The Bioscan 15(4): 423-428, 2020
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

LADY BEETLES OF NEPAL (*Coleoptera: Coccinellidae*) FROM THE FIELDS AT NEPAL AGRICULTURAL RESEARCH COUNCIL, KHUMALTAR, LALITPUR

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KEYWORDS
Ladybird beetles
Phytophagous
Entomophagous
Diversity

Received on :
20.05.2020

Accepted on :
30.07.2020

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ABSTRACT
The diversity of lady beetle fauna of Nepal Agricultural Research Council (NARC), Khumaltar, Lalitpur is studied in this paper. All the findings are included except those of the subfamily Coccinellinae which have been included in a separate paper previously. However, Epilachninae (now Epilachnini) is also included here. In this research, except for Coccinellinae, 7 species from 5 subfamilies (Chilocorinae, Epilachninae, Sticholotidinae, Scymninae and Coccidulinae), 5 tribes (Chilocorini, Epilachnini, Sticholotidini, Scymnini and Noviini) and 6 genera (*Chilocorus, Henospilachna, Jauravia, Pharoscymnus, Novius* and *Scymnus*) were collected and identified. The identified species were *Chilocorus nigritus* (Fabricius, 1798), *Henosepilachna kathmanduensis* Miyatake, 1985, *Henosepilachna vigintioctopunctata* (Fabricius, 1775), *Jauravia quadrinotata* Kapur, 1946, *Pharoscymnus flexibilis* (Mulsant, 1853), *Novius cf. pumilus* (Weise, 1892) and *Scymnus (Pullus) posticalis* Sicard, 1913.

INTRODUCTION

Coccinellidae is the largest family under the superfamily Coccinelloidea. They are commonly known as ladybugs, ladybirds, lady beetles or ladybird beetles. Their habitat range includes those as diverse as cities, fields, gardens, sea coasts and mountains (Majerus and Kearns, 1989; Hodek and Honek, 1996). It has about 6000 species under 360 genera worldwide (Escalona *et al*., 2017). Many Coccinellids are predators and major biological control agents of hemipteran pests such as aphids, mealy bugs and scale insects, as well as thrips and mites (Moreton, 1969; Hawkeswood, 1987; Majerus, 1994). Some Coccinellids also prey upon early instars of Lepidoptera and Coleoptera (Hodek, 1964) while some feed on fungi (Bagal and Trehan, 1945). Usually, the brightly colored species are aphidophagous, while the darker colored and smaller species feed on insects such as scale insects, mealy bugs, whiteflies or spider mites (Ipetri, 1999). The color and its pattern differ greatly often even within the same species with local adaptation, in which the frequency of melanic forms varies greatly between populations (Michie *et al*., 2010). Prey location by lady beetle adults is dependent on a number of factors, such as honeydew produced by aphids acting as an arrestant stimulus (Carter and Dixon, 1984), or micro-climate and their searching ability affected by plant density (Honek, 1982). Recently, Epilachninae (which are normally herbivores and sometimes major agricultural pests) have been merged under Coccinellinae as Epilachnini by Slipinski and Tomaszewska (2010) and Seago *et al*. (2011) based on morphology (Slipinski, 2007) and initial molecular analyses by Giorgi *et al*. (2009). However, in this study, the older classification is followed and the species of Epilachninae (now Epilachnini) are not included under Coccinellinae in the previous paper (K.C. *et al*., 2019) and hence included in this paper.

Nepal Agricultural Research Council, Khumaltar, Lalitpur stretches at an altitude of about 1320masl. The vegetation is of deciduous type. Common fruits found are citrus, mulberry, guava, papaya, pear, peach *etc*. Cruciferous vegetables like cabbage, radish, cauliflower, broccoli, mustard, rapeseed *etc*., cucurbits like cucumber, pumpkin, bitter gourd, bottle gourd, ash gourd *etc*. and other vegetables like peas, beans, potatoes *etc*. are found to be grown. Similarly, grasses like rye, oats, white clover, cocksfoot and cereal crops like rice, maize, wheat, barley are grown. The climate is hot and wet during monsoon while cold and dry during winter. The area of NARC, Khumaltar, Lalitpur stretches up to 47.2 hectors including 22.40 hectors of National Animal Science Research Institute.

In Nepal overall, Hope (1831) took the first effort to record the Coccinellidae in which he described 19 new species. Subsequently, Mulsant (1850) added three and Crotch (1874) added one species later to the list of Hope. Dohrn (1882) later described one more species from Nepal. Kapur (1955) reported 26 species from Nepal among which 5 were new to science and 15 were new to Nepal. Kapur (1963) also enlisted 51 species from Darjeeling, Sikkim and Tibet. Similarly,

Miyatake (1985) listed 46 spp. from Nepal Himalayan expedition in 1968. Canepari and Milanese (1997) listed 114 species along with 26 new species from Himalaya of Nepal. Poorani (2002; 2004; 2012) listed several species from Nepal in her annotated checklist. Likewise, Joshi and Manadhar (2001) listed 31 species from Nepal while Thapa (2000) also listed 31 species although the records like *Propylea japonica* (Thunberg, 1781) and *Coccinella 10-punctata* now *Adalia decempunctata* (Linnaeus, 1758) seem doubtful.

