



## First attempt to study the terrestrial beetles (Coleoptera) from Pauri City of Garhwal, Uttarakhand, India

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### Abstract

In order to understand the current status of beetles (Coleoptera) in two different ecosystems, i.e., Pauri Gaon (including unprotected forests and vegetable gardens) and Kandoliya Road (a dense forest of oak and pine) in Pauri city of Garhwal, Uttarakhand a study was conducted from October 2019 to May 2020. The present study deals with the record of a total of 17 species of beetles, which belong to 2 families and 17 genera. The coccinellidae was the dominant family among the two, with 14 species, and the chrysomelidae had 3 species. Maximum numbers of beetles were recorded in Pauri Gaon as compared to the Kandoliya of district Pauri Garhwal, Uttarakhand. Climatic variables significantly influenced the beetle community, as higher species, abundance, and availability were recorded in the summer season, followed by rainy and winter, respectively.

**Keywords:** Beetles, checklist, Pauri city, Uttarakhand

### Introduction

Order coleoptera which contains the beetles is the largest insect order with an estimated 400,000 species reported from all over the world. Beetles are found in all types of habitats, ranging from the bark of trees to flower, leaves, underground near roots, and all over the plant parts, including dead or decaying ones. Beetles have a very large number of species, pose and the largest suborder is Polyphaga containing more than 170 families (Hunt *et al.* 2007) [18], which contain more than 300,000 described species (Evans and Bellamy, 1977 [12]; Lawrence and Newton, 1982) [24]. Considerable work has been carried out on biology and morphology of Coccinellids (Khan, 2016 [28]; Rahaman and Aniszewski, 2015) [33]. Few studies on the morphology of larvae of Coccinellidae was carried out by Gage (1920) [13] and Akbar *et al.*, (2009) [1] studied the life cycle and larval morphology of *Diomus terminates* (cited latest literature). Some researchers have been studied the beetles worldwide are (Chapin, 1965 [6]; Simpson and Burkhardt, 1960 [36]; Hagen, 1962 [16]; Meyerdirk, 1983 [26]; Blackman and Eastop, 1984 [3]; Babu, 1991; Chapin and Brou, 1991 [7]; Diraviamand Viraktamath, 1991 [10]; Kobayashi *et al.*, 1972; Gregg, 2002 [15]; Koch, 2003; Bista and Omkar, 2011; Joshi *et al.*, 2012) [20]. Mostly, beetles are phytophagous and harmful to humans and some of them function as scavengers, breaking down materials such as dead logs, lumber used in houses, dead plants and animal matter, excrement, and other waste products. Some species, such as, the Colorado potato beetle, are serious agricultural pests, while others such as Coccinellidae (ladybirds or ladybugs) eat aphids, scale insects, thrips, and other phytophagous insects. The research work carried out on beetles in Uttarakhand was in early-stage and little work has been done by different works in different parts of the state (Poorani 2002b [30], 2004 [31]; Joshi *et al.*, 2012 [20]; Shram *et al.* 2017. But no such work was conducted exclusively in Pauri city till date. Hitherto this study was designed to update the present status of beetles in Pauri city and descriptions of some species of beetles have been embedded in this paper.

### Materials and Methods

The present study was conducted in the district Pauri Garhwal, Uttarakhand, which lies in the northern part of central Himalaya between 29°45' to 30°15' north latitude and 78°24' to 79°23' east longitude and 1814m above sea level. The study was conducted from October 2019 to May 2020 at two different sites of Pauri district *viz.*, Kandoliya, Paurigaon.

These sites were situated about 2-3km away from Pauri city. Beetles recorded in this study were observed and photographed in selected places and set free after proper photographs in their habitat. The photograph of beetles was captured using a camera and mobile phone by visiting the sites and the beetles were observed in the local agricultural fields in their natural habitat and other activities of beetles were recorded in the notebook. These were recorded in the morning and afternoon hours or whenever they are best seen. The captured photographs were used to identify different beetles using their morphology, and coloring, spot pattern on the elytra. Coccinellids beetles are identified based on their number of spots and/ or arrangements of elytral patterns. We also consulted the existing literature for the final identification of beetles following Poorani (2002) [30] and Smith (1837) [37].

