



Studies on Colour Morphs in Different Snake Species of District Poonch, Jammu and Kashmir, India

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ABSTRACT

Colour polymorphism is a widespread phenomenon in snakes and contributes significantly to understanding their ecology, evolution, and adaptive strategies. During herpetological surveys conducted in the Poonch district, Jammu and Kashmir, India, multiple colour morphs were documented in seven snake species. These included two species belonging to the family Viperidae, namely *Daboia russelii* (Shaw & Nodder, 1797) and *Gloydius himalayanus* (Günther, 1864), and five species belonging to the family Colubridae, namely *Coelognathus helena helena* (Daudin, 1803), *Lycodon bicolor* (Nikolsky, 1903), *Fowlea piscator* (Schneider, 1799), *Herpetoreas platyceps* (Blyth, 1854), and *Platyceps r. rhodorachis* (Jan, 1863). Distinct colour morphs were recorded through field observations and photographic documentation, highlighting considerable intraspecific variation in external coloration. This study represents the first report of colour morph diversity in snakes from the Poonch district. These observations provide baseline information on the occurrence of colour polymorphism in the region and contribute to the understanding of the local snake fauna. The findings emphasize the importance of continued herpetofaunal surveys and long-term monitoring to document phenotypic variation and evaluate its ecological and evolutionary significance.

Keywords: Colour morphs, distribution, pholidosis.

INTRODUCTION

Colour polymorphism is a common phenomenon in snakes and plays an important role in camouflage, predator avoidance, thermoregulation, and other ecological interactions. Documenting colour variation is important for understanding the ecology, evolution, and taxonomy of snake species.

District Poonch, covering an area of 1,673.8 km², forms the western part of the Pir Panjal Range of the Lesser Himalayas in Jammu and Kashmir. The district exhibits a subtropical to temperate climate with an altitudinal range of 760–4,745 m (Fig. 1), supporting diverse habitats for herpetofauna. Although herpetofaunal surveys have been conducted in Jammu and Kashmir (Günther, 1864; Stoliczka, 1872; Boulenger, 1890; Fenton, 1910; Annandale, 1917; Smith, 1931, 1935, 1943; Das et al., 1964; Sharma and Sharma, 1975; Duda et al., 1977; Dubois, 1978; Duda and Sahi, 1978; Sahi and Duda, 1978, 1983, 1985; Sahi, 1979), only sporadic records of snakes are available from District Poonch (Murthy and Sharma, 1976; Sahi and Duda, 1985; Whitaker and Captain, 2015).

During the present survey, 19 snake species were recorded (checklist to be published separately), of which seven species belonging to the families Colubridae and Viperidae exhibited distinct colour morphs while retaining their diagnostic meristic and morphometric characters. This study represents the first report of colour morph diversity in snakes from District Poonch and adds to the previously documented eight colour morphs of *Spalerosophis diadema* and *Spalerosophis atriceps* from the region (Hussain et al., 2023).

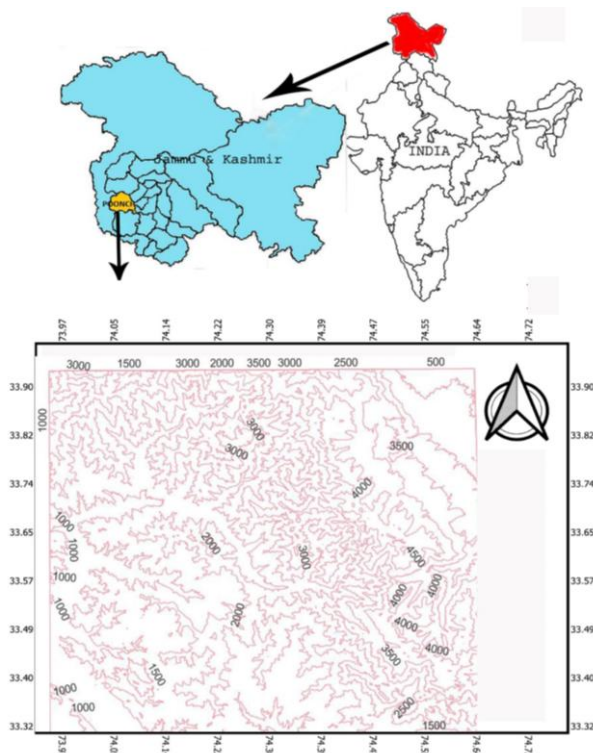


Figure : Contour Map of Study Area Showing Elevational Ranges.

MATERIALS AND METHODS

Materials: Materials required for the collection of samples include snake tong, snake hook, bagger (clothed bag attached to a butterfly net or tennis racket frame), stick/rod, hand gloves, a plastic container with lid, perforated bottle, Garmin GPS, camera with micro-lens or high pixel mobile camera of good quality, calliper, divider, reptile sexing probes, hand lens and thread.

Methods: The study was conducted between January 2020 and December 2021 with due permission from the Department of Wildlife Protection, Jammu & Kashmir. The occurrence of snakes from the study area has been reported through two methods, viz., Direct Sightings (Visual Encounter Surveys) and Indirect Evidence (People Science). The number of individuals, microhabitats and other ecological parameters were recorded by using the mobile application epicollect5. In the direct sightings time-constrained diurnal visual encounter surveys (VES) (Campbell and Christman, 1982) were conducted through the line transect method and site-specific sighting (potential waterbodies like bowlis and ponds publically famous for occurrence of snakes). In the people science, secondary data about the occurrence of snakes was also collected from areas other than the selected transects, based on the reporting of the people through social media (a dedicated WhatsApp group of volunteers, snake catchers and biodiversity lovers), direct contacts and rescue calls. Upon receiving the information, confirmation was made through video calls and the sites were visited to collect the information.

Identification: Following the methodologies of Smith (1943), Sahi and Duda (1985), Sharma (2007), Whitaker and Captain (2008, 2015), Hedges et al. (2014), Schätti et al. (2014), and Lalremsanga et al. (2022), the following morphological and meristic characters were recorded for the identification and description of the taxa:

1. The live coloration of each snake was documented.
2. Head length (HL), snout-vent length (SVL), and tail length (TL) were measured to the nearest millimetre using a digital caliper.
3. Sex was determined by either hemipenial eversion (popping) or cloacal probing, as appropriate.
4. Meristic characters, including the number of ventral scales, subcaudal scales, head scales, and dorsal scale rows at one head length behind the

head, at midbody, and one head length anterior to the vent, were recorded.

