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The first report of *Pisaura novicia* (L. Koch, 1878) (Araneae, Pisauridae) from India

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ABSTRACT. This paper provides the first occurrence report of *Pisaura novicia* (L. Koch, 1878) from India, based on male and female specimens collected from the ecozone area of the Great Himalayan National Park Conservation Area, Himachal Pradesh. The distribution of the species ranges from the Mediterranean to Central Asia. The previous Indian records of the genus are only from the coastal belts of Andhra Pradesh and Gujarat, thereby the current study extends the range of Indian *Pisaura* spp. northwards to the Western Himalayas.

Key words: GHNP, Himachal Pradesh, Indian Himalayas, Nursery-web spider

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INTRODUCTION

The spider family Pisauridae Simon, 1890 is globally represented by 359 species across 52 genera, of which Indian records account for 19 species across eight genera (World Spider Catalog, 2023). Members of the genus *Pisaura* Simon, 1886 are represented by 13 species with a Palearctic distribution, occurring locally across Macaronesia, Mediterranean, and East Asia (Nadolny et al., 2012), of which, only two have been reported from India (World Spider Catalog, 2023). Both Indian records date back to the late 1900s (i.e., 1987 and 1990). Furthermore, these records do not include any material from the Indian Himalayan Region. Members of the genus *Pisaura* can be easily differentiated by two features in the epigynal structure, i.e., lateral margins of the lateral lobes forming several curves, and looped copulatory ducts (Zhang et al., 2004). During systematic surveys in the Indian Western Himalayas to document spider diversity of Himachal Pradesh, several specimens of *Pisaura* were collected, of which three were adults. These specimens were collected from the ecozone region of the Great Himalayan National Park Conservation Area (GHNP), which lies at a junction of two major global biogeographic realms, i.e., the Indomalayan and the Palearctic realms, supporting a plethora of floral and faunal diversity, several endemic to the region. It serves as a core conservation area to a larger landscape housing several protected areas, forming an island of undisturbed habitats in the Western Himalayan landscape. The area is therefore recognized as a UNESCO World Heritage Site under the criterion of "outstanding significance for biodiversity conservation" (UNESCO, 2014). The current paper

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gives the first occurrence report of *P. novicia* (L. Koch, 1878) from the Indian Western Himalayas, adding to its existing distribution range across the Mediterranean to Central Asia, while also establishing the northernmost distribution range of the members of the genus from the Indian sub-continent.

MATERIAL AND METHODS

Spiders were sampled during March–June 2021 from under rocks and web retreats made inside medium–large sized boulders along a riparian patch from the eco-zone of the Great Himalayan National Park Conservation Area. Specimens were preserved in 70% alcohol followed by examination under a stereomicroscope. The genus identification is based on Zhang et al. (2004), and species identification and derivation of terminology is based on Nadolny et al. (2012). Epigyne was dissected and cleared and cleaned using lactic acid. Photographs and measurements were taken using MICAPS camera attached to a Carton DSZ-45T microscope, and using ToupView software. All measurements are in millimetres (mm). Specimens are deposited at the Wildlife Information Liaison Development Society (WILD), Coimbatore, Tamil Nadu, India. Abbreviations used in text and figures. AEP – anterior epigynal pocket, ALE – anterior lateral eyes, AME – anterior median eyes, C – conductor, CD – copulatory ducts, DA – distal apophysis, E – embolus, fe – femur, GHNPCHA – Great Himalayan National Park Conservation Area, LF – lateral folds, LL – lateral lobes, MA – median apophysis, MOA – median ocular area, MOQ – median ocular quadrangle, mt – metatarsus, pa – patella, PLE – posterior lateral eyes, PME – posterior median eyes, RTA – retrolateral tibial apophysis, ta – tarsus, ti – tibia, S – septum, SH – spermathecal heads.

RESULTS

Taxonomic hierarchy

Class Arachnida Lamarck, 1801

Order Araneae Clerck, 1757

Family Pisauridae Simon, 1890

Genus *Pisaura* Simon 1886

Type species: *Aranea mirabilis* Clerck, 1757.

