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New records of jumping spiders (Araneae: Salticidae) from Nepal

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Abstract. This paper presents new records for nine species of jumping spiders (*Asemonea tenuipes*, *Chrysilla volupe*, *Epocilla aurantiaca*, *Hyllus semicupreus*, *Icius alboterminus*, *Phintella vittata*, *Siler cupreus*, *Telamonia dimidiata* and *Telamonia festiva*) from Nepal. Habitats and distribution of species within the country are briefly discussed.

Introduction

Salticidae is one of the largest families within the Araneae, including 644 genera and 6215 described species globally (World Spider Catalog 2020). However these spiders are little-known in Nepal (Table 1), even though Nepal is a biodiversity hotspot due to both its unique geographic position and its altitudinal and climatic variations (Bhuju et al. 2007).

Table 1. Jumping spider (Salticidae) species previously recorded from Nepal, based on the World Spider Catalog (2020). Clades are based on Maddison (2015).

clade	genus	count	species
Aelurillina	*Stenaelurillus* Simon 1886	1	*S. triguttatus* Simon 1886
	Thyene Simon 1885	3	*T. bivittata* Xie & Peng 1995, *T. typica* Jastrzebski 2006, *T. yuxiensis* Xie & Peng 1995
Agoriini	*Synagelides* Strand 1906	10	*S. bagmaticus* Logunov & Hereward 2006, *S. gosainkundicus* Bohdanowicz 1987, *S. kosi* Logunov & Hereward 2006, *S. martensi* Bohdanowicz 1987, *S. nepalensis* Bohdanowicz 1987, *S. nishikawai* Bohdanowicz 1979, *S. oleksiaki* Bohdanowicz 1987, *S. tukchensis* Bohdanowicz 1987, *S. ullerensis* Bohdanowicz 1987, *S. walesai* Bohdanowicz 1987
Chrysillini	*Phintella* Strand 1906	1	*P. suavis* (Simon 1885)
	Nepalicus Prószyński 2016	1	*N. nepalicus* (Andreeva, Hęciak & Prószyński 1984)
Dendryphantini	*Rhene* Thorell 1869	2	*R. flavicomans* Simon 1902, *R. phuntsholingensis* Jastrzebski 1997
Euophryini	*Chalcoscirtus* Bertkau 1880	1	*C. martensi* Żabka 1980
	Euophrys C. L. Koch 1834	5	*E. dhaulagirica* Żabka 1980, *E. jirica* Żabka 1980, *E. nepalica* Żabka 1980, *E. omnisuperstes* Wanless 1975, *E. yulungensis* Żabka 1980
Harmochirina	*Bianor* Peckham & Peckham 1886	1	*B. tortus* Jastrzebski 2007
	Harmochirus Simon 1885	1	*H. zabkai* Logunov 2001
Hasariini	*Chinattus* Logunov 1999	2	*C. chichila* Logunov 2003, *C. validus* (Xie, Peng & Kim 1993)
	Habrocestoides Prószyński 1992	1	*H. phulchokiensis* Logunov 1999
Plexippina	*Epeus* Peckham & Peckham 1886	2	*E. exdomus* Jastrzebski 2010, *E. indicus* Prószyński 1992
	Orientattus Caleb 2020	1	either *O. minutus* (Żabka 1985) or *O. aurantius* (Kanesharatnam & Benjamin 2018)
	Pancorius Simon 1902	5	*P. armatus* Jastrzebski 2011, *P. cadus* Jastrzebski 2011, *P. kaskiae* Żabka 1990, *P. magnus* Żabka 1985, *P. urnus* Jastrzebski 2011
	Plexippoides Prószyński 1984	1	*P. tristis* Próchniewicz 1990
	Plexippus C. L. Koch 1846	1	*P. pokharae* Żabka 1990
	Ptocasius Simon 1885	3	*P. nepalicus* (Żabka 1980), *P. tenzingi* (Żabka 1980), *P. thakkholaicus* (Żabka 1980)
Salticini	*Carrhotus* Thorell 1891	4	*C. catagraphus* Jastrzebski 1999, *C. erus* Jastrzebski 1999, *C. operosus* Jastrzebski 1999, *C. s-bulbosus* Jastrzebski 2009
Sitticini	*Attulus* Simon 1889	1	*A. niveosignatus* (Simon 1880)
Spartaeina	*Brettus* Thorell 1895	1	*B. anchorum* Wanless 1979
	Phaeacius Simon 1900	3	*P. fimbriatus* Simon 1900, *P. saxicola* Wanless 1981, *P. wanlessi* Wijesinghe 1991
	Portia Karsch 1878	1	*P. fimbriata* (Doleschall 1859)

A field survey of a verious habitats was conducted in Chitwan National Park (CNP), Nepal in SEP 2019 and JAN 2020. As a result we can now document the presence of nine well-known species of tropical Asian salticids for the first time in Nepal.