### Results

During this study, a total of 17 species of beetles (belonging to 2 families Coccinellidae and Chrysomelidae) were reported. Coccinellidae dominated the habitat with 14 species, while only 3 species of Chrysomelidae were recorded (Photo Plate 1). Higher densities of beetles were recorded in Pauri Gaon as compared to other site and this study provides baseline data for future study of beetles in the Pauri. In spite of this, their distribution and habitat ecology have been listed and described below.

### Description of collected beetles

1. *Alloneda dodecaspilota* (Hope 1831)  
Altitude of species distribution: 1400-2100m asl

**Diagnostic Characters:** 5.5mm in size, hemispherical, slightly longer than wide glabrous. Head yellowish with black eyes, Elytra yellow, lateral sides yellowish-brown, each elytron four and two half-black spots, scutellar spots, and apical spots consisting of sutural spots, anterior sutural one nearly the cordiform distance from scutellum about the width of scutellum.

**Global Distribution:** Thailand, China, Australia (Poorani 2002b<sup>[30]</sup>, 2004)<sup>[31]</sup>.

**Distribution in India:** West Bengal, Nepal, Myanmar, Bhutan, Uttarakhand (Miyatake 1985<sup>[27]</sup> Canepari 1997)<sup>[5]</sup>.

**Ecology and Habitat:** The adults were found feeding on mustard aphid, *Lipaphis erysimi* (Kaltenbach) and also other aphid species found on the herbal plant in the garden ecosystem during high temperature.

2. *Harmonia eucharis* (Mulsant, 1850)

Common name: Asian lady beetle

Altitude of species distribution: 1200-3100m asl.

**Diagnostic Characters:** Length of *H. eucharis* is 10.5mm and width is 7mm and is broad, oval & moderately convex. The body has reddish-brown elytra with black spots and black bars can be formed with the linkage of patches. Antennae are 11 segmented and a little shorter than the head of. The last- three antennal segments are thickened at the tip and form a club.

**Global Distribution:** China, Myanmar, Nepal, Bhutan, and Pakistan (Poorani 2004<sup>[31]</sup> and Wu *et al.* 2011)<sup>[38]</sup>

**Distribution in India:** Arunachal Pradesh, Jammu and Kashmir, Himachal Pradesh, Manipur, Sikkim, Uttarakhand, and Uttar Pradesh. (Shram *et al* 2017)

**Ecology and Habitat:** *Harmonia eucharis* is a predaceous ladybird feeding on various insects, especially aphids. It is bivoltine, active during spring, summer, and hibernating in autumn and winter. It is associated with aphids infesting apple, peach, plum, quince, apricot, almond, cherry, etc. This species found in a warm climate, when the temperature is not too hot.

3. *Oenopia sexareata* (Mulsant, 1853)

Altitude of species distribution: 300-1900m asl

**Diagnostic Characters:** The body size of this beetle measuring about 6.5mm in length and 5.5mm in width. The adult's body is oval moderately convex. The color of the beetle is yellowish red and black with six cells on the elytra. The cells divided into two as the upper half of with two cells and lower half just one on each elytron, which are diagnostic characteristics of the species.

**Global distribution:** Pakistan, Bhutan, China, Indonesia, Japan, Myanmar, Nepal, and Vietnam (Rahatullah *et al.* 2011<sup>[34]</sup>, Poorani 2004<sup>[31]</sup> and Wu *et al.* 2011)<sup>[38]</sup>

**Distribution in India:** Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Meghalaya, Sikkim, Uttar Pradesh, Uttarakhand, and West Bengal. (Sharama *et al* 2017 and Joshi *et al* 2012)<sup>[20]</sup>

**Ecology and Habitat:** Predatory on aphids and *Adelges* on forestry trees, *Cedrus deodara* and *Quercus leucotrichophora* food plant and silver fir. It is associated with aphids in orchards and with adelgids on silver fir and other coniferous vegetations of selected sites and is observed in May during a hot environment.

4. *Adalia bipunctata*, (Linnaeus, 1758)

Altitude of species distribution: 1420-2420 m asl

**Diagnostic Characters:** This ladybeetle is 4 to 5mm in length; 3-4mm width and ovoid. The head and thorax are black with yellow markings and the under sides are black to reddish-brown. A glandular swelling at the posterior portion of the body and the pygidium helps them to provide adhesion on smooth surfaces. Pronotum creamy in color and having a M-shape black medium design. Their elytra are red with one black spot on each side in the center of the fourth abdominal segment on these bases of this spot these species get to name two-spotted beetle.