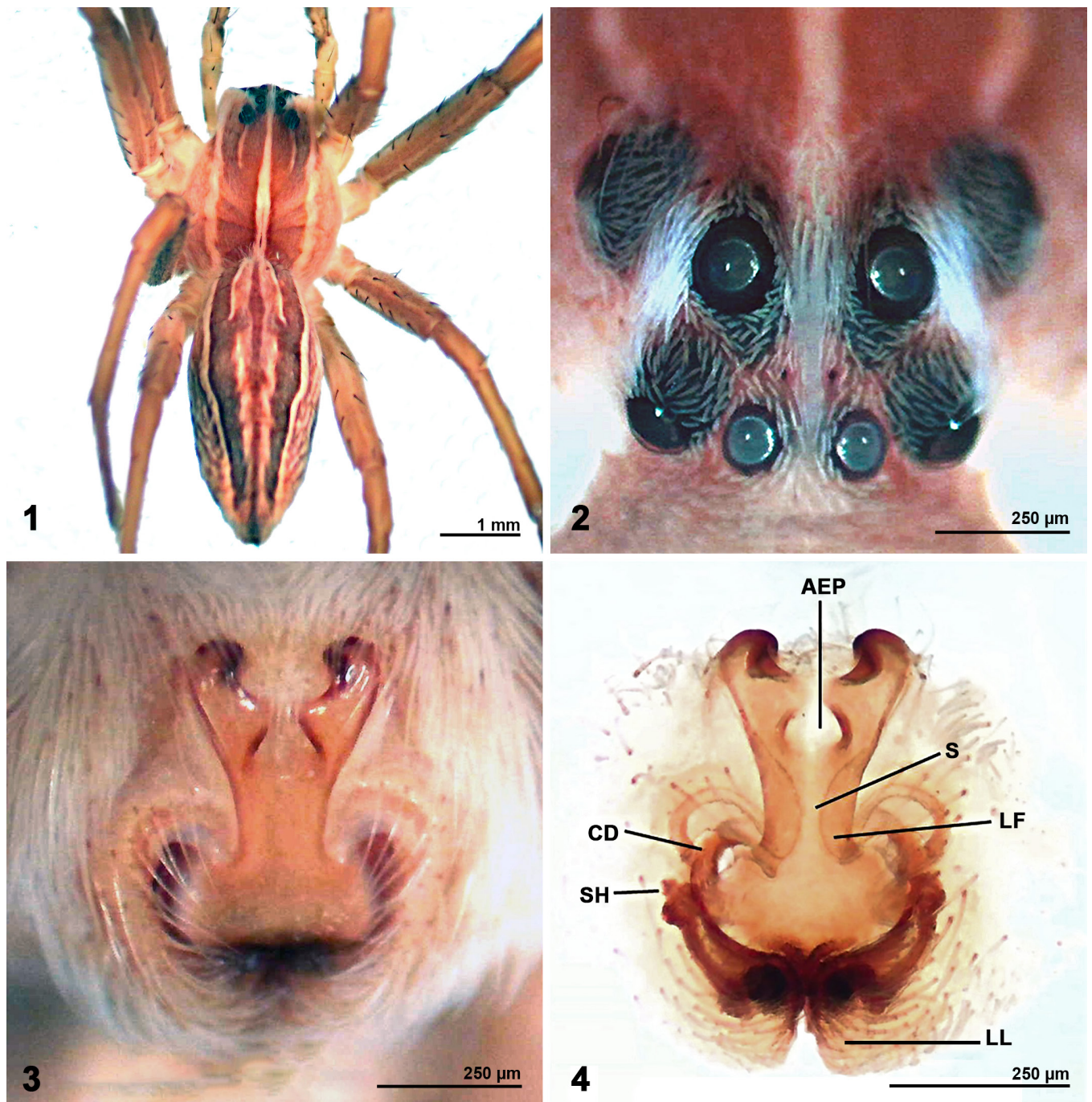
***Pisaura novicia* (L. Koch, 1878) (Figs 1–9)**

Pisaura novicia: Kovblyuk et al., 2011:38, Figs 37–38, 41, 43 (♀); Nadolny et al., 2012:260, Figs 2, 4, 6, 8, 12–14, 17–18, 20–21, 24–25, 28–30, 33–34, 36–38, 40–45 (♂♀); Fedoriak & Moscaliuc, 2013:152, Figs 4A, 5A (♂♀); Kovblyuk, 2014:47, Figs 31–32 (♂♀); Fedoriak, 2015:106, Figs 2.6.7A, 2.6.8A (♂♀); Esysunin & Sozontov, 2015:327, Figs 5–8, 13–16, 19 (♂♀). For the full list of taxonomic entries, see World Spider Catalog (2023).

Material examined. 2 ♀♀, WILD-21-ARA-1617, WILD-21-ARA-1618; 1 ♂, WILD-21-ARA-1619. India: Gushaini (31°38'7.69"N, 77°26'0.87"E), 1598 m, GHNPCHA, Himachal Pradesh. 30 March 2021, coll. Irina Das Sarkar.