Study Area

This study was carried out in Chitwan National Park (CNP), Nepal. CNP (952.63 km^2) is situated in South Central Nepal between 27°16.56′ - 27°42.14′N latitudes and 83°50.23′ - 84°46.25′E longitudes (Figure 1). This is the first national park of Nepal, established in 1973 and designated a World Heritage Site in 1984. It is divided into four sectors, the Eastern sector, the Kasara sector, the Western sector and the Madi sector. This park has a monsoon-dominant sub-tropical climate with an average monthly maximum temperature of 24–38°C, monthly minimum temperature 11–26°C, annual rainfall ~2250 mm and relative humidity 89-98% during 2000-2010 (Subedi et al. 2017). Sal (*Shorea robusta*) is the dominant forest vegetation, covering nearly 70% of the park. CNP is known to provide shelter to 75 species of mammals, 643 birds, 56 members of the herpetofauna, 121 fishes, 206 butterflies and 422 plants (NTNC-BCC 2020). It is also one of the 42 designated tiger source sites globally and holds the second largest population of the greater one-horned rhinoceros (*Rhinoceros unicornis*) (Walston et al. 2010; Subedi et al. 2017).

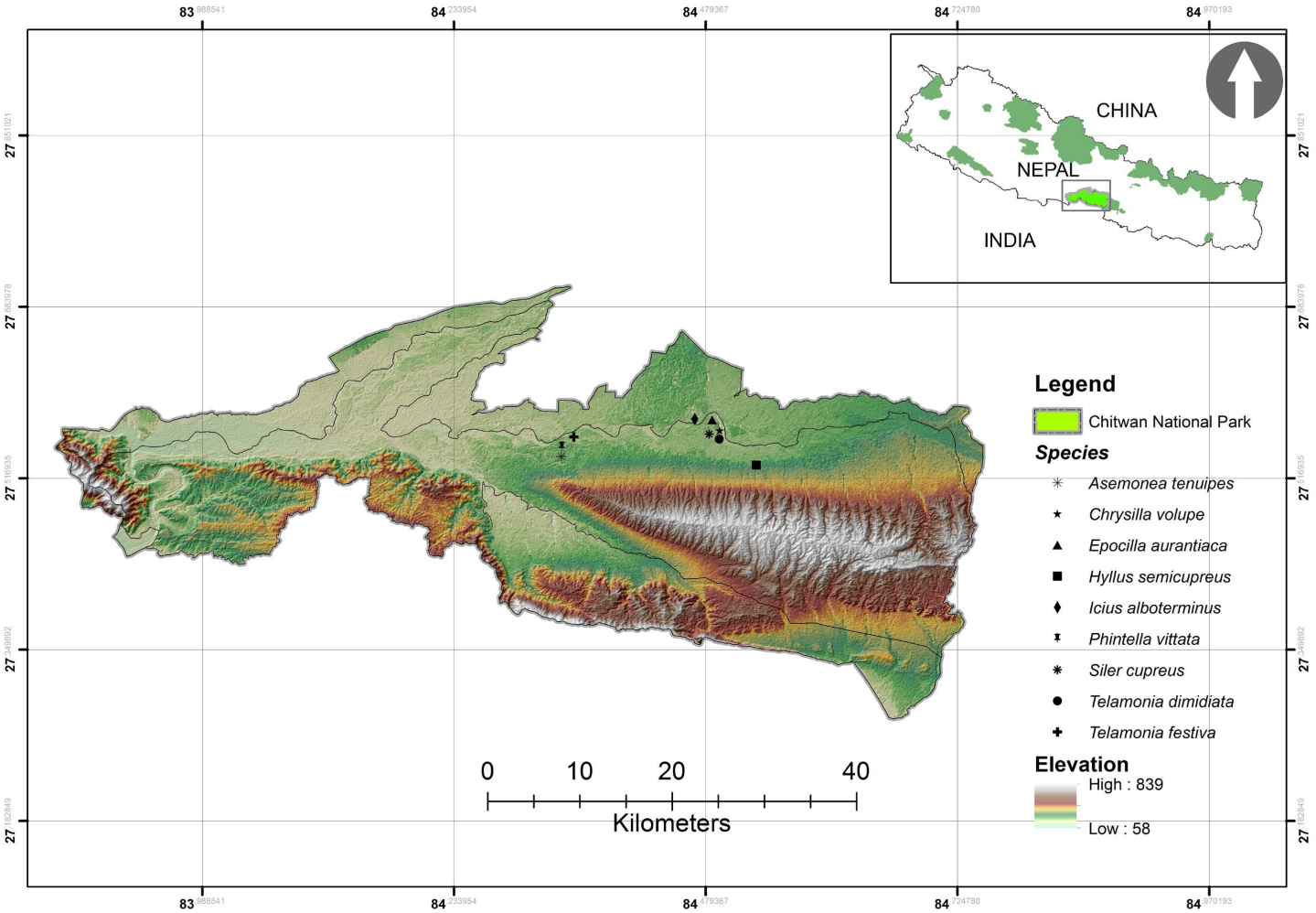


Figure 1. Map of Chitwan National Park in Nepal, showing where each jumping spider species was found in the study area.

Materials and Methods

The sampling was carried out in the Eastern sector and Kasara sector of CNP in SEP 2019 and JAN 2020. At each sampling station a line transect was used to search for spiders. Transects were chosen in random with semi-quantitative sampling methods to record the spiders. All probable microhabitats were searched (under stones, under dead leaves, on bushes, on branches of trees, near water bodies, and on trees and tree trunks) during every line transect. Sorensen et al. (2002) described this method for spider collection. Sweep-netting, ground hand collection, aerial hand collection, and vegetation beating were employed in each sampling station to record and collect the spiders.