**Distribution:** Distribution: Pakistan (Rafi *et al.* 2005; Khan *et al.* 2007). Chile, Argentina, New Zealand and Australia (Lipiski *et al.*, 2020) and in India (Sharma *et al* 2012)<sup>[35]</sup>.

**Ecology and Habitat:** *A. bipunctata* was found on aphids infested on leaves, stems, and flowers, in backyard gardens, crop field's meadows, and woodlands. High numbers of *A. bipunctata* were recorded in May feeding on aphids and psyllids.

5. *Hippodamia variegata* (Goeze, 1777)

Common name: Spotted amber ladybeetles/variegated ladybeetle

Altitude of species distribution: 1600-3400m asl

**Diagnostic Character:** *Hippodamia variegata* attains a size of 3.0 - 5.5mm in length and 3.0 -3.5 mm in width. The pronotum has two small white spots on the anterior portion of the pronotum and the body has a slightly semi-hemispherical shape. There are 12 black spots on the elytra of the adult and the color of the elytra is dull yellow or red.

**Global distribution:** Afghanistan, Europe, South Africa, Kenya, China, India, Canada, USA, Chile, and Australia, Pakistan. (Kovář 2007)

**Distribution in India:** Arunachal Pradesh, Himachal Pradesh, Jammu and Kashmir, Maharashtra, Uttar Pradesh, and Uttarakhand. (Poorani 2002b<sup>[30]</sup>, 2004)<sup>[31]</sup>

**Ecology and Habitat:** Can be found on leaves, stems, and flowers in backyard gardens, crop fields, meadows, and woody lands. It is widely distributed in cultivated crops, fodders, fruit trees, and wild vegetation. *H. variegata* feeds on weedy plants on sandy and open soils. These are mostly seen in the summer season in a hot environment.

6. *Coccinella septempunctata* (Linnaeus, 1758)

Common name: Seven-spot ladybird or C-7 ladybeetle

Altitude of species distribution: 1600-3400m asl

**Diagnostic Characters:** *Coccinella septempunctata* beetles are in the size of 6.0mm in length and 5.0mm in width with shiny red color. The body of this beetle is generally smoothed, oval, and moderately convex. Smooth elytra with seven spots including one sutural spot i.e. three and a half

spot on each elytron. The head is transverse in section black in color with a pair of yellow spots on the front portion near the eyes.

**Global Distribution:** Bangladesh, China, Japan, Sri Lanka (Poorni 2004, Poorani, 2002b<sup>[30]</sup>; Rahatulla *et al* 2011).

**Distribution in India:** Sikkim, Darjeeling, Meghalaya, Uttar Pradesh, Arunachal Pradesh, and Uttarakhand. (Mishra and Yousaf 2009; Joshi *et al* 2012)<sup>[20]</sup>

**Ecology and Habitat:** Mainly found in croplands, forests, fruit orchards, fruit trees, and wild vegetation in the Kandoliya region. Also found on leaves, stems, and flowers in backyard gardens, crop fields, meadows. *C. septempunctata* feeds on different species of aphids, psyllids, whiteflies in agroforestry fields of Paurigaon. The maximum population of this species was found in March followed by February.

7. *Coccinella transversalis* (Fabricius 1781)

Common name: Transverse ladybird

Altitude of species distribution: 200-1900m asl.

**Diagnostic Characters:** *Coccinella transversalis* was found an average range of 3.8 to 6.7mm long and 3.3 to 5.4mm wide, elongate oval, convex in shape. The Head is black in color and a pair of subtriangular spots with yellow color on the inner margin of the eye. Pronotum black, anterolateral corners light cream in color, Scutellum black, Elytra bright carmine red or orange or yellow, with an oval substellar spot, a large trilobed spot on humeral callus, and a transverse band.