Taxonomy and nomenclature of snakes adopted herein follow Whitaker and Captain (2015), except for the latest updation by Hedges et al. (2014), Schätti et al (2014) and Lalremsanga et al (2022).

RESULTS

FAMILY- COLUBRIDAE

1. Common Trinket Snake, *Coelognathus helena helena* (Daudin, 1803), ($n=29$) (Fig. 2)

Distribution

The snake has been reported both through direct sightings and indirect evidences (elevation 920-1330m) from subtropical regions only.

Localities: Chak Banola, Nakka Manjhari, Chhatral, Ari, Bhera, Banola, Nangali, Narol, Sakhimaidan, Bhainchh, Salwah and Gohlad.

Description

The size of the body from the snout to the tip of the tail spans between 420-1085mm. They have a slender body with smooth scales. The dorsal body colour is olive-brown with sharp banding patterns. Nape possesses two parallel black bands. Forebody with white and black checks, whereas the hind body has two prominent black stripes running down the tail. The first five transverse bands are at 4-5 dorsal scales distance from each other (Fig. 2A). The floor of the

mouth is dark black. Based upon the black markings on the lateral sides of the head, they have two colour morphs:

Colour Morph 1 (Fig. 2B).

An oblique black streak runs from behind the eye up to the angle of the mouth and a black marking on the antero-lateral margins of some infralabials.

Colour Morph 2 (Fig. 2C).

In addition to the black streak behind the eye, one or two vertical black streaks below the eye running between the margin of supralabials were also present. The vertical black streaks are not equally prominent on the right and left sides. Black marking on the antero-lateral margins of some infralabials may also be present.

Pholidosis (Individual Examined – 2 Males; 3 Females):

Scale rows are 23 or 24 or 26 at one head length posterior to head (anterior rows); 25 at midbody (at the position of mid ventral) and 19 at hindbody (one head length anterior to vent). Belly scales range between 211-240, angulate laterally and have dull brown shades on the lateral margins. The anal scale is entire, subcaudals are paired and range between 79-95. Supralabials 9-10 (5 and 6 touching the eye). Preocular 1; postocular 2; temporals 1+2, 2+2, 2+3.

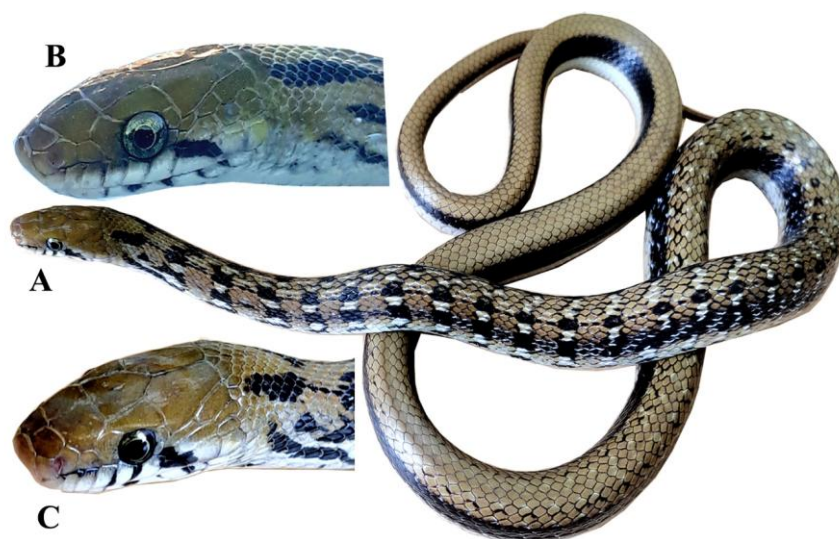


Figure 2: Common Trinket Snake, *Coelognathus helena helena* (Daudin, 1803). **A.** Olive-coloured body; white and black coloured checks on the forebody; two prominent lateral black stripes on the hindbody; **B. Colour Morph 1 (Female).** Only one prominent oblique black streak behind the eye. Black marking on the antero-lateral margin of some infralabials. **C. Colour Morph 2 (Female).** One prominent oblique black streak behind the eye, two vertical narrow black bands below the eye.

2. Mackinnon's Wolf Snake, *Lycodon bicolor* (Nikolsky, 1903) (n=39) (Fig.3)

Distribution

This species has been reported both through direct sightings and indirect evidences (elevation 952-1836 m), both from subtropical and temperate regions, more abundant in the former.

Localities: Kalaban, Fazalabad, Bhainchh, Sathra, Lassana, Sandote, Salwah, Bhainchh, Potha, Lassana, Pathanateer, Chhaperdhara, Behrote, Sialan, Dachhal, BG, Topa, Thalan, Bedar, Kuniyan, Mankote, Bufliaz, Dhargaloon, Jallian, Betar Nallah, Azmabad and Bhera.



Figure 3. Mackinnon's Wolf Snake, *Lycodon bicolor* (Nikolsky, 1903). **A. Colour Morph 1 (Male).** Glossy blackish-brown back with white bands that widens on the side to enclose a roughly triangular black spot; **B. Colour Morph 2 (Male).** Glossy blackish-brown back with yellow bands that widens on the side by the white band to enclose a roughly triangular black spot; **C. Response to stress.** Showing the whitish underside of the body.

Description

Individual of this species ranges between 180-415mm during the present study. Slender-shaped body with smooth scales. The head is slightly broader than the neck. Entirely black eye. Glossy blackish-brown back with bands on the body. Depending upon the colour of the bands there are two colour morphs:

Colour Morph 1 (Fig. 3A).

Blackish-brown back with white bands that widen on the sides to enclose a roughly triangular spot.

Colour Morph 2 (Fig. 3B).

Blackish-brown back with yellow bands that widen on sides but become white in colour to enclose a similar triangular spot as in forma typica.

