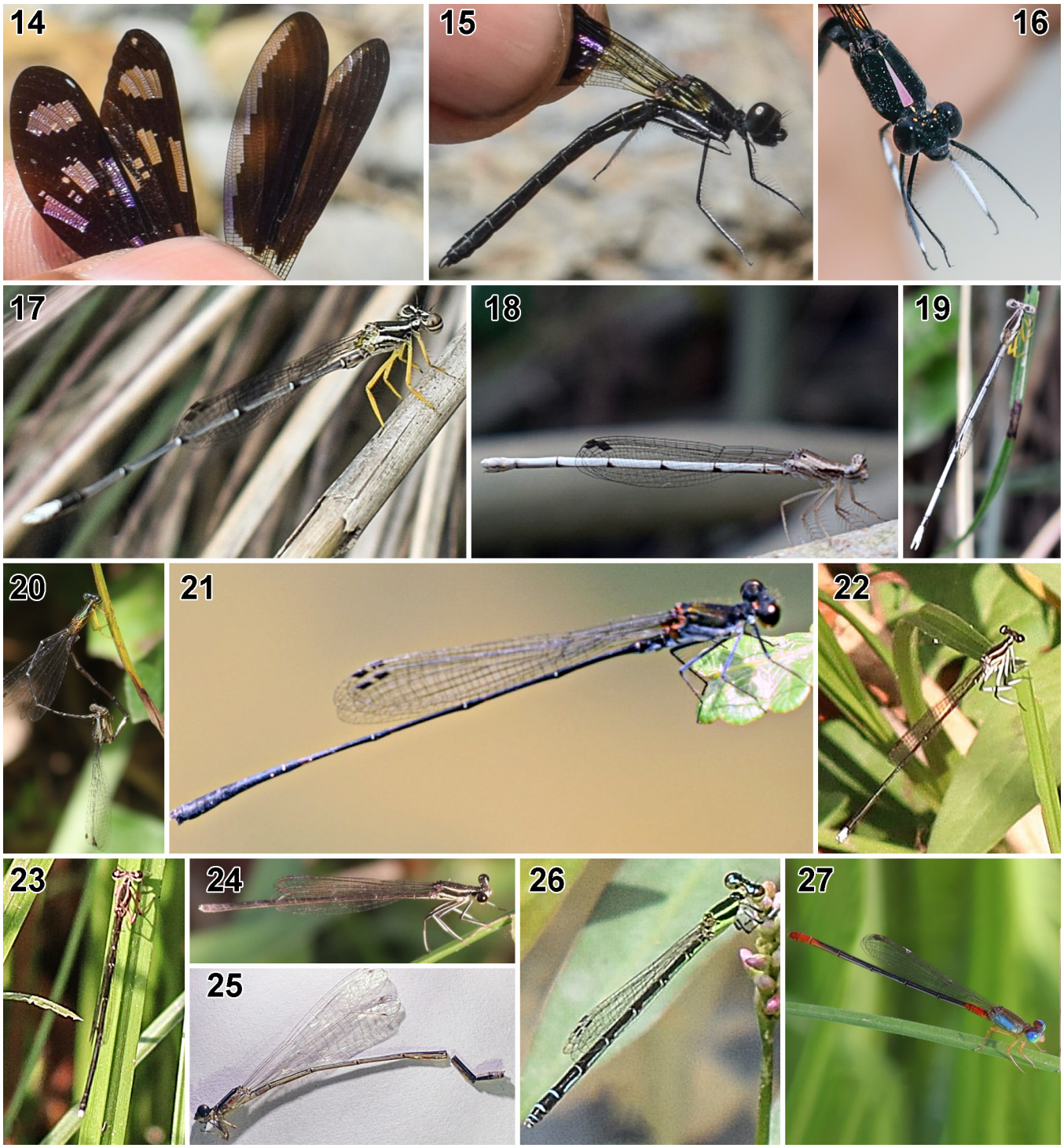
Material Examined. 2♂♂, Karnali province, Surkhet district, Hurke (28°40'5.66"N, 81°30'49.54"E, 783 m a.s.l.), 6-viii-2022. Coll. M. Sharma.