**Global Distribution:** Cosmopolitan, has a worldwide distribution (Poorani 2004)<sup>[31]</sup>

**Distribution in Indian:** Uttarakhand, Sikkim, Meghalaya, Tripura, Manipur, West Bengal, Andhra Pradesh, Kerala, Goa, and the Andaman Islands. ((Poorani 2002b<sup>[30]</sup>, 2004)<sup>[31]</sup>

**Ecology and Habitat:** *Coccinella transversalis* is polyphagous ladybeetle and normally found on small herbaceous plants, shrubs, and trees in open fields, grasslands, marshes, agricultural fields, suburban gardens, and parks. Its three individuals were noticed preying voraciously on aphids of different host plants. The maximum population of this species was found in April.

8. *Harmonia axyridis* (Pallas, 1773)

Common Name: Harlequin ladybird

Altitude of species distribution: <1700m asl

**Diagnostic Characters:** *H. axyridis* is oval-shaped and convex, was found in red and orange color with many black spots. Species having a 'smooth' transition between their elytra, pronotum, and head. The pronotum is white with four black spots that tend to form an 'M' shape. These species have very distinct, square "shoulders". Adults are 6mm long and 5mm wide.

**Global distribution:** Eastern Asia, Siberia, Russia, Kazakhstan, Japan, Korea, China, Taiwan, Canada, Argentina, Brazil, UK, Denmark, Norway, etc. (Brown *et al* 2011)<sup>[4]</sup>.

**Distribution in India:** Uttar Pradesh, Maharashtra, Himachal Pradesh, Arunachal Pradesh, Karnataka, Uttarakhand. (Poorani 2002b<sup>[30]</sup>, 2004)<sup>[31]</sup>

**Ecology and Habitat:** *H. axyridis* found in cropping areas and semi-natural areas of Kandoliya. The maximum population was observed on the pine trees (*Pinus* sp.). They are found on a variety of ornaments, and field crops including rose, apple, wheat, cotton, tobacco, and small grains. It is a predatory insectivore with chewing mandibles. The species were easily identified by the black mark look like a letter M or W at the pronotum. The maximum densities of this species were found in May and only 2 species of different color morphs were recorded during the study period.

9. *Myzia oblongoguttata* (Linnaeus, 1758)

Common name: Striped ladybird

Altitude of species distribution: <1700masl

**Diagnostic Characters:** *M. oblongoguttata* is brown or chestnut-colored with spots on each side, two white, two prominent white parallel scutellary spot near scutellum, head is deeply demarked from the elytron and contain white patch on pronotum. The adult has 7mm in length with 4.5 mm broad. Strongly convex, oval-shaped, yellowish-brown, and slightly narrower than pronotum. Antenna and mouthparts reddish brown. Antennae distinctly longer than the head.

**Distribution:** Data deficient (As of right now, the study is going on for more validation of species)

**Ecology and Habitat:** *M. oblongoguttata* were found on the *Pinus* species from site A (Kandoliya Road). They occur in coniferous and mixed forests and grasslands. Adults are also found on *Pinus sylvestris*, *Picea abies*, and *Betula pendula*, most frequently when they are producing pollen. They feed on aphids, especially species of the genus *Cinara*. Striped ladybird overwinters under loose bark and in-ground litter.

10. *Anatis ocellata* (Linnaeus, 1758)

Common name: The Eyed ladybug

Altitude of species distribution: 200-1100masl

**Diagnostic Characters:** The Eyed beetle is the largest native ladybird species with a length of 9mm. The adult-eyed ladybird has brownish-red elytra with usually 15- 18 black spots. Each spot is surrounded by a yellowish halo. The pronotum is black with a thick white U-shaped mark and two small white spots.

**Global distribution:** Europe, Russia, Central Asia, Mongolia, Korean peninsula (Kesten 1969)<sup>[21]</sup>.

**Distribution in India:** Maharashtra, Jammu, and Kashmir, Uttarakhand, Uttar Pradesh (Poorani 2023)<sup>[32]</sup>

**Ecology and Habitat:** The primary habitat is temperate coniferous forest. Also found on the mixed forests and pines species. They feed on aphids on coniferous trees. The eyed ladybird is very sensitive to the odor of pine needles and feeds on aphids on pine trees, but also spruces, birches, and aspens. The maximum populations of this species were recorded in June.