In the previous paper of the NARC Coccinellidae series (K.C. *et al*., 2019), 14 species of Coccinellinae from 9 genera were found. This paper includes Coccinellidae from the fields at NARC, Khumaltar, Lalitpur, apart from those mentioned in the previous paper.

MATERIALS AND METHODS

The surveys were carried out during June 2018- January 2019, in the pasturelands of National Animal Science Research Institute and crop fields at Nepal Agricultural Research Council (Khumaltar, Lalitpur, 27º65'N, 85º32'E, 1320 masl). The sightings were recorded capturing photos in Sony Cyber-Shot DSC-HX90V 18.2MP camera. The GPS details of the location and date were recorded on the photos themselves. The specimens were collected by using sweep nets and hand collection method. They were then placed in Borosilicate glass veils (6.3 x 2.3 cm dia) with cotton plugs soaked in ethyl acetate for killing purpose. The collected specimens were taken to the Insect Museum Laboratory of Entomology Division (NARC, Khumaltar, Lalitpur). Larvae collected were reared till adults emerged. The adults were dissected under Olympus stereo-microscope Model SZ2-ILST. The stereo-microscope was connected to Dell Inspiron 3537 laptop installed with ScopeImage 9.0 (H1C) software and connected with COSLAB MODEL: MDCE-5C Digital USB Microscope Camera to capture images under the view. After dissection, their genitalia were preserved in the microscope slides using Fevicol® glue that became transparent when dried. Detached head, abdomen and rest of the body were also pasted to the slide. The slides were preserved in a slide box with labels on them for future reference. Other adults were mounted on cards using adhesive- Fevicol®, and pinned and labeled with data on locality, collection date and identification. They were then preserved in a sealed box containing naphthalene balls. Thus, the main basis for identification was the observation of male genitalia.

RESULTS AND DISCUSSION

A total of 7 species of Coccinellidae belonging to 6 genera from 5 tribes and 5 subfamilies were recorded.

***Chilocorus nigritus* (Fabricius, 1798)**

Coccinella nigrita Fabricius, 1798, *Chilocorus nigritus* Mulsant, 1850, *Chilocorus nigrita* Bielawski, 1957

Material(s) examined: Khumaltar, Lalitpur, 04.x.2018(male).

Description: Size 3.7mm in length and 3.1mm in width. Head brownish. Pronotum, scutellum and elytra bright black. Proximal angles of pronotum have testaceous patch. Glabrous body almost circular with dorsum strongly convex and dome shape. Venter all brownish. Elytral epipleuron black. Pronotal epipleuron brownish.

Distribution: India, Pakistan, Sri Lanka, Bangladesh, Myanmar, China, Indonesia, Thailand, South Africa, Seychelles, Pacific, Brazil (Poorani, 2012), Nepal (Joshi and Manandhar, 2001).

Found on: A single male specimen was found on mulberry tree.

***Henosepilachna kathmanduensis* Miyatake, 1985**

Material(s) examined: Khumaltar, Lalitpur, 13.viii.2018 B&; Khumaltar, Lalitpur, 10.x.2018 (female).

Description

Size from 5-6.1mm length and 3-4.5mm width. Males smaller than females. Oval dome shaped brownish pubescent body. Head brownish. 5 black spots on pronotum, 1 arrow shaped in the middle and 2 on each side at posterior parts. 6 bold black spots on each elytron in 1-1-2-1-1 fashion. 1 on humerus, 1 near basal half of suture, 2 at the median transverse line, 1 near apical half of suture and 1 near the apex of elytron. Venter brown with metasternum and median of abdominal sternites more fuscous. A small central portion of elytral epipleuron near hind femur black.

Distribution: Nepal (Poorani, 2012).

Found on: It was found feeding on small weeds.

***Henosepilachna vigintioctopunctata* (Fabricius, 1775)**

Coccinella 28-punctata Fabricius, 1775, *Coccinella chrysomelina* Fabricius, 1775, *Coccinella sparsa* Herbst, 1786, *Henosepilachna vigintioctopunctata* Jadwiszczak and Wegrzynowicz, 2003

Material(s) examined: Khumaltar, Lalitpur, 2018.x.01(male) Khumaltar, Lalitpur, 2018.x.08(female)

Description: Size from 5.8-6.4mm length and 3.9-5mm width. Convex hemispherical pubescent brownish body. 3-4-1-3-2-1 fashion black spots on pubescent elytra. 7 spots on pronotum in 2-5 fashion, 2 in front and 5 at back. The anterior 2 are larger. Brown head and black eyes. Brown elytral epipleuron with some large oval black patches along. Legs brown. Sternum brown but metasternum fuscous with center brown. Edges and medians of abdominal sternites rather fuscous.