Distribution. Mediterranean to Central Asia, India (**new record**).

Diagnosis. Female of *P. novicia* resembles those of *P. acorensis* Wunderlich, 1992, *P. consocia* (O. Pickard-Cambridge, 1872), and *P. quadrilineata* (Lucas, 1838). While it can be differentiated from *P. consocia* by the absence of septal ridge, it is difficult to distinguish from the other two species (Nadolny et al., 2012). Female of *P. novicia* can also be differentiated from *P. mirabilis* (Clerck, 1757) by broader funnel-shaped septum (*vs.* visibly narrow in *P. mirabilis*), broader and trapezoidal spermathecal base formed by shorter posterior extension of septum, coils of copulatory ducts parallel to each other and not laterally and anteriorly extended (*vs.* anterior arch of ducts extended till base of AEP with wider lateral curves), and club-shaped spermathecal heads (*vs.* ovoid). Male of *P. novicia* is similar to that of *P. mirabilis*, but can be differentiated by the dorsally curved tibial apophysis with small projection on anterior side (*vs.* no curvature or anterior projection), smaller diameter of embolic division (*vs.* 1.3 times larger embolic division), comparatively shorter median apophysis and conductor and differently shaped distal apophysis (Nadolny et al., 2012).



Figures 1-4. *Pisaura novicia* (Female): **1.** Habitus, dorsal view; **2.** Eyes, anterior view; **3.** Epigyne, ventral view; **4.** Same, dorsal view. AEP-Anterior epigynal pocket; CD-Copulatory duct; LF-Lateral fold; LL-Lateral lobe; S-Septum; SH-Spermathecal head.

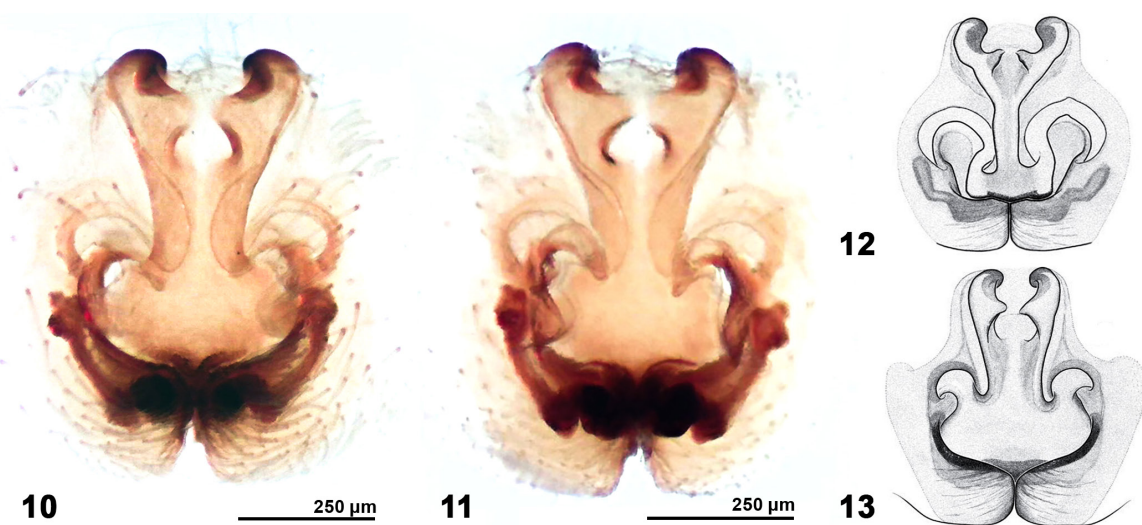
Description — Female (Figs 1-4). Total length 7.04, carapace 3.15 long, 2.55 wide, brown-yellow, tapering anteriorly, with distinct longitudinal white band running entire carapace length and two lateral white bands running from lateral margins of ocular field till posterior margin. Fovea distinct red with radiating striae towards lateral bands. Eight eyes in two recurved rows with distinct black rims that are smaller for anterior median eyes; MOA 0.51 long, 0.50 wide, MOQ 0.71 long, 0.72 anterior width, 0.94 posterior width. Eye measurements: AME 0.09, ALE 0.10, PME 0.11, PLE 0.12. Inter-eye distances: AME-AME 0.10, AME-ALE 0.02, PME-PLA 0.10, PME-PME 0.13, ALE-PLA 0.26.



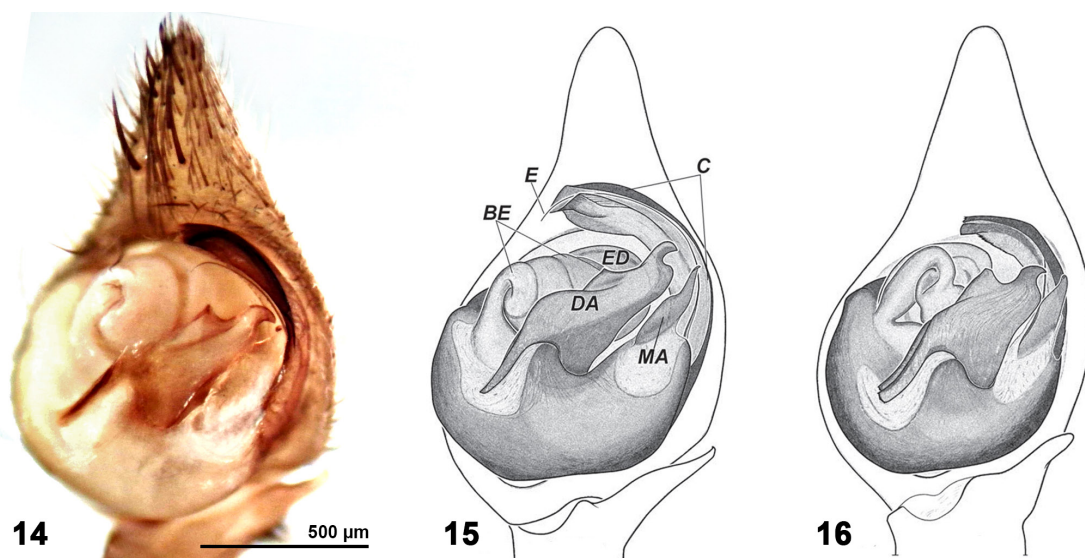
Figures 5–9. *Pisaura novicia* (Male): **5.** Habitus, dorsal view; **6.** Eyes, anterior view; **7.** Right palp, ventral view; **8.** Same, ventro-retrolateral view; **9.** RTA, dorso-retrolateral view; C-Conductor; DA-Distal apophysis; E-Embolus; MA-Median apophysis.

Chelicerae yellow-brown 1.41 long, 0.66 wide, with three promarginal and three retromarginal teeth. Labium pale brown with white distal end; 0.43 long, 0.58 wide. Endites pale brown with white distal ends; 0.81 long, 0.53 wide. Sternum ovoid, bluntly tapering posteriorly, brown with thick yellow longitudinal band running entire length, interspersed with white setae along lateral margin; 1.28 long, 1.40 wide. Legs brown. Leg measurements: I: fe 3.47 pa 1.22 ti 3.51 mt 3.01 ta 1.56 (12.77), II: fe 3.61 pa 1.26 ti 3.48 mt 2.80 ta 1.53 (12.68), III: fe 3.15 pa 1.04 ti 2.69 mt 2.58 ta 1.17 (10.63), IV: fe 3.81 pa 1.12 ti 2.49 mt 3.61 ta 1.48 (12.51). Leg formula 1243. Abdomen 4.23 long, 2.04 wide, with red medial band running entire length and two lateral brown bands. Epigyne (Figs 3–4) with funnel-shaped septum, droplet-shaped anterior epigynal pocket and prominent lateral folds; copulatory ducts looping twice dorsally from base of septum and joining spermathecal base forming trapezoidal cavity; broad lateral lobes with anterior portion close to each other, diverge posteriorly, forming triangular notch; fertilization ducts ovoid; club-shaped spermathecal heads.

Male (Figs 5–9). Total length 7.69, carapace long 3.40, wide 2.72, brown-yellow, tapering anteriorly, with distinct longitudinal white band running entire carapace length. Fovea distinct red with radiating striae towards lateral margins. Eight eyes in two recurved rows with distinct black rims that are smaller for the anterior median eyes; MOA long 0.50, wide 0.52, MOQ long 0.70, anterior width 0.73, posterior width 0.96. Eye measurements: AME 0.10, ALE 0.13, PME 0.11, PLE 0.16. Inter-eye distance: AME-AME 0.10, AME-ALE 0.03, PME-PLE 0.14, PME-PME 0.14, ALE-PLE 0.19. Chelicerae yellow-brown length 1.30, width 0.73, with three promarginal and three retromarginal teeth. Labium pale brown with white distal end. Endites pale brown with white distal ends. Sternum 1.43 long, 1.52 wide, brown with white medial band running entire length, interspersed with black setae. Legs strong, brown. Leg measurements: I: fe 3.56 pa 1.3 ti 3.58 mt 3.33 ta 1.72 (13.49); II: fe 3.88 pa 1.31 ti 3.45 mt 3.62 ta 1.83 (14.09); III: fe 3.25 pa 1.22 ti 2.89 mt 2.75 ta 1.20 (11.31); IV: fe 3.97 pa 1.27 ti 3.57 mt 4.31 ta 1.66 (14.78). Leg formula 4213. Abdomen 4.59 long, 2.11 wide, with distinct medial and wavy lateral bands running entire length, laterally silver-white.



Figures 10–13. Epigynes of *Pisaura novicia* (L. Koch, 1878) (**10, 11.** India; **13.** Crimea) and *Pisaura mirabilis* (Clerck, 1757) (**12.** Crimea). [Figs 12 and 13 from Nadolny et al. (2012)].



Figures 14–16. Male palps of *Pisaura novicia* (L. Koch, 1878) (**14.** India; **16.** Crimea) and *Pisaura mirabilis* (Clerck, 1757) (**15.** Crimea). BE–Base of embolic division; C–Conductor; DA–Distal apophysis; E–Embolus; ED–Embolic division; MA–Median apophysis. [Figs 15 and 16 from Nadolny et al. (2012)].

Palps (Figs 7–9). Palp with hooked RTA, broader at base; distal apophysis large with wavy retrolateral margin with bluntly curved distal tip; central depression of DA prominent; median apophysis small, transparent, with blunt distal tip prolaterally curved; embolus short and located in the conductor fold.

Habitat. Rocky riparian habitat with nest located among medium-large sized rocks with sparse vegetation.

DISCUSSION

The genus *Pisaura* remains severely under-studied in the Indian subcontinent, previously known only by two species descriptions dating back to the 1900s (i.e., 1987 and 1990). The other known species from India vary drastically from *P. novicia* in both copulatory structure and geographic distribution (i.e., *P. podilensis* Patel & Reddy, 1990 from coastal belt of Andhra Pradesh, and *P. swamii* Patel, 1987 from Gujarat). Furthermore, we believe that the minor discrepancies of the Indian and Crimean (Nadolny et al., 2012) individuals (see Figs 10–16) in copulatory structures reflect geographical variations among individuals of a species that demand investigations at a larger scale; regardless, the diagnostic characters provided above well separate the species from its congeners. The Indian collection locality of *P. novicia* corroborates the generic affinity towards rocky-riparian habitats, although intensive surveys in the study area revealed its occurrence only from the localized area of collection. This may highlight the possibility of habitat specificities that may need further assessments. The authors also believe that systematic arachnid research in the study area may reveal newer insights into resident Himalayan biodiversity that remain currently unknown due to paucity of research in the region.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution in the paper as follows: I.D. Sarkar: Data collection, funding acquisition, taxonomic identification, manuscript preparation; M. Siliwal: Manuscript preparation, taxonomic expertise, technical review of manuscript; V.P. Uniyal: Project investigator and supervisor, funding acquisition, conceptualization of work, technical review of manuscript. The 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 Wildlife Information Liaison Development Society (WILD), Coimbatore, Tamil Nadu, India 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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اولین گزارش گونه *Pisaura novicia* (L. Koch, 1878) (Araneae, Pisauridae) از هند

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موسسه مطالعات حیات وحش هند، دهرادون، اوتارکند، هند.

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چکیده: در این مقاله، حضور یک گونه عنکبوت به نام *Pisaura novicia* (L. Koch, 1878) بر اساس نمونه‌های نر و ماده جمع‌آوری شده از زیست‌بوم واقع در منطقه حفاظت شده پارک ملی هیمالیای بزرگ (هیمالچال پرادش)، برای اولین بار از هند گزارش شد. این گونه از منطقه مدیترانه یا آسیای مرکزی انتشار دارد. حضور گونه‌های دیگر از این جنس محدود به کمربند ساحلی ایالات آندرا پرادش و گجرات بوده و بر اساس نتایج این تحقیق به حدود شمالی و هیمالیای غربی توسعه می‌یابد.

واژگان کلیدی: GHNPFA، هیمالچال پرادش، هیمالیای هند، عنکبوت گهواره‌باف،