11. *Propylea quatuordecimpunctata* (Linnaeus, 1758)

Common name: 14-spotted ladybird or P-14

Altitude of species distribution: 300-1800masl

Diagnostic Characters: *P. quatuordecimpunctata* are 4mm in length and 2.5 in width. They have a creamish-yellow background there are 14 black rectangular spots on the elytra. Several of the spots are fused into larger markings. The pronotum is pale yellow, with 6 black spots. The antennae and legs are yellowish browns.

**Global distribution:** Europe, North Africa, Cyprus, European Russia, Siberia, Ukraine, Kazakhstan, Pakistan, and Japan (Hayat *et al.* 2017)

Distribution in India: Coldest part of the northwest Indian subcontinent Jammu and Kashmir and Uttarakhand (Ren *et al.* (2009) and Yu 2010)

Ecology and Habitat: *P. quatuordecimpunctata* was found in mixed forests and meadows as well as on fields, gardens, on grasses, in bushes, and in trees. The species can be found in forest litter, on brushwood, in moss, in rotten plant residues, and also in compost. Propyleaquatuordecimpunctata is entomophagous (insect-eating).

12. *Acalymma vittatum* (Fabricius, 1775)

Common name: Striped cucumber beetle

Altitude of species distribution: <1700masl

**Diagnostic Characters:** Striped cucumber beetles are 7mm long and 1.3mm wide have black undersides, with 2 yellow and 3 black stripes on top, thorax, and a blackhead. The brown-yellow elytra completely cover the abdomen and longitudinally transverse by 3 thick black stripes.

**Distribution:** Texas, Canada, New Mexico and arizona (Munroe and smith 1980) <sup>[29, 37]</sup>. (As of right now, the study is going on for more validation of species)

**Ecology and Habitat:** *Acalymma vittatum* found in gardens, fields crops, especially on the Cucumis species. They found also on a pumpkin, *cucurbit*, gourd, musk melons, and watermelons.

13. *Leptinotarsa decemlineata* (Say, 1824)

Common name: Ten- lined potato beetle

Altitude of species distribution:<1700masl

Diagnostic character: Adult beetles are 9mm in length and 3mm in width. The beetles are orange-yellow with 10 characteristic black stripes on the elytra. Round to oval-shaped convex bodies simple claws which separate at the base, open cavities behind the procoxae, and a variable apical segment of the maxillary palp. Elytra punctuation is coarse is irregular rows. The underside of the beetle and the legs are mostly dark.

**Distribution:** Global distribution and invade more than 40 countries (Goa *et al* 2022)

**Ecology and Habitat:** *L. decemlineata* were found from the plants of the family Solanaceae, especially *Solanumtuberosum* (potato). It is directly associated with *Solanumcoruntum*, *S. nigrum* (black nightshade), *S. melongena* (eggplant). They are also found on other plants namely tomato and pepper. Colorado potato beetle is a serious pest of potatoes and other solanaceous plants. These beetles were found from the potato plant. Adults dig into the soil to a depth of several inches and emerge in the spring depending on the climate and their physiological condition.

14. *Halyzia sedecimguttata* (Linnaeus, 1758)

Common name: Orange lady beetle

Altitude of species distribution: 200-1400masl

**Diagnostic Character:** Orange ladybird is 5.5mm in length and 4.8mm in width. The body is rounded in shape. Eyes are black and compound. 16-creamy white large spots present on the orange elytra (8spots on each elytron). The neck shield usually covers the head and shows orange-colored spots. Edges of the elytra are slightly transparent. Antennae are long, light-brown, and slightly thickened at the end.

**Distribution:** Jammu and Kashmir, Madhya Pradesh, Meghalaya, Andra Pradesh, Uttarakhand, Uttar Pradesh (Poorani, 2023) <sup>[32]</sup>

**Ecology and Habitat:** *Halyzia sedecimguttata* commonly found at Kandoliya forest edges. Orange lady beetle also found in woodlands, more frequent in dry areas, in mixed forests, and in parkland. Ecologically they are found in the wild rose (*Rosa rugosa*) aphid host plant. They are commonly active on the available food source like aphids.