Field diagnosis (♂)**.** Thorax back with narrow greenish-blue antehumeral stripes, pale blue below. Abdomen azure blue with black markings, on the back of segment 2 a cobra-hood marking present, segment 7 with a quadrate black spot, segments 8–10 black. Cerci slightly longer than segment 10, paraproct shorter with a robust spine pointing backwards.

Distribution. Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Thailand (Zhang, 2017; Kalkman et al., 2020; Current study).

***Ceriagrion cerinorubellum* (Brauer, 1865)** (Fig. 27)

Material Examined. 1♂, Karnali province, Surkhet district, Bulbule lake (28°34'56.14"N, 81°37'10.38"E, 646 m a.s.l.), 3-viii-2022; 2♂♂, Karnali province, Surkhet district, Hurke (28°40'05.66"N, 81°30'49.54"E, 783 m a.s.l.), 6-viii-2022. Coll. M. Sharma.



Figures 14–27. Zygoptera: **14.** *Aristocypha spuria*, wings; **15.** *Aristocypha spuria,* general habitus, male; **16.** *Aristocypha spuria,* thorax; **17.** *Copera marginipes*, male; **18.** *Copera marginipes*, female; **19.** *Copera marginipes,* teneral male; **20.** *Copera vittata,* copulating; **21.** *Prodasineura autumnalis*; **22.** *Pseudocopera ciliata,* male; **23.** *Pseudocopera ciliata,* immature female; **24.** *Pseudocopera ciliata,* female; **25.** *Aciagrion occidentale,* female; **26.** *Agriocnemis clauseni*; **27.** *Ceriagrion cerinorubellum*.

Field diagnosis (♂)**.** Thorax green above, fading blue on the sides and yellow below. Abdomen bright red at the basal end of segments 1–2 and segments 8–10, segments 3–7 blue grey with a black band on the dorsum.

Distribution. Bangladesh, India, Nepal, Pakistan, and Sri Lanka (Kalkman et al., 2020; Current study).

DISCUSSION

A total of 17 species belonging to six families were documented of which *Aristocypha spuria* Selys, 1879, *Pseudocopera ciliata* (Selys, 1863), *Aciagrion occidentale* Laidlaw, 1919 and *Zyxomma petiolatum* Rambur, 1842 were newly added to the Odonata fauna of Nepal. The occurrence of these four species new to Nepal is not surprising since these are common and widely distributed in the Indian subcontinent (Kalkman et al., 2020). *Aristocypha spuria* was recorded from India only in South Asian countries and now its range extends to Nepal. It was also reported from China and Myanmar. Likewise, Miya et al. (2021) listed *Aciagrion occidentale* in their checklist of Sishaghat of Tanahun district with a record of 2 individuals from the agricultural field. But we consider their record unreliable and presented as new odonata species for Nepal as there was not any detailed description and photographs.