The number of spots may vary considerably from 6-14 spots on each elytron and this variation can be found in specimens from even the same or different locality. The number of spots on pronotum can vary as well (Dieke, 1947).

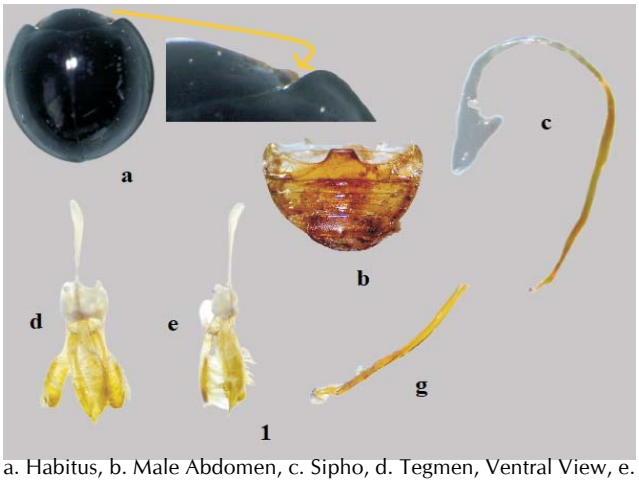
Distribution: India, Sri Lanka, Pakistan, Nepal, Bhutan, Burma, Thailand, Vietnam, Philippines, Indonesia, Japan, China, New Guinea, Fiji, Solomon Islands, Australia (Poorani, 2012).

Found on: They were found feeding on various vegetables and weeds.

***Jauravia quadrinotata* Kapur, 1946**

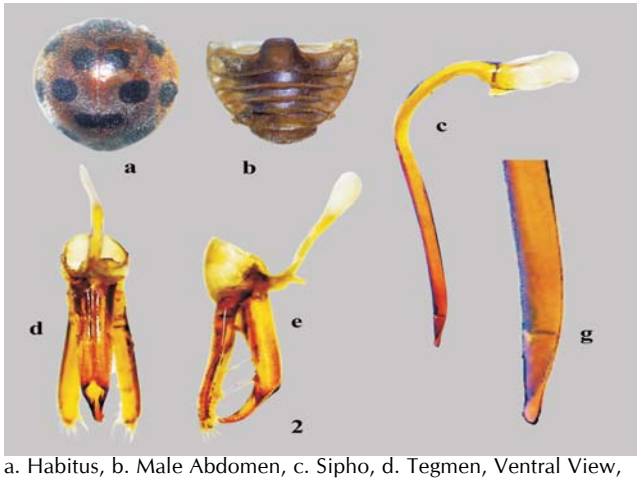
Material(s) examined: Khumaltar, Lalitpur, 2018.x.05(male) Khumaltar, Lalitpur, 2018.x.05(female).

Description: Size about 2.4mm in length and 1.9mm in breadth. Small circular convex pubescent brownish body. Elytron has 2 large subrounded black spots, 1 on base and 1 on subapical part. Eyes black. Metasternum and first abdominal sternite rather fuscous. Outer lateral part of tibia and inner



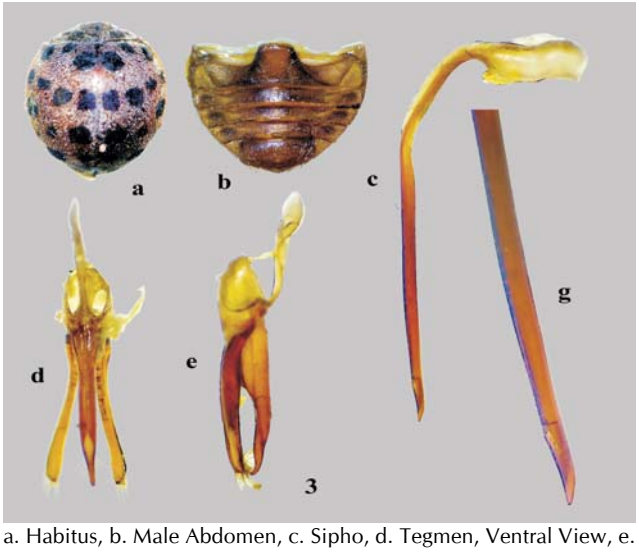
a. Habitus, b. Male Abdomen, c. Sipho, d. Tegmen, Ventral View, e. Tegmen, Lateral View, g. Sipho Apex

Figure 1: *Chilocorus nigritus* (Fabricius, 1798)