Preservation and identification. A macro photo was taken of living representatives of collected specimens using a Nikon Coolpix P900 camera attaching Raynox Macroscopic Lens M-250. The collected specimens were preserved in 70% ethanol. Adult specimens were used for the identification up to species level with the help of available relevant taxonomic literature (Tay & Li 2010; Caleb 2014, 2020a, 2020b; Kim & Lee 2014; Prószyński 2016; Caleb & Sankaran 2020; Metzner 2020). Nomenclature follows the World Spider Catalog (2020). All collected materials are deposited at the museum of the National Trust for Nature Conservation, Biodiversity Conservation Center (NTNC-BCC), Sauraha, Chtiwan, Nepal.

Results

A total of nine jumping spider species were recorded in the CNP, all representing new records for Nepal (Table 2). Most of these species were recorded in the eastern sector of the park. Many of them were recorded in the forest habitat types.

Table 2. Jumping spiders found by this study in the CNP. All are well-known species in tropical Asia. Clades are based on Maddison (2015). Global distribution is based on the World Spider Catalog (2020) and other references.

SN	Figures	species	clade	location (CNP)	habitat	global distribution (new record*)
1	2-3	*Asemonea tenuipes* (O. Pickard-Cambridge, 1869)	Asemoneinae	Kasara sector	Forest	Andaman Islands, India, Myanmar, Nepal*, Singapore, Sri Lanka and Thailand
2	4-6	*Chrysilla volupe* (Karsch, 1879)	Chrysillini	Eastern sector	Grassland near water bodies	Bhutan, India, Nepal* and Sri Lanka
3	7-8	*Epocilla aurantiaca* (Simon, 1885)	Chrysillini	Eastern sector	Bushes	India, Malacca, Malaysia, Myanmar, Nepal*, Sri Lanka and Vietnam
4	9-11	*Hyllus semicupreus* (Simon, 1885)	Plexippina	Eastern sector	Forest	India, Nepal* and Sri Lanka
5	12-13	*Icius alboterminus* (Caleb, 2014)	Chrysillini	Eastern sector	Forest	India and Nepal*
6	14-15	*Phintella vittata* (C. L. Koch, 1846)	Chrysillini	Kasara sector	Forest	Borneo, China, India, Indonesia, Malaysia, Myanmar, Nepal*, Philippines and Vietnam
7	16-18	*Siler cupreus* Simon, 1889	Chrysillini	Eastern sector	Bushes	China, Japan, Nepal*, North Korea, South Korea and Taiwan
8	19-21	*Telamonia dimidiata* (Simon, 1899)	Plexippina	Eastern sector	Forest	Bhutan, India, Indonesia, Nepal*, Pakistan, Singapore and Sumatra
9	22-24	*Telamonia festiva* Thorell, 1887	Plexippina	Kasara sector	Bushes	China, India, Indonesia, Java, Malaysia, Myanmar, Nepal*, Singapore, Sulawesi and Vietnam