In addition, *Copera marginipes* (Rambur, 1842), *Copera vittata* (Selys, 1863), *Prodasineura autumnalis* (Fraser, 1922), *Agriocnemis clauseni* Fraser, 1992, *Ceriagrion cerinorubellum* (Brauer, 1865), *Cephalaeschna viridifrons* (Fraser, 1923), *Gynacantha incisura* Fraser, 1935, *Gynacanthaeschna sikkima* (Karsch, 1891), *Lamelligomphus risi* (Fraser, 1922), *Scalmogomphus bistrigatus* (Hagen in Selys, 1854), *Rhodothemis rufa* (Rambur, 1842), *Tetrathemis platyptera* Selys, 1868 and *Urothemis signata signata* (Rambur, 1862) have extended their distribution to western Nepal. *Prodasineura autumnalis* was reported from central Nepal (Vick, 1985; Kemp & Butler, 2001). Besides this, it was not re-recorded in the last two decades and now this is recorded from western Nepal. *Copera marginipes* was first recorded from Makwanpur (St. Quentin, 1970). Now after five decades, it is recorded from the western region of Nepal. Vick (1987) recorded *Copera vittata* from Chitwan, Bardiya National Park, Ilam (Mai valley). Likewise, Mahato (1986) reported *Lamelligomphus risi* as *Onychogomphus risi* from Makwanpur district (Reutikhola). Besides this, there is no published literature for these species and now they are widely distributed in the western region of Nepal. *Agriocnemis clauseni*, *Cephalaeschna viridifrons*, *Gynacantha incisura*, *Gynacanthaeschna sikkima*, *Scalmogomphus bistrigatus* and *Urothemis signata signata* were reported from central Nepal only (Shrestha & Mahato, 1983; Vick, 1985, 1987; Sasamoto & Ushijima, 2000; KC & Gurung, 2020; Sharma & Oli, 2022) and now its national distributional extends to western region of Nepal. *Ceriagrion cerinorubellum* and *Rhodothemis rufa* have recently been recorded from the central and eastern regions of Nepal (KC & Gurung, 2020; Conniff et al., 2020) which is also common in western Nepal. Similarly, Kalkman et al. (2020) listed *Tetrathemis platyptera* as distributed in Nepal probably based on Conniff (2020), where she recorded the male specimens from the Lamjung district. Here both males and females are recorded from western Nepal. This species was also recorded from Bangladesh and India (Kalkman et al., 2020). The inclusion of these four new species expands the diversity of Odonata fauna in Nepal. With this addition, the total number of species recorded in Nepal reaches up to 186 species belonging to 94 genera and 18 families. Likewise, the odonatological survey in western Nepal is scanty and these new regional records will be added to the previous regional checklist (Sharma et al., 2018). However, the checklist is not complete. So, future exploration should be continued to update Nepalese odonata fauna.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: M. Sharma: Conceptualization and designing the research, collecting and preserving the specimens, writing the original draft and the revised version of the manuscript; I. Gautam: Conceptualization and designing the research, confirming the identifications, review and editing of the manuscript to the final version; B.R. Oli: Helping in the collection of specimens and the data, writing the revised version of the manuscript. All authors read and approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the Museum of the Central Department of Zoology, Tribhuvan University in Kirtipur, Kathmandu, Nepal and are available from the curator, upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

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

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آسیابک‌ها و سنجاقک‌های (Insecta, Odonata) ناحیه غربی نپال و گزارش جدید چهار گونه

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چکیده: آسیابک‌ها و سنجاقک‌ها، به عنوان شاخص‌های زیستی شناخته می‌شوند. این تحقیق به منظور تکمیل و روزآمدی فهرست طیاره‌مانندهای نپال و ثبت گزارش‌های جدید از گونه‌ها، از آوریل تا اوایل اکتبر ۲۰۲۲ در حوضه رودخانه کارنالی انجام شد. طی این مطالعات، انتشار چهار گونه شامل *Aristocypha spuria* Selys, 1879، *Pseudocopera ciliata* (Selys, 1863)، *Aciagrion occidentale* Laidlaw, 1919 و *Zyxomma petiolatum* Rambur, 1842 برای اولین بار از نپال ثبت شدند. علاوه بر این، گونه‌های دیگر شامل *Copera marginipes* (Rambur, 1842)، *Copera vittata* (Selys, 1863)، *Prodasineura autumnalis* (Fraser, 1922)، *Agriocnemis clauseni* Fraser, 1992، *Ceriagrion cerinorubellum* (Brauer, 1865)، *Cephalaeschna viridifrons* (Fraser, 1923)، *Gynacantha incisura* Fraser, 1935، *Gynacanthaeschna sikkima* (Karsch, 1891)، *Lamelligomphus risi* (Fraser, 1922)، *Scalmogomphus bistrigatus* (Hagen *in* Selys, 1854)، *Rhodothemis rufa* (Rambur, 1842)، *Tetrathemis platyptera* Selys, 1868 و *Urothemis signatasignata* (Rambur, 1862) برای نخستین بار در منطقه غربی نپال ثبت شدند.

واژگان کلیدی: آسیابک‌ها، انتشار، تنوع زیستی، تالاب‌ها، سنجاقک‌ها