In both the colour morphs, bands are less distinct towards the tail. The underside of both the colour morphs is also white (Fig. 3C).

Pholidosis (Individual Examined - 3 Males; 3 Females).

Scale rows are 17 (anterior): 17 (midbody): 15 (hindbody). Belly scales 160-194; anal divided; subcaudal paired 48-62. Loreal 1, touches internasal; preocular 1; postocular 2. Temporal 1+2 or 2+3. Supralabials 7 or 8 (2-4, 3-4, 3-5 or 4-5 touch the eye).

3. Checkered Keelback, *Fowlea piscator* (Schneider, 1799), (n=54), (Fig. 4)

Distribution

Checkered Keelback has been reported both through direct sightings and indirect evidences (elevation 920-1100 m) from subtropical regions only.

Localities: Betar Nallah, Darungali, Dharana, Dhargaloon, Dingla, Dungus Chashma, Fisheris Pond Azad Mohalla, Gohlad, Kuniyan, Mankote, Mendhar Town, Saanpon ki Bowli Azad Mohalla, Sagliad, Salwah and Sona Bowli Mendhar.

Description

Total length ranges between 300-1307mm. Keeled scales. Head broader than the neck; the eye has a round pupil (Figs 4A-D). Two bold black streaks- one below, the other from the eye to the angle of the mouth (Fig. 4B). These streaks are not well marked in young (Fig. 4A) and highly melanistic forms (Fig. 4D). The background colour of the body ranges from glossy olive green (Figs. 4A,C) to olive brown (Fig. 4D) with a checkered body pattern. The checkered pattern is very light and visible on the anterior body in young individuals (Fig. 4A) compared to adults, where the

checkered pattern is prominent throughout the body (Figs 4C,D). Underside glossy white or yellowish white. Adults show two colour morphs:

Colour Morph 1.

Olive green background of the body with closely set black blotches alternatingly arranged in rows to give a chess-board-like pattern with strong contrast (Fig. C).

Colour Morph 2.

Large and confluent blotches make the body nearly black. The blotches are separated by small whitish or hues of yellowish-brown spots (Fig. D).

Pholidosis (Individual Examined – 4 Males; 3 Females; 3 Young)

Scales in 19:19:17 rows. Ventrals 142-158; anal divided; subcaudals 56-97, paired. Internasal distinctly narrower anteriorly. Supralabials 8 or 9; only 4th touching the eye, whereas 5th and 6th are excluded by lowest postocular. Preocular 1; postocular 3 or 4. Temporals 2+2 or 2+3 or 2+4.

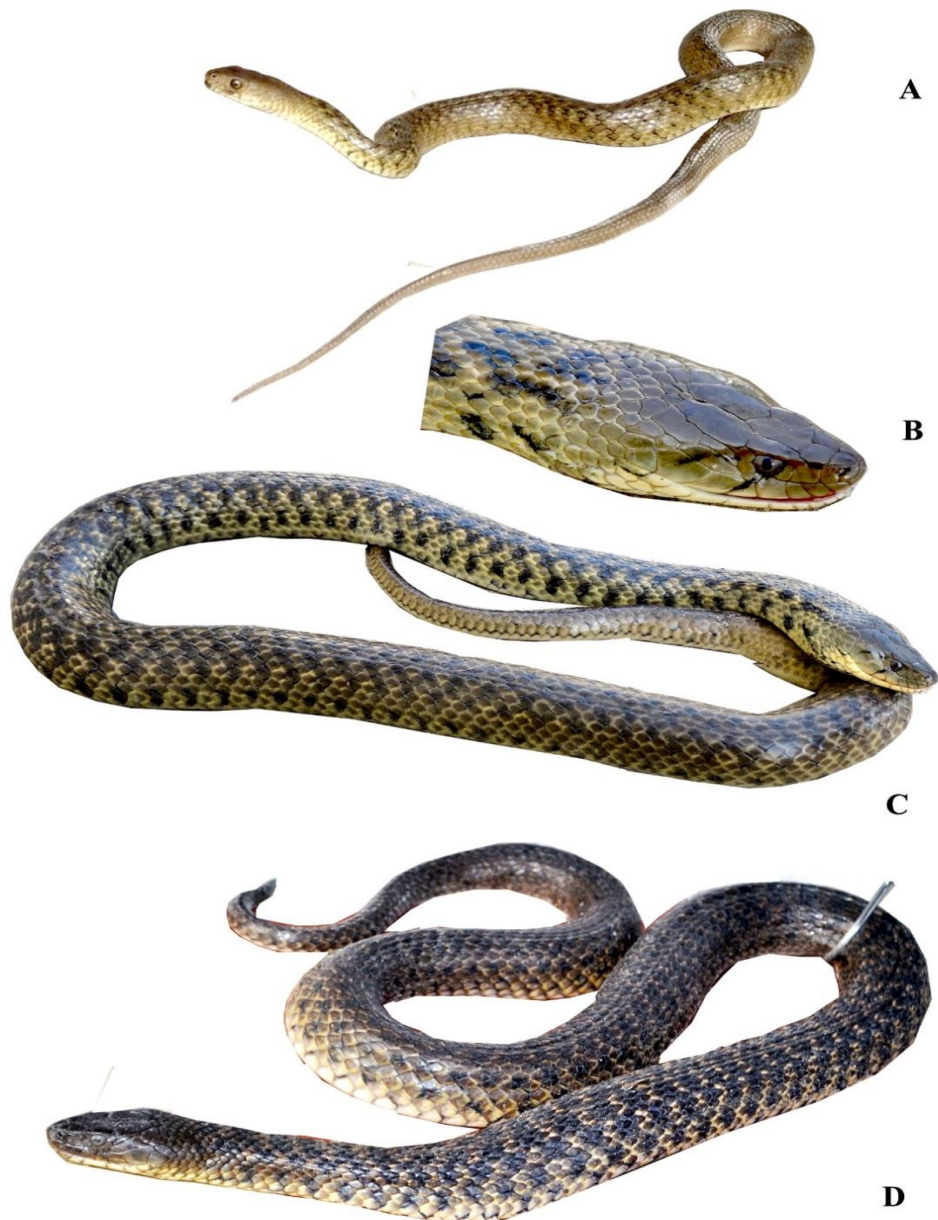


Figure 4. Checkered Keelback, *Fowlea piscator* (Schneider, 1799).