Species accounts

1. *Asemonea tenuipes* (O. Pickard-Cambridge, 1869) (Figures 2-3)

Material examined. Continent: Asia; country: Nepal; province: Bagmati; district: Chitwan; locality: Kasara sector, Chitwan National Park; habitat: forest; elevation: 178 m asl; latitude: 27.5382N; longitude: 84.3385E; sampling protocol: vegetation beating; sex: 1 female.

Global distribution. Andaman Islands, India, Myanmar, Nepal (new record), Singapore, Sri Lanka and Thailand.

Identification. Identification of the female *A. tenuipes* was based on the unique appearance of pale yellow in colouration of the entire body with greenish blue or brown spots on the dorsum of abdomen (after Tay & Li 2010).

Habitat notes. This specimen was found on the leaf of a Sal tree (*Shorea robusta*).

Figures 2-3. Two views of the female *Asemonea tenuipes*.

2. *Chrysilla volupe* (Karsch, 1879) (Figures 4-6)

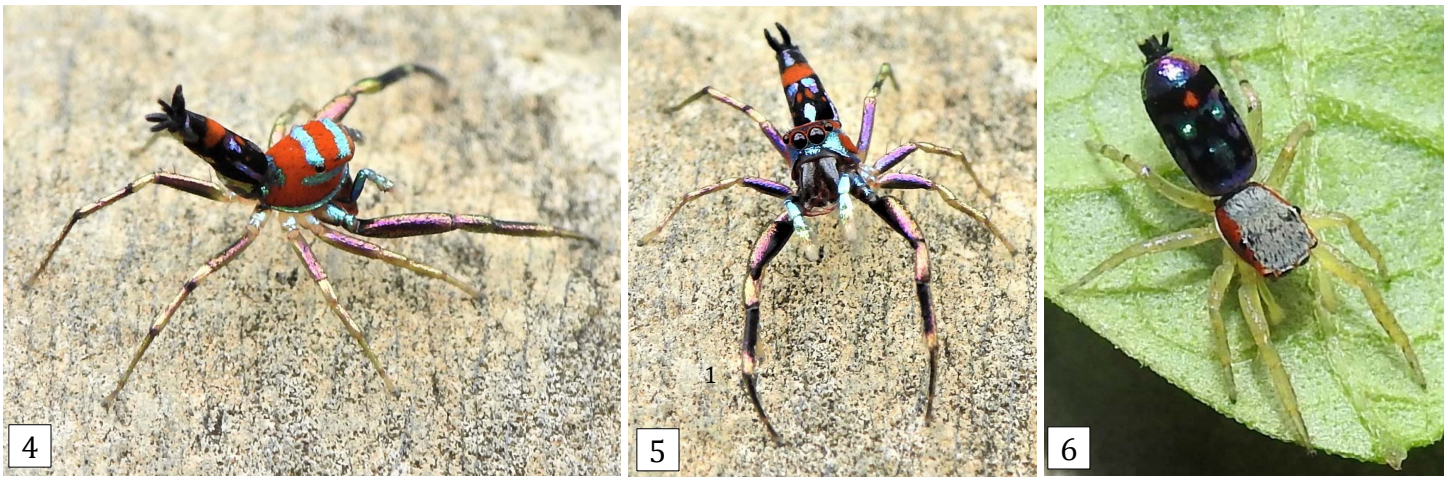
Material examined. Continent: Asia; country: Nepal; province: Bagmati; district: Chitwan; locality: Eastern sector, Chitwan National Park; habitat: grassland (near water bodies); elevation: 169 m asl; latitude: 27.5633N; longitude: 84.4929E; sampling protocol: aerial hand collection; sex: 1 female and 1 male.