15. *Calvia quatuordecimguttata* (Linnaeus, 1758)

Common name: Cream-spot ladybird

Altitude of species distribution: 1500-3200masl

**Diagnostic character:** *C. quatuordecimguttata* is oval and weakly convex. Beetles are 4.5mm long and 3.2mm broad. The species had maroon- brown elytra and 14 cream-colored spots. It has glossy pronotum and the underside of the beetle has a thin red rim and black abdominal segments. *C. quatuordecimguttata* has 2 spurs on the apex of the middle and hind tibia.

**Global distribution:** North America. Europe, North Africa, Cyprus, European Russia, Siberia, Ukraine, Moldova, Kazakhstan, Western Asia, Pakistan, China, and Japan (Kits, 2011) <sup>[22]</sup>.

Distribution in India: Meghalaya, Karnataka, Andra Pradesh, Uttarakhand (Kovář 2007)

**Ecology and Habitat:** *C. quatuordecimguttata* was found in forests of deciduous trees and on shrubs. This species also found on the flowering plants that are present in grassland. Also found on agricultural land, living on crops. Also occur in parks, gardens, and meadows on grasses, bushes, and trees. It is entomophagous feeding on aphids, coccids, larvae, and eggs of some beetle and butterflies.

16. *Anisostica novemdecipunctata* (Linnaeus, 1758)

Common name: 19-spot lady beetle

Altitude of species distribution: 200-2400masl

**Diagnostic characters:** *A. novemdecipunctata* is 4mm in length with an elongated body that is weakly curved. They have yellowish-orange to reddish-pink elytra that display 19 black spots. On the yellow scutum are 6 black patches that can be connected through ridges. Legs are yellow, feet, and claws are slightly darker.

**Distribution:** data deficient (As of right now, the study is going on for more validation of species)

**Ecology and Habitat:** *Anisostica novemdecipunctata* were found in wetlands- fen, grassy marshes, forested swamps of the selected site A. They were found on marsh plants,

sweetgrass (*Glycerio* species), and also on willows (*Saliz* species), where they feed on aphids. They prefer the hot climate. *A. novemdecipunctata* has toothless claws, it is polyphagous species, feeding on various insects (especially aphids), as well as economic plants. The maximum densities of this species were found in June.

17. *Altica himalayensis* (Chen, 1936)

**Common Name:** Metallic blue flea beetle  
 Altitude of species distribution: 300-1900masl

**Diagnosis Character:** Metallic blue flea beetles have hard outer wings called ‘elytra’ that are metallic blue that protects similarly colored metallic bodies that reflect purple and bronze colors, and elongate oval in shape. 4.8mm in length and have round eyes and have 11 segments in antennae which are filiform (threadlike) in shape.

**Global Distribution:** Species is worldwide (Jolivet, 1991<sup>[19]</sup>; Clark *et al.*, 2004)<sup>[8,9]</sup>.

**Distribution in India:** Meghalaya, Uttarakhand, Assam, Himalaya, Kashmir, Shimla (H.P.), Sikkim, Uttar Pradesh, and West Bengal (Mahendiran *et al* 2019)<sup>[25]</sup>

**Ecology and Habitat:** Mostly found on the horticultural crops, including apple, peach, cherry, apricot, almond, strawberry in addition to the number of other host plants (Onagraceae). Adult flea beetle, feed-in aggregate on the leaves of indigenous plants in the Onagraceae, and important non-indigenous ornamental plants in the Lythraceae. Adult flea beetles are herbivorous pests, fed

externally on plants, eating the surface of the leaves, stems, and petals.

**Conclusion**

In the present study, an attempt was made to describe the terrestrial beetle fauna from Pauri City, Garhwal, Uttarakhand, India, which will provide useful information for future research pertaining to the coleoptera of Uttarakhand. As a result of the short study, 17 species of Coleoptera beetles were described, of which 14 are from the Coccinellidae family and 3 are from the Chrysomelidae family, respectively. On the basis of present study, it has been concluded that the region has a large variety of terrestrial insects, and therefore a detailed study of their diversity, abundance, and availability is needed for the region.

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**Conflict of interest**

The authors have no conflicts of interest.

**Author Contributions**

RS gathered information and wrote the whole manuscript. KK created the article's figures and tables in addition to critically editing and revising the prose. The final manuscript was read and approved by all writers.





**Plate 1:** List of beetles collected during this study from Pauri City

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