A. A young individual with light markings or reduced blotches on the body.

B-D. Colour Morph 1. **B.** Head showing two bold black streaks – one below, the other from the eye to the angle of mouth; **C.** Adult with olive green background and dark checker-board blotches with strong contrast.

D. Colour Morph 2. Adult with large and confluent blotches, the body looks nearly black with small whitish or pale or hues of yellowish-brown dots.

4. Himalayan Mountain Keelback, *Herpetoreas platyceps* (Blyth, 1854), (n=9) (Fig. 5)

Distribution

The distribution of Himalayan Mountain Keelback has been reported both through direct sightings and indirect evidence (elevation 1628-2906 m) from subtropical and temperate regions, more abundant in the latter.

Localities: Sialan, Bhimber Gali and Sankh Doda.



Figure 5. Himalayan Mountain Keelback, *Herpetoreas platyceps* (Blyth, 1854).

A. Colour Morph 1. Grey-coloured back with small black spots more conspicuous anteriorly. The chin, lips and underside of the forebody are yellowish. Visible black streak from behind the nostril to the angle of the mouth.

B-C. Colour Morph 2. B. Dorsal. Grey-coloured back with small black spots more conspicuous anteriorly. Lips white, conspicuous black streak from nostril to the angle of mouth; **C. Ventral.** Light brown underside, dark brown chin and gular region, the dark-brown line separating the ventrals on lateral sides more conspicuous on the forebody. **D. Colour Morph 3.** Grey-coloured back with inconspicuous black spots and white underside including lips and chin. Inconspicuous black streak from the nostril to the angle of the mouth.

Description

Total length ranges between 527-670mm. Slender bodied. Scales weakly keeled. Head broader than the neck, eyes with round pupils. Depending upon variable colour patterns following colour morphs have been reported from the study area:

Colour Morph 1 (Fig. 5A).

Grey-coloured back with small black spots more conspicuous anteriorly. The chin, lips and underside of the forebody are yellowish, while the underside of the hindbody is whitish. Visible black streak from behind the nostril to the angle of the mouth.

Colour Morph 2 (Fig. 5B).

Grey-coloured back with inconspicuous black spots and white underside including lips and chin. Inconspicuous black streak from the nostril to the angle of the mouth.

Colour Morph 3 (Figs. 5C,D).

Grey-coloured back with small black spots more conspicuous anteriorly. Lips white, conspicuous black streak from the nostril to the angle of the mouth (Fig. 5C). Light brown underside, dark brown chin and gular region, and the dark brown line separating the ventrals on lateral sides more conspicuous on the anterior half of the body (Fig. 5D).

Pholidosis (Individual Examined – 2Males; 4Females). Scales in 19:19:17 rows. Ventrals 210-230; anal divided; subcaudals 85-98, paired. The prefrontal extends well onto the side of the head (above the loreal). Loreal 1; supralabials mostly 8, rarely 9; when 8, 3rd to 5th touching the eye; when 9, 4th to 6th touching the eye. Preocular 1. Temporals 1+1, 1+2, 1+3 or 2+2. Internasal tunicate anteriorly.

5. Jan's Cliff Racer, *Platyceps r. rhodorachis* (Jan, 1863) (n=23), (Fig. 6)

Distribution

The species has been reported through indirect evidence only (elevation 760-1638 m) from both subtropical and temperate regions, more abundant in the former.

Localities: Balnoi, Bhainchh, Chak Banola, Gohlad, Kalaban, Madana, Narol, Parat, Pathanateer, Plera, Sakhimaidan, Salwah and Sangala.

Description

Total length ranges from 291-1085mm. Body long, smooth-scaled, and slender-shaped. Head distinctly broader than the neck; the large eye has a round pupil; lips white; a white band in front and behind the eye.



Fig 6. Jan's Cliff Racer, *Platyceps rhodorachis rhodorachis* (Jan, 1863).

A-C. Colour Morph 1. Non-stripped blotched phase with spots. **A.** Young individual (291 mm) with roughly roundish spots on anterior dorsum; **B.** Head of the young individual. A creamy white band in front and behind the eye. A lyre-shaped dark mark on the parietals. Collar with one broadband on the nape; **C.** Adult (1050mm). The lyre-shaped marking of parietals is less conspicuous and round spots of the body are confluent.

D. Colour Morph 2 (1085mm). Non-stripped blotched phase with transverse bands. Head with a creamy white band in front and behind the eye. Inconspicuous lyre-shaped mark on parietals.

Tail long and thin. The head has a lyre-shaped mark on the parietals, the dorsum of the forebody is variously spotted, while the hindbody and tail are uniformly coloured. Underside white with dark spots at the outer edges of ventrals. Two colour morphs have been identified: the non-stripped blotched phase with spots and the non-stripped blotched phase with transverse bands.

Colour Morph 1: Non-stripped blotched phase with spots (Figs. 6 A-C).

Young Individual: A young individual (291 mm) showed roughly roundish spots on the anterior dorsum arranged in six rows in a chequered manner on a brownish background with the uniformly coloured dorsum of hindbody and tail (Fig. A). Head brownish except for the creamy white band in front and behind the eye. A lyre-shaped dark mark on the parietals and a noticeable mottled anterior pileus. Darker loreal region. A distinct oblique subocular band and one broad dark mark across the temples between the lateral edges of the parietal and mouth. Collar with one broadband on the nape (Fig. 6B).

Adult (Fig. 6C): An adult male individual (1050mm) showed two broad vertical marks on temples, the first in contact with the lateral edges of the parietal and the other running to the corner of the mouth from the lateral margin of the parietals. Subocular bands persist as found in young individuals. The lyre-shaped marking of parietals is less conspicuous, and the whole of the pileus appears mottled with a dark marking. Roundish spots of brown colour arranged in six rows down the forebody confluent along the spine, forming a chequered pattern resembling a zipper.