Global distribution. Bhutan, India, Nepal (new record) and Sri Lanka.

Identification. Identification was based on the description of the male and female *C. volupe* by Caleb et al. (2018). Male: reddish orange carapace with pair of broad bluish iridescent transverse stripes, anterior eyes surrounded with reddish-orange orbital setae in the upper half and white orbital setae in the lower half; clypeus covered by bluish iridescent scales which diverge laterally, one branching below the lateral

eyes almost reaching the posterior patch, the other runs along outer edge of the carapace. Female: greyish carapace with white rim; clypeus covered with reddish orange; anterior eyes with grey eyebrows.

Habitat notes. The male and female *C. volupe* were collected from grassland of *Imperata cylindrica* near the bank of Rapti River.



Figures 4-6. Adult *Chrysilla volupe*. **4-5,** Two views of the male. **6,** The female.

3. *Epocilla aurantiaca Simon, 1885* (Figures 7-8)

Material examined. Continent: Asia; country: Nepal; province: Bagmati; district: Chitwan; locality: Eastern sector, Chitwan National Park; habitat: bushes; elevation: 167 m asl; latitude: 27.5673N; longitude: 84.4854E; sampling protocol: aerial hand collection; sex: 1 female.

Global distribution. India, Malacca, Malaysia, Myanmar, Nepal (new record), Sri Lanka and Vietnam.

Identification. Based on brownish lateral thin band borders at cephalothorax, legs with thin, semi-transparent without hairs, and whitish band surrounded by orange band on dorsum of abdomen.

Habitat notes. This specimen was found on a leaf of Gandhe jhar (*Ageratum* sp.).

Figure 7-8. Two views of the female *Epocilla aurantiaca* on a leaf (*Ageratum* sp.).

4. *Hyllus semicupreus* (Simon, 1885) (Figures 9-11)

Material examined. Continent: Asia; country: Nepal; province: Bagmati; district: Chitwan; locality: Eastern sector, Chitwan National Park; habitat: forest; elevation: 220 m asl; latitude: 27.5295N; longitude: 84.5288E; sampling protocol: aerial hand collection; sex: 1 female.

Global distribution. India, Nepal (new record) and Sri Lanka.

Identification. Based on blackish hairs raised vertically upward near posterior medial eyes in cephalothorax. Brownish abdomen with two blackish semi curved spots present in the mid-dorsum.

Habitat notes. This specimen was found on the branch of Sal tree (*Shorea robusta*).

Figures 9-11. Three views of the female *Hyllus semicupreus*.

5. *Icius alboterminus* (Caleb, 2014) (Figures 12-13)

Material examined. Continent: Asia; country: Nepal; province: Bagmati; district: Chitwan; locality: Eastern sector, Chitwan National Park; habitat: forest; elevation: 161 m asl; latitude: 27.5745N; longitude: 84.4688E; sampling protocol: aerial hand collection; sex: 1 male.

Global distribution. India and Nepal (new record).

Identification. Based on the description of male by Caleb (2014). Blackish carapace with white stripe of hairs run along the outline of cephalothorax, anterior part of the abdomen covered by pale brownish scales, lower half covered by darker reddish black hairs, two pairs of white spots on the dorsum.

Habitat notes. This specimen was found on the bark of Simal tree (*Bombax cieba*) near the bank of the Rapti river.

Figures 12-13. Two views of the male *Icius alboterminus* on the bark of *Bombax cieba*.

6. *Phintella vittata* (C. L. Koch, 1846) (Figures 14-15)

Material examined. Continent: Asia; country: Nepal; province: Bagmati; district: Chitwan; locality: Kasara sector, Chitwan National Park; habitat: forest; elevation: 153 m asl; latitude: 27.5479N; longitude: 84.3393E; sampling protocol: vegetation beating; sex: 1 male.

Global distribution. Borneo, China, India, Indonesia, Malaysia, Myanmar, Nepal (new record), Philippines and Vietnam.

Identification. Based on transverse silver-black, parallel bands across the cephalothorax and abdomen. Cephalothorax raised upwards. Abdomen broad in front and tapered distally.

Habitat notes. This specimen was found on a leaf of the Sal tree (*Shorea robusta*) at a height less than 3 meters above the ground.

Figures 14-15. Two views of the male *Phintella vittata*.

7. *Siler cupreus* Simon, 1889 (Figures 16-18)

Material examined. Continent: Asia; country: Nepal; province: Bagmati; district: Chitwan; locality: Eastern sector, Chitwan National Park; habitat: bushes; elevation: 161 m asl; latitude: 27.5638N; longitude: 84.4917E; sampling protocol: aerial hand collection; sex: 1 female.

Global distribution. China, Japan, Nepal (new record), North Korea, South Korea and Taiwan.

Identification. Female light greyish carapace with light blue outline of cephalothorax and grey abdomen with black stripe at midline.

Habitat notes. This specimen was found on a *Mikania micrantha* bush.

Figures 16-18. Three views of the female *Siler cupreus*.

8. *Telamonia dimidiata (Simon, 1899)* (Figures 19-21)

Material examined. Continent: Asia; country: Nepal; province: Bagmati; district: Chitwan; locality: Eastern sector, Chitwan National Park; habitat: forest; elevation: 167 m asl; latitude: 27.5673N; longitude: 84.4854E; sampling protocol: aerial hand collection; sex: 1 female.

Global distribution. Bhutan, India, Indonesia, Nepal (new record), Pakistan, Singapore and Sumatra.

Identification. Based on creamy white to light brown cephalothorax; abdomen elongate, pointed and dorsum with two light to dark brown, dorsal, longitudinal stripes.

Habitat notes. This specimen was found on the leaf of a Sal tree (*Shorea robusta*).

Figures 19-21. Three views of the female *Telamonia dimidiata*.

9. *Telamonia festiva* Thorell, 1887 (Figures 22-24)

Material examined. Continent: Asia; country: Nepal; province: Bagmati; district: Chitwan; locality: Kasara sector, Chitwan National Park; habitat: bushes; elevation: 160 m asl; latitude: 27.5569N; longitude: 84.3508E; sampling protocol: sweep netting; sex: 1 female.

Global distribution. China, India, Indonesia, Java, Malaysia, Myanmar, Nepal (new record), Singapore, Sulawesi and Vietnam.

Identification. Based on reddish brown cephalothorax; slender and elongate abdomen with two longitudinal mid dorsal reddish brown bands enclosing a series of white chevrons along the midline.

Habitat notes. This specimen was found on the leaf of major invasive species found in CNP, *Mikania micrantha*, near lami Tal.

Figures 22-24. Three views of the female *Telamonia festiva*.

Discussion

Among the spiders reported in the present study, *Chrysilla volupe* and *Icius alboterminus* were found on vegetation close to Rapti river. This may indicate their preference for habitats associated with water bodies. Similar habitat preferences for *Chrysilla volupe* and *Icius alboterminus* have been reported in India (Caleb 2014; Prajapati & Kamboj 2020).

Asemonea tenuipes, *Hyllus semicupreus*, *Phintella vittata*, and *Telamonia dimidiata*, and were found in Sal forest (*Shorea robusta*). *Asemonea tenuipes* was previously found on the mangrove trees *Brugeria* and *Avicennia* in Singapore (Tay & Li 2010), *Telamonia dimidiata* from tropical forest (Ahmed et al. 2019), *Phintella vittata* from shrubs and small trees, and *Hyllus semicupreus* from the bark of tree in India (India Biodiversity Portal 2020a, 2020b). This suggests that these species may also prefer forest patches. Furthermore, Kim & Lee (2014) reported that the shrubs, bushes and ground of mountainous regions are suitable habitats for *Siler cupreus*. In the present study, *Epocilla aurantiaca*, *Siler cupreus* and *Telamonia festiva* were found in bushes, which might represent a preferred habitat. No information regarding the habitat preference of either *Epocilla aurantiaca* or *Telamonia festiva* is available from other countries.

The present study, although limited, has produced nine new species records for salticids in Nepal. The Western sector and the Madi sector of the CNP were not studied and an unknown number of species are still waiting to be discovered. More extensive studies will be necessary to determine the real diversity and habitat preferences of salticid spiders in the CNP.

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