



The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

Journal of Threatened Taxa

Building evidence for conservation globally

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

NOTE

EXTENDED DISTRIBUTION RECORD OF TWO BELLFLOWER SPECIES OF *CODONOPSIS* (CAMPANULACEAE) FROM THE INDIAN STATE OF ARUNACHAL PRADESH

Khilendra Singh Kanwal, Umeshkumar Lalchand Tiwari, Lod Yama & Mahendra Singh Lodhi

26 July 2019 | Vol. 11 | No. 9 | Pages: 14228–14231

DOI: 10.11609/jott.4432.11.9.14228-14231



For Focus, Scope, Aims, Policies, and Guidelines visit <https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-0>

For Article Submission Guidelines, visit <https://threatenedtaxa.org/index.php/JoTT/about/submissions#onlineSubmissions>

For Policies against Scientific Misconduct, visit <https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-2>

For reprints, contact <ravi@threatenedtaxa.org>

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the political boundaries shown in the maps by the authors.

Partner



صندوق محمد بن زايد
للمحافظة على
الكائنات الحية

The Mohamed bin Zayed
SPECIES CONSERVATION FUND

Member



Publisher & Host





ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

PLATINUM
OPEN ACCESS



The genus *Codonopsis* Wall. (Campanulaceae) consists of about 42 species, widely distributed in tropical and temperate to alpine regions of Asia and Europe (Haridasan & Mukherjee 1996; Hong 2015). In India, the genus is mainly distributed in temperate, sub-alpine, and alpine regions of the Himalaya. The name *Codonopsis* was given by Wallich (1824). Derived from the Greek word 'kodon/ codon' meaning bell and the Latin suffix '-opsis' used to indicate resemblance, the name refers to the shape of its flower, which is similar to that of a bell. Among the *Codonopsis* species, *C. pilosula* (Franch.) Nannf. and *C. lanceolata* (Sieb. et Zucc.) Benth. & Hook. f. ex Trautv. are more popular than the others, especially due to their phytochemical activities (He et al. 2015). According to Kala (2010), *C. clematidea* (Schrenk) Cl., *C. ovata* Benth., and *C. rotundifolia* Benth of the western Himalaya are used in indigenous medicine by 'amchis' for curing skin diseases. "Sowa-Rigpa" commonly known as amchi system of medicine is one of the oldest living and well documented medical tradition of the world. It has been popularly practice in Tibet, Magnolia, Bhutan, some parts of China, Nepal, Himalayan regions of India and few parts of former Soviet Union.

A survey was carried out in Tawang District of Arunachal Pradesh during 2016–2017 for the assessment of the floral diversity of high altitude areas. *Codonopsis foetens* and *C. thalictrifolia* were collected from Kyo Tso Wetlands (27.696°N & 91.842°E, 4,245m

EXTENDED DISTRIBUTION RECORD OF TWO BELLFLOWER SPECIES OF *CODONOPSIS* (CAMPANULACEAE) FROM THE INDIAN STATE OF ARUNACHAL PRADESH

Khilendra Singh Kanwal¹ , Umeshkumar Lalchand Tiwari² , Lod Yama³ , & Mahendra Singh Lodhi⁴ 

^{1,3,4} G.B. Pant National Institute of Himalayan Environment and Sustainable Development, North East Regional Centre, Itanagar, Arunachal Pradesh 791111, India.

² Botanical Survey of India, Arunachal Pradesh Regional Centre, Itanagar, Arunachal Pradesh 791111, India.

¹kskanwal03@gmail.com, ²tigerumesh11@gmail.com (corresponding author), ³lod1437@gmail.com, ⁴mahen29.mail@gmail.com

and Nagula Tso Wetlands (27.654°N & 91.863°E, 4,070m), respectively. These two species of *Codonopsis* are very rare and endemic to the eastern Himalaya and have a limited distribution in Sikkim, Bhutan, and China. The Nagula Wetland complex area is rich in high altitude floral diversity and is little explored at present. The identification of the species was confirmed through consultation of type specimens and the protologue of the species. Further consultation of important literature (Clarke 1882; Haridasan & Mukherjee 1996; Chowdhery et al. 2008; Pal 2013; Tiwari 2015–2016; Dash & Singh 2017) and of herbarium at various institutions, such as the Botanical Survey of India, Itanagar (ARUN), the State Forest Research Institute (SFRI), Itanagar, and the Royal Botanic Gardens, Kew (K), United Kingdom, were done for the identification of the species and the gathering

DOI: <https://doi.org/10.11609/jott.4432.11.9.14228-14231>

Editor: Pankaj Kumar, Kadoorie Farm and Botanic Garden (KFBG) Corporation, Tai Po, Hong Kong S.A.R., China. Date of publication: 26 July 2019 (online & print)

Manuscript details: #4432 | Received 25 July 2018 | Final received 12 June 2019 | Finally accepted 25 June 2019

Citation: Kanwal, K.S., U.L. Tiwari, L. Yama & M.S. Lodhi (2019). Extended distribution record of two bellflower species of *Codonopsis* (Campanulaceae) from the Indian state of Arunachal Pradesh. *Journal of Threatened Taxa* 11(9): 14228–14231. <https://doi.org/10.11609/jott.4432.11.9.14228-14231>

Copyright: © Kanwal et al 2019. Creative Commons Attribution 4.0 International License. JoTT allows unrestricted use, reproduction, and distribution of this article in any medium by adequate credit to the author(s) and the source of publication.

Funding: Science & Engineering Research Board (SERB), Department of Science & Technology (DST), Government of India.

Competing interests: The authors declare no competing interests.



Acknowledgements: Authors are highly thankful for financial support from project (F.No. EMR/2014/000408) funded by Science & Engineering Research Board (SERB), Deptt. of Science & Technology (DST), Government of India. Authors are thankful to Director of G.B. Pant National Institute of Himalayan Environment and Sustainable Development and Director of Botanical Survey of India for necessary facilities and encouragement. Special thanks are due to the local communities for sharing valuable information about Nagula wetland area. Authors are also highly grateful to the Department of Environment and Forest, Govt. of Arunachal Pradesh and Indian Army for giving the necessary permission and support during field study.

of information on their historical distribution. These sources revealed that the species were not reported earlier from Arunachal Pradesh and that, in India, these were known from Sikkim and Darjeeling District of West Bengal. Therefore, these species are presented here as new distribution records for the state of Arunachal Pradesh. The present communication provides detailed descriptions with type, ecology, and images of the collected plant species. The specimens are deposited in the herbarium of the G.B. Pant National Institute of Himalayan Environment and Sustainable Development in Itanagar and at BSI APRC Itanagar (ARUN) for future references.

Codonopsis foetens

J.D.Hooker & Thomson, J. Proc. Linn. Soc., Bot. 2: 16. 1858; C.B. Clarke in Hook.f., Fl. Brit. India 3: 433.1882 (Image 1).

Type: India, Sikkim, J.D.Hooker s.n. (K!) Ascending herbs, roots slender, 10–55 cm × 1–2 cm. Caudexes abundantly branched, and thus stems several to many from one caudex, caespitose. Main stem erect or ascending, 20–40 cm tall, villous; branches numerous, aggregated in the lower part, 1–10 cm tall, usually sterile. Leaves on main stems alternate, those on branches opposite or subopposite; broadly ovate to elliptic-ovate, caudate to cordate at base, 3–11 mm × 3–10 mm, densely white pilose on both surfaces; margin entire or subentire, apex obtuse; petiole 1–3 mm, pilose. Flowers solitary (rarely several), terminal on main stems and sometimes branches, ± pendent; pedicels 4.5–3.5 cm, terminal, glabrous or sparsely pilose. Hypanthia 3–4 mm × 7.5–9.0 mm, broadly subglobose, glabrous or sparsely pilose. Calyx tube adnate to ovary up to middle, semiglobose or hemispherical, glabrous or very sparsely white hispidulous, perigynous; lobes ovate, ovate-oblong, or ovate-lanceolate, 7–20 mm × 2–7 mm, rather densely hispidulous, entire, recurved at margin, apex acute or obtuse. Corolla epigynous, pale blue or pale purple with interior markings, globose-campanulate, 2.0–4.5 cm × 2.5–3 cm; lobes suborbicular, 8–12 mm, apex obtuse or acute, tube 15–20 mm long. Stamens glabrous; filaments slightly dilated at base, ca. 5mm; anthers 4–5 mm; anther 3–5 mm long. Ovary semi inferior; style ca. 9mm long. Capsule obconical at inferior part, conical at superior part, ca. 2.0cm × 1.5cm. Seeds brownish-yellow, ellipsoid or oblong, ca. 1mm, smooth.

Flowering and fruiting: July–October.

Habitat: Found in the alpine habitats of the Himalaya at an elevation of 3500–4500 m along grassy slopes, alpine scrub, crevices, forests, and meadows at forest



Image 1. *Codonopsis foetens* Hook.f. & Thoms.: A - Habit | B - Leaves | C - Closeup of open flower. © K.S. Kanwal.

margins on north-facing slopes.

Distribution: India (Sikkim and Arunachal Pradesh), Bhutan, Nepal, and China (Xizang, Zizhique, and northwestern Yunnan).

Specimen examined: (ARUN!) 1020, 11.viii.2017, India, Arunachal Pradesh, Tawang District, 27.696°N & 91.842°E, above 4,000m, coll. Lod, Roona & K.S. Kanwal (Image 3).

Ecology and threats: This terrestrial plant grows on grassy slopes in alpine pastures near Kyo Tso Wetlands. The species is facing threats from grazing by domestic animals (mainly yak and sheep), firewood collection, unregulated tourism, solid waste generation, and development projects. Climate change may be a future threat for the species. Therefore, in situ and ex situ conservation measures are essentially required for the conservation of this species.

Codonopsis thalictrifolia

Wall. in Roxb., Fl. Ind. 2: 106. 1824; Hook.f. & Thoms. In J. Linn. Soc. 2:16 1858; C.B. Clarke in Hook.f., Fl. Brit. India 3: 432.1882. (Image 2)

Type: Nepal, Gosainthan, *Wallich cat. no. 1297* (K!)

Ascending herbs, 10–35 cm high; roots carrot-shaped, 15–20 cm × 0.5–1.0 cm. Stems robust, sparsely pilose or glabrous, profusely branched near base; branches sterile, slender, leafy, aggregated at base of



Image 2. *Codonopsis thalictrifolia* Wall. in Roxb.: A - Habitat | B - Habit | C - Closeup of open flower. © K.S. Kanwal.

main stems, 4–6 cm, villous. Leaves on main stems alternate, those on branches subopposite; petiole ca. 2mm, white hirsute; blade ovate or suborbicular, 2.0–5.5 mm × 2–6 mm, both surfaces villous, base cordate or truncate, margin sub-entire or crenate, apex obtuse or acute. Flowers solitary, terminal on main stems, slightly pendent. Hypanthis 1.5–2.0 mm × 6–8 mm, broadly obconic, scabrid-pilose. Calyx tube perigynous; adnate to ovary up to middle, hemispheric, 3–5 mm × 6–10 mm, glabrous or villous; lobes triangular or oblong, 5mm × 3mm, outside hairy, margin entire, apex acute or obtuse; sinus between lobes broad and obtuse. Corolla tubular-campanulate, 2.0–4.8 cm × 1.5–4.3 cm, shallowly lobed; lobes triangular, 2–4 mm × 7–9 mm, apex obtuse; tube pale blue, 18–23 mm long, glabrous or occasionally sparsely villous. Filaments slightly dilated at base, ca. 1cm; anthers ca. 3mm, villous at connective. Capsule hemispherical at base, conical toward apex, rostrate. Seeds numerous, brownish-yellow, ellipsoid, smooth.

Flowering and fruiting: July–October

Habitat: Found in the alpine habitats of the Himalaya at an elevation of 3300–4500 m along grassy slopes, alpine scrub, crevices, forests, and meadows at forest margins on north-facing slopes.

Distribution: India (Singalelah in West Bengal, Dzongri to Alokton in Sikkim, and Arunachal Pradesh), Bhutan, Nepal, and China (Xizang and Zizhique).

Specimen examined: (ARUN!) 1019, 11.viii.2017, India, Arunachal Pradesh, Tawang District, three samples, 27.654°N & 91.863°E, 4,000m, coll. Lod, Roona & K.S. Kanwal (Image 4).

Ecology and threats: The species grows on the hilltop of an alpine pasture of Nagula Lake. Grazing, fuelwood collection, tourism activities, infrastructure establishment, and change of land use pattern were observed as some of the threats for the species in the area. The catchment area of the lake is used as a grazing site by the local villagers for their cattle, mainly yak

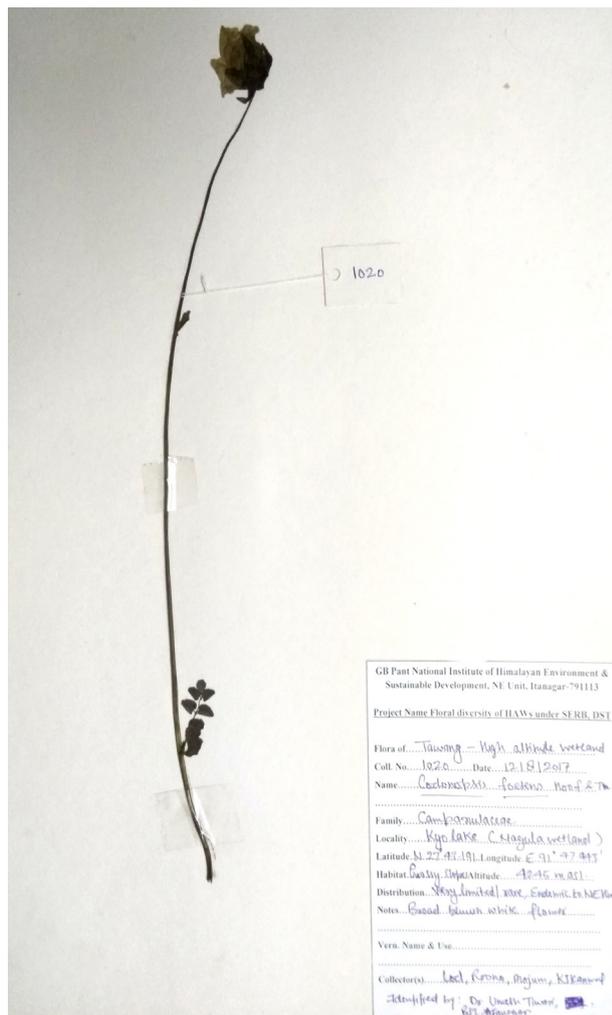


Image 3. Herbarium image of *Codonopsis foetens* [(ARUN!) 1020].

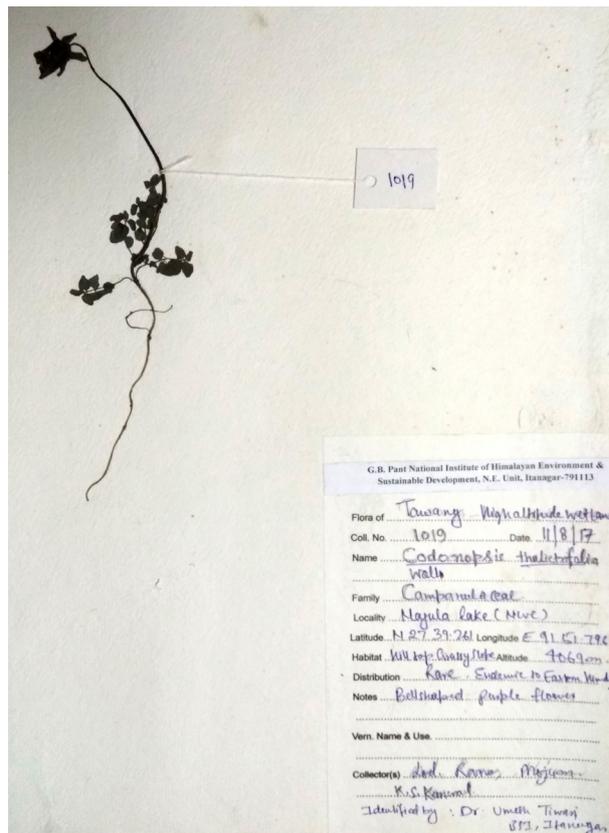


Image 4. Herbarium image of *Codonopsis thalictrifolia* [(ARUN!) 1019].

and sheep. The species may face a further threat from climate change in the near future. Hence, conservation and management measures are required for the conservation of this species.

References

- Chowdhery, H.J., G.S. Giri, G.D. Pal, A. Pramanik & S.K. Das (2008). *Materials for the Flora of Arunachal Pradesh, Vol. 2*. Botanical Survey of India, Kolkata, 693pp.
- Clarke, C.B. (1882). Campanulaceae, pp421–442. In: Hooker, J.D. (ed.). *The Flora of British India, Vol. 3*. L. Reeve & Co., London.
- Dash, S.S. & P. Singh (2017). Campanulaceae, pp276–281. In: *Flora of Kurung Kumey District, Arunachal Pradesh*. Botanical Survey of India, Kolkata, 780pp.
- Haridasan, V.K. & P.K. Mukherjee (1996). Campanulaceae, pp23–118. In: Hajra, P.K. & M. Sanjappa (eds.). *Fascicles of Flora of India, Fascicle 22*. Botanical Survey of India, Kolkata, 144pp.
- He, J.Y., N. Ma, S. Zhu, K. Komatsu, ZY. Li & WM. Fu (2015). The genus *Codonopsis* (Campanulaceae): a review of phytochemistry, bioactivity and quality control. *Journal of Natural Medicines* 69:1–21. <https://doi.org/10.1007/s11418-014-0861-9>
- Hong, de-Y. (2015). *A Monograph of Codonopsis & Allied Genera (Campanulaceae)*. Academic Press, 270pp.
- Kala, C.P. (2010). Medicinal plants of the high altitude cold desert in India: diversity, distribution and traditional uses. *The International Journal of Biodiversity Science and Management* 2(1): 43–56. <https://doi.org/10.1080/17451590609618098>
- Pal, G.D. (2013). Campanulaceae, pp50–58. In: *Flora of Lower Subansiri District, Arunachal Pradesh (India), Vol. 2*. Botanical Survey of India, Kolkata, 610pp.
- Tiwari, U.L. (2015–2016). Notes on some new records of plants with their distribution in Arunachal Pradesh. *Bulletin of Arunachal Pradesh Forest Research* 30–31(1–2): 86–94. Published online on 20th February 2017.
- Wallich, N. (1824). *Codonopsis*, pp103–107 In: Roxburgh, W. (ed.). *Flora Indica, Vol. 2*. Serampore, W. Thaker & Co. Calcutta & Parbury, Allen & Co., London.



PLATINUM
OPEN ACCESS



The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

July 2019 | Vol. 11 | No. 9 | Pages: 14087–14246
Date of Publication: 26 July 2019 (Online & Print)
DOI: 10.11609/jott.2019.11.9.14087-14246

www.threatenedtaxa.org

Article

Species richness and abundance of monogonont rotifers in relation to environmental factors in the UNESCO Sakaerat Biosphere Reserve, Thailand
– Nattaporn Plangklang, Chaichat Boonyanusith & Sujeephon Athibai, Pp. 14087–14100

Communications

Distribution and habitats of *Paphiopedilum* Pfitzer (Orchidaceae) known to occur in Bhutan
– Dhan Bahadur Gurung, Nima Gyeltshen, Kezang Tobgay, Stig Dalström, Jangchu Wangdi, Bhakta Bahadur Ghalley, Lekey Chaida, Phuntsho, Ngawang Gyeltshen, Kelzang Dawa, Tandin Wangchuk, Rebecca Pradhan, Thomas Hoijer & Choki Gyeltshen, Pp. 14101–14111

Diurnal *Serianthes nelsonii* Merr. leaflet paraheliotropism reduces leaflet temperature, relieves photoinhibition, and alters nyctinastic behavior
– Thomas Edward Marler, Pp. 14112–14118

Pollination ecology of *Brownlowia tersa* (Malvaceae), a Near Threatened non-viviparous true mangrove shrub
– Aluri Jacob Solomon Raju, Pp. 14119–14127

A note on the taxonomy and natural history of the Summer Clicker *Lahugada dohertyi* (Distant, 1891) (Insecta: Hemiptera: Cicadidae) along with its distribution in northern West Bengal, India
– Vivek Sarkar, Pp. 14128–14136

Observations on nesting activity, life cycle, and brood ball morphometry of the Bordered Dung Beetle *Oniticellus cinctus* (Fabricius, 1775) (Coleoptera: Scarabaeidae) under laboratory conditions
– Amar Paul Singh, Kritish De, Shagun Mahajan, Ritwik Mondal & Virendra Prasad Uniyal, Pp. 14137–14143

Spiders of Odisha: a preliminary checklist
– Sudhir Ranjan Choudhury, Manju Siliwal & Sanjay Keshari Das, Pp. 14144–14157

Status of water birds in Haripura-Baur Reservoir, western Terai-Arc landscape, Uttarakhand, India
– Tanveer Ahmed, Harendra Singh Bargali, Deepa Bisht, Gajendra Singh Mehra & Afifullah Khan, Pp. 14158–14165

Bird diversity in the coastal talukas of Sindhudurg District, Maharashtra, India
– Golusu Babu Rao, Santhanakrishnan Babu, Goldin Quadros & Vijaykumar Anoop, Pp. 14166–14186

Greater One-horned Rhinoceros *Rhinoceros unicornis* (Mammalia: Perissodactyla: Rhinocerotidae) population census in the Rajiv Gandhi Orang National Park, Assam, India
– Deba Kumar Dutta & Parikshit Kakati, Pp. 14187–14193

Crowding, group size and population structure of the Blackbuck *Antelope cervicapra* (Linnaeus, 1758) (Mammalia: Cetartiodactyla: Bovidae) in the semi-arid habitat of Haryana, India
– Deepak Rai & Jyoti, Pp. 14194–14203

Short Communications

An updated checklist of Indian western Himalayan gymnosperms and lectotypification of three names
– Jibankumar Singh Khuraijam & Jaideep Mazumdar, Pp. 14204–14211

New record of Blue Perch *Badis badis* (Anabantiformes: Badidae) from Godavari River basin of Telangana State, India
– Kante Krishna Prasad & Chelmala Srinivasulu, Pp. 14212–14215

First record of the Small Bamboo Bat *Tylonycteris fulvida* (Peters, 1872) (Mammalia: Chiroptera: Vespertilionidae) from Nepal
– Basant Sharma, Anoj Subedi, Bandana Subedi, Shristee Panthee & Pushpa Raj Acharya, Pp. 14216–14219

Is canine distemper virus (CDV) a lurking threat to large carnivores? A case study from Ranthambhore landscape in Rajasthan, India
– Nadisha Sidhu, Jimmy Borah, Sunny Shah, Nidhi Rajput & Kajal Kumar Jadav, Pp. 14220–14223

Notes

Extended distribution of the vulnerable Cooper's Stone Flower *Corallodiscus cooperi* (Gesneriaceae) in India
– Vikas Kumar, Samiran Panday, Sudhansu Sekhar Dash, Bipin Kumar Sinha & Paramjit Singh, Pp. 14224–14227

Extended distribution record of two bellflower species of *Codonopsis* (Campanulaceae) from the Indian state of Arunachal Pradesh
– Khilendra Singh Kanwal, Umeshkumar Lalchand Tiwari, Lod Yama & Mahendra Singh Lodhi, Pp. 14228–14231

First record of the Blue-and-white Flycatcher *Cyanoptila cyanomelana* (Temminck, 1829) (Aves: Passeriformes: Muscicapidae) from Bhutan
– Kado Rinchen, Kinley Kinley, Chhimi Dorji & Dorji Wangmo, Pp. 14232–14234

Butterflies collected using malaise traps as useful bycatches for ecology and conservation
– Augusto Henrique Batista Rosa, Lucas Neves Perillo, Frederico Siqueira Neves, Danilo Bandini Ribeiro & André Victor Lucci Freitas, Pp. 14235–14237

Notes on the hairstreak butterflies *Euaspa* Moore, 1884 (Lepidoptera: Lycaenidae) with new distribution records to the Indian eastern Himalaya
– Gaurab Nandi Das, Subrata Gayen, Motoki Saito & Kailash Chandra, Pp. 14238–14241

First report of the Australian gall midge *Actilasioptera tumidifolium* Gagné, 1999 (Diptera: Cecidomyiidae) from Andaman Islands, India
– Duraikannu Vasanthakumar & Radheshyam Murlidhar Sharma, Pp. 14242–14243

New record of Blanford's Fox *Vulpes cana* (Mammalia: Carnivora: Canidae) in central Oman: a connection between the northern and southern populations
– Taimur Alsaid, Abdulrahman Aluwaisi, Sultan Albalushi, Zahran Alabdulsalam, Said Alharsusi & Steven Ross, Pp. 14244–14246

Partner



صندوق محمد بن زايد
للمحافظة على
الكائنات الحية
The Mohamed bin Zayed
SPECIES CONSERVATION FUND

Member



Publisher & Host