Colour Morph 2: Non-stripped blotched phase with transverse bands (Fig. 6D).

A male individual (1085mm) showed transverse bands on the anterior dorsum running on both flanks on a greyish background. Head greyish except for the creamy white band in front and behind the eye. The lyre-shaped marking of parietals is less conspicuous, pileus without a discernible pattern but with irregular darker markings particularly on the parietals and supraocular. Loreal region slightly darker. A distinct oblique subocular streak (curved backwards) and usually two broad dark marks across the temples, the first in contact with the anterior lateral edge of the parietal and the other running to the corner of the mouth. Collar with two broad complete bands on the nape. Rest markings of the head are similar to the adult of Colour Morph 1.

Pholidosis (Individual Examined – 2 Males; 2 Females; 1 Subadult)

Scales in 19:19:13 rows. Ventrals 200-222; anal divided; subcaudals 101-133, paired. Supralabials 8 or 9 (5th and 6th touching the eye). Preocular 2; postocular 1 or 2. Temporals 2+3.

FAMILY- VIPERIDAE

6. Russell's Viper *Daboia russelii* (Shaw & Nodder, 1797) (n=99) (Fig.7)

Distribution

The distribution of Russell's Viper has been reported both through direct sightings and indirect evidence (elevation 836-1842 m) from both subtropical and temperate regions, more abundant in the former.

Localities: Ari, Azmabad, Balakote, Balnoi, Bedar Tarra, Behrote, Bhainchh, Bhera, Bufliaz, Chaktro, Chandak, Chhaperdhara, Dharana, Dhargaloon, Dharra Fatehpur, Draba, Fazlabad, Gohlad, Jallian, Jhalas, Kalai, Kandi, Keri, Galhutta, Kermara, Kotan, Kund, Kuniyan, Lassana, Mendhar Town, Mirza Morh, Mohra Bacchai,

Nakka Manjhari, Nangali, Narol, Parat, Pathanateer, Phagla, Salwah, Sandote, Sangala, Sarhutti, Sathra and Sialan.

Description

Minimum to maximum body size of the individuals of this species recorded during the present study ranges between 335-981 mm.

Dorsal of Body (Fig. 7A). The body is stout and rough in appearance. Tail short, thin. Scales strongly keeled. Light greenish brown to reddish brown back with three longitudinal series of prominent, large rounded spots: one vertebral row and two lateral rows. Spots are in the form of a black ring with narrow white or creamish outer margin. The area of spots within the ring matches in colour with the body colour but in a darker shade. The vertebral pots are full moon-shaped, while the lateral rows of spots are half-moon-shaped.

Head (Fig. 7B). Triangular head broader than neck; scales on the upper surface of the head small, strongly keeled; nostril very large. The eye has a vertical pupil. The top of the head has a narrow white V-shaped mark enclosing three dark brown spots with black margins. This arranges spots on the head in a triangular fashion. Spots towards the base of the triangle are semi-circular, and the spot at the apex of the triangle is rectangular. A dark streak from the eye to the angle of the mouth. Supralabials with vertical white and brown bands.

Ventral. Lower lip, chin and underside white, speckled with black semilunar markings. Blotches on subcaudal few compared to ventral scales (Fig. 7C).

With slight variations in colouration and shapes of spots, two colour morphs have been recognized during the present investigation:

Colour Morph 1 (Fig. 7A).

Light greenish brown body with full moon-shaped separate spots along the vertebral line.

Colour Morph 2 (Fig. 7D).

Reddish-brown body with some of the vertebral spots meeting to form a chain-like pattern on the back and a continuous mid-dorsal strip on the tail.

Pholidosis (Individual Examined – 7 Males; 6 Females; 2 Young)

Scales in 27-29:27-29:21-23 rows. Ventrals 165-172; anal entire; subcaudals 47-53, paired. Supralabials 11 or 12 (4-5 touching the eye). *Canthus rostralis* distinct. Nostril very large, supranasal crescentic.

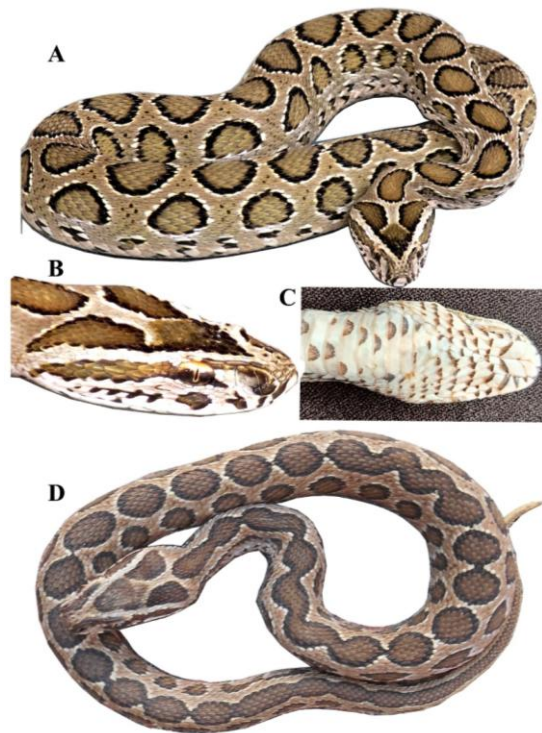


Fig 7. Russell's Viper, *Daboia russelii* (Shaw & Nodder, 1797).

A. Colour Morph 1. Greenish-brown body with separate full moon-shaped spots along the vertebral line.

B. Head. Triangular, narrow white V-shaped mark, very large nostril.

C. Ventral. Lower lip, chin and underside white, speckled with black semilunar markings.

D. Colour Morph 2. Reddish-brown body with some mid-dorsal spots meeting to form a chain-like pattern on the back and a continuous mid-dorsal strip on the tail.

7. Himalayan Pit Viper, *Gloydius himalayanus* (Günther, 1864), (n=49), (Fig. 8,9)

Distribution

Distribution

Distribution of Himalayan Pit Viper has been reported through direct sightings and indirect evidences (elevation 1310-2490 m) from both subtropical and temperate regions, more abundant in the latter.

Localities: Arai, Azmabad, Basuni, Bedar, Bedar Tarra, BG, Chhamber, Salwah, Dhargaloon, Draba, Fazlabad, Gulhutta, Jallian, Kalaban, Kalai, Lassana, Plera, Salwah, Sandote, Sawjian, Sialan and Toti.

Description

Size ranges between 265-630 mm. Scales strongly keeled. Slender body with a short tail (Fig. 8A).

Head (Fig. 8B). The triangular head is distinctly broader than the neck. Scales on the upper side of the head are very large. Heat sensitive pit, the loreal pit, between nostril and eye. The eye has a vertical pupil. Distinct angular edge around the top of the head.

Two distinct colour morphs have been recognised during the present study:

Colour Morph 1. Body with narrow and less conspicuous markings on the back (Figs. 8A-D).

Female (Fig. 8A). Light greenish brown body with dark blackish-brown narrow wavy bars on the back. A slightly darker line from the eye to the angle of the mouth. Tail and body uniformly coloured.

Male (Figs. 8B,C). Light bluish brown body with five rows of small darker bluish spots of blurred margin running from head down the tail. A conspicuous dark band from the eye to the angle of the mouth. A reddish-brown distal portion of the tail.

Ventral (Fig. 8D). Underside off-white in the anterior half and brownish in the posterior half in both sexes.

Colour Morph 2. Body with heavy dark brown markings on the back (Figs 9A-E).

Male (Fig. 9A). Light brown background on the back with six rows of dark brown spots running down the tail. Mid-dorsal spots are confluent to form a festoon on each side of the vertebral line. The pileus region also possesses dark markings on the internasal,

prefrontals and supraocular. The dark band from the eye extends to the neck. Two longitudinal bands on the nape. The lips are light brown. Tail short and uniformly coloured.

Female (Fig. 9B). More thicker and darker spots on the body. On the tail, dark spots of the vertebral line are connected with laterals as well. A dark band extends from the loreal region onto the neck. Upper lip is light brown with a vertical dark band on supralabials below the eye, lower lip with alternate light and dark vertical markings. Tail short and uniformly coloured.

Ventral (Fig. 9C). The underside of both the variants is heavily marked with various shades of brown. Ventrally the distal part of the tail is yellowish brown.

Variation in markings on the head. The head of the 'Colour Morph 2' also shows some variation in colouration other than explained above. Upper side of the head uniform brownish, lips and underside creamish. A sharp dark brown band from the eye to the angle of the mouth. The lower lip has only one vertical dark band between the 6th and 7th infralabial (Fig. 9D). The head may have a yellowish-brown marking arranged in a pattern (Fig. 9B).

Pholidosis (Individual Examined – 3 Males; 4 Females; 1 Young)

Scales in 21-22:21:16-17 rows. Ventrals 155-170; anal entire; subcaudals 44-54, paired. Upper head scales are large. *Canthus rostralis* sharp. Supraocular broad. Supralabials 6-8; 1st sometimes united with 2nd and last two extend into temporal region.

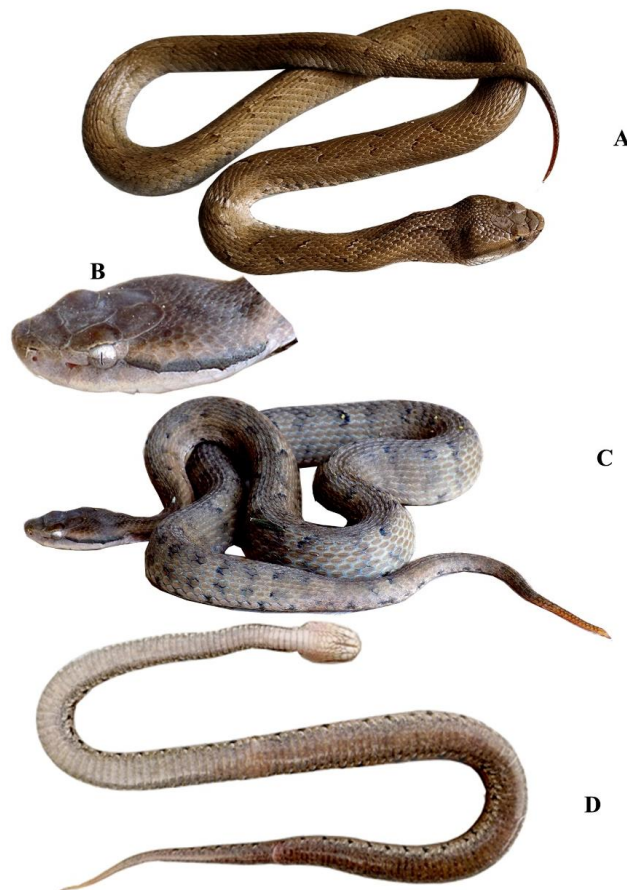


Figure 8. Himalayan Pit Viper, *Gloydius himalayanus* (Günther, 1864).

Colour Morph 1. Body with dull and less dark markings on the back.

A. Dorsal, Female. Greenish brown body with dark blackish-brown and narrow wavy bars on the back. **B. Head.** The heat-sensitive pit between the nostril and eye. Distinct angular edge around the top of the head. A dark line from the eye to the angle of the mouth; **C. Dorsal, Male** Bluish brown body with five rows of bluish spots of blurred margin. Short tail with reddish distal portion. **D. Ventral.** Underside off-white in the anterior half and brownish in the posterior half.

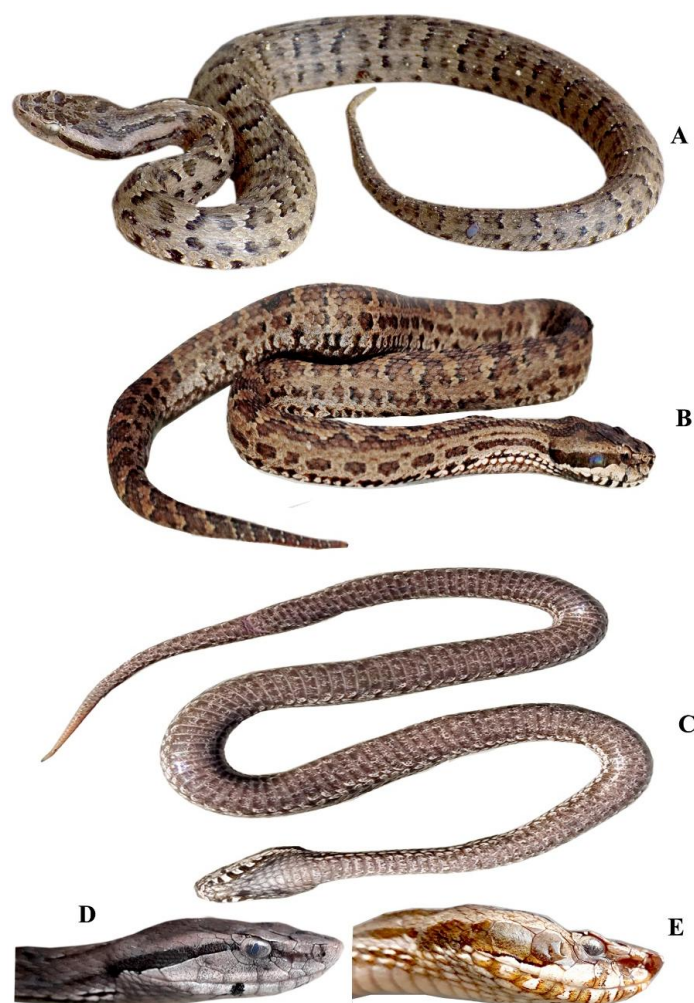


Figure 9. Himalayan Pit Viper, *Gloydius himalayanus* (Günther, 1864).

A-C. Colour Morph 2. Body with heavy dark brown markings on the back

A. Dorsal, Male. Dark brown spots running down the tail. Mid-dorsal spots are confluent to form a festoon on each side of the vertebral line. Pileus region with dark markings. The dark band from the eye extends to the neck. Two longitudinal bands on the nape. **B. Dorsal, Female.** Similar in markings with dorsal above (A) except that on the tail, dark spots are connected with laterals as well. A dark band extends from the loreal region onto the neck. Lower lips with alternate dark and light vertical bands. **C. Ventral.** Underside is heavily marked with various shades of brown.

Variations in markings on the head in heavily marked morph.

D. Uniform brownish head with dark-brown band from the eye to the angle of mouth.

E. Yellowish brown marking on the head. Pattern similar to that of 'B.'

DISCUSSION

Common Trinket Snake, *Coelognathus helena helena* (Daudin, 1803)

Distribution and Description: Widespread throughout India (Whitaker and Captain, 2015; Aengals, 2018), the non-venomous Common Trinket Snake is common in the Poonch district. Identifiable by its olive-brown dorsal coloration, the snake may exhibit variations, including rare occurrences of black markings on the head's lateral side. (Whitaker and

Captain, 2015; Mohapatra et al., 2016; Patel et al., 2021). The diagnostic feature of the Common Trinket Snake, observed in the present individuals, is its olive-brown dorsal body color adorned with distinctive white and black checks on the fore body, coupled with prominent black stripes running down the hind body and tail (Whitaker and Captain, 2015; Mohapatra et al., 2016; Patel et al., 2021). 'Colour Morph 2' (Fig. 2C) showcases an interesting variation in the black markings on the lateral side of the head. This morph reveals the presence of 1-2 vertical black streaks

below the eye, effectively separating the supralabials. Additionally, an oblique black band extending from the eye to the angle of the mouth is evident. Such variations in head markings, represented by 'Colour Morph 2,' were noted as rare occurrences in earlier studies (Mohapatra et al., 2016).

Comparison with Subspecies *C.h. monticollaris*: Distinguishing between subspecies, the Common Trinket Snake, *C.h. helena*, and *C.h. monticollaris*, is crucial. *C.h. monticollaris* is characterized by two bands on the nape that remain connected posteriorly, forming a distinctive V or U-shaped marking. In contrast, the present study identifies a less prominent black band separating supralabials from above in *C.h. helena* (Whitaker and Captain, 2015; Mohapatra et al., 2016). This serves as a novel observation reported from the study area.

Remarks on New Findings: The identification of a less prominent black band separating supralabials from above, as reported in this study, adds a novel dimension to the understanding of the Common Trinket Snake in the study area.

Scalation: The morphometric and meristic characteristics outlined in 'Colour Morph 1' (Fig. 2A) align consistently with earlier findings (Smith, 1943; Sahi and Duda, 1985; Sharma, 2007; Whitaker and Captain, 2015). Our data reaffirms the scalation patterns of *C.h. helena*, as documented by Whitaker and Captain (2015), with notable consistencies in rows at forebody (23 or 24 or 26), midbody (25), hindbody (19), ventrals (211-240), subcaudals (79-95 pairs), supralabials (9-10, 5th-6th touching the eye), preocular (1), postocular (2), and temporals (1+2, 2+2, 2+3) (Whitaker and Captain, 2015).

Corroborating Previous Studies: Additional congruence with earlier research is observed in the occurrence of 24 and 26 rows of scales at the neck, 19 rows of scales before the anal plate, 5th-6th supralabials touching the eye, and a 1+2 arrangement of temporals, as reported by Mohapatra et al. (2016). This reaffirms the reliability and consistency of the documented scalation characteristics of *C.h. helena* in the region.

Mackinnon's Wolf Snake, *Lycodon bicolor* (Nikolsky, 1903)

Distribution and Description: The Mackinnon's Wolf Snake, a non-venomous species identified as *Lycodon*

bicolor (Nikolsky, 1903), was originally reported in district Poonch by Sahi and Duda (1985). The Mackinnon's Wolf Snake exhibits two distinct colour morphs, characterized by a blackish-brown back with either white or yellow bands, as observed in the current study. These morphs align with previous descriptions by Whitaker and Captain (2015).

Scalation: The scalation pattern of Mackinnon's Wolf Snake, as per our findings, concurs with the observations of Whitaker and Captain (2015). Noteworthy variations include the presence of 62 subcaudals in a male individual, differing from the reported range of 44-58 by Whitaker and Captain (2015). Moreover, the occurrence of seven supralabials, with specific configurations touching the eye, represents a novel observation in the study area. This unique variation expands the known range of supralabials from 7-8, challenging previous reports of a consistent count of 8 (Smith, 1943; Sharma, 2007; Vogel et al., 2012; Whitaker and Captain, 2015; Sharma, 2022).

Checkered Keelback, *Fowlea piscator* (Schneider, 1799)

Distribution and Description: *Fowlea piscator*, a non-venomous snake, previously reported in district Poonch (Sahi and Duda, 1985), is commonly distributed across India with an unassessed IUCN status (Aengals, 2018). The distinctive glossy olive-green body with a checkered pattern and bold black streaks is a key diagnostic feature (Vogel and David, 2012; Whitaker and Captain, 2015).

Scalation: Scalation patterns closely align with prior findings by Whitaker and Captain (2015), emphasizing consistency in rows at the forebody, ventral counts, supralabials, and postoculars. Noteworthy is the discovery of new meristic variations, such as four posterior temporals and a minimum of 56 subcaudals, expanding the known range in *F. piscator*.

Himalayan Mountain Keelback, *Herpetoreas platyceps* (Blyth, 1854)

Distribution and Description: The Himalayan Mountain Keelback, common in the Himalayan Foothills (Aengals, 2018), is a mildly venomous species, formerly recognized as *Amphiesma platyceps* (Sahi and Duda, 1985). Recent taxonomic revisions led to its reclassification as *Herpetoreas platyceps* (Guo et al., 2014; Lalremsanga et al., 2022). The Himalayan

Mountain Keelback exhibits diverse colour patterns, as illustrated in Colour Morphs 1, 2, and 3 (Fig. 5). Consistent with previous findings, the snake's grey-coloured body adorned with various black spots and whitish or yellowish underside is noted (Whitaker and Captain, 2015).

Scalation: Scalation patterns align with prior research, with some notable variations. A male individual presents a novel configuration of 9 supralabials (4th-6th touching the eye), expanding the known range. The recognition of this new variation enhances our understanding of the species' diversity.

Jan's Cliff Racer, *Platyceps r. rhodorachis* (Jan, 1863)

Distribution and Description: *Platyceps r. rhodorachis*, commonly known as Jan's Cliff Racer, has been reported with 'Colour Morph 1' with spots and 'Colour Morph 2' with transverse bands (Fig. 6) in earlier findings of Schätti et al (2014). The study reinforces the importance of understanding variations in coloration patterns.

Scalation: Scale counts, especially ventrals, help differentiate *Platyceps r. rhodorachis* from other subspecies, highlighting its unique features compared to Ladakh Cliff Racer (*P. r. ladacensis*).

Russell's Viper *Daboia russelii* (Shaw & Nodder, 1797)

Distribution and Description: Russell's Viper, a venomous and widespread species in India, has been consistently documented (Whitaker and Captain, 2015; Aengals, 2018; Khandakar and Jeny, 2020). This study broadens our understanding, reporting its presence in both subtropical and temperate regions, spanning an altitudinal range of 836-1842 m. Despite its nocturnal nature, daytime sightings challenge conventional observations. The diagnostic features of Russell's Viper, including a stout body, keeled scales, and distinctive coloration patterns, align with prior descriptions (Smith, 1943; Sahi and Duda, 1985; Sharma, 2007; Whitaker and Captain, 2015; Nath et al., 2019). Noteworthy is the reporting of reddish-brown coloration from the study area, adding a regional nuance to the species' known variation.

Remarks: The present study contributes by documenting the reddish-brown color morph, corroborating earlier findings in Mangalore.

Scalation: Scalation patterns presented in this study remain consistent with prior observations, showcasing rows at different body sections, ventral counts, and supralabials. However, the variation in supralabials within the known range suggests morphological diversity within the species.

Remarks: The documentation of 12 supralabials, though rare, fits within the broader range reported by Smith (1943) and Sharma (2007). The novel findings enhance our understanding of intraspecific variation (Whitaker and Captain, 2015).

Himalayan Pit Viper, *Gloydius himalayanus* (Günther, 1864)

Distribution and Description: Widely distributed in Western Himalayas and previously reported in Poonch (Sahi and Duda, 1985), the Himalayan Pit Viper is considered common (Whitaker and Captain, 2015). The altitudinal distribution and regional prevalence in temperate regions are consistent with its montane classification (Whitaker and Captain, 2015). Characteristic features, such as a triangular head, loreal pit, and variations in coloration patterns, are consistent with earlier reports (Smith, 1943; Sharma, 2007; Whitaker and Captain, 2015). The present study introduces novel aspects, including a uniform brownish upper side of the head and distinctive markings on the lower lip.

Remarks: The documentation of upper lip spots contributes to the existing knowledge, emphasizing the importance of continuous observation for discovering intraspecific variations.

Scalation: Meristic characters conform to earlier studies, but the reporting of 54 subcaudals from a single individual expands the known range and challenges previous limits (Sharma, 2007; Whitaker and Captain, 2015).

Remarks: The study extends the known range of subcaudals for Himalayan Pit Viper, providing a more comprehensive understanding of its morphological variability.

CONCLUSION

The present study provides the first documented account of colour morph diversity in the snake fauna of District Poonch, Jammu and Kashmir. Different

colour morphs were recorded in seven snake species belonging to two families while the specimens retained species-specific meristic and morphometric characters, confirming that the observed variations represent intraspecific colour polymorphism. In addition, variations in morphometric and meristic characters were documented among several species, reflecting the previously understudied nature of the snake populations in the region. These observations broaden the existing knowledge of phenotypic variation in the snakes of the western Himalayas and complement the earlier report of eight colour morphs in *Spalerosophis d. diadema* and *Spalerosophis atriceps* (Hussain et al., 2023). The present findings provide valuable baseline data on colour polymorphism and diagnostic morphometric and meristic characters, thereby contributing to improved species identification and serving as a foundation for future taxonomic, ecological, evolutionary, and conservation studies on the snakes of District Poonch

Conflict of interest

The authors declare no competing interests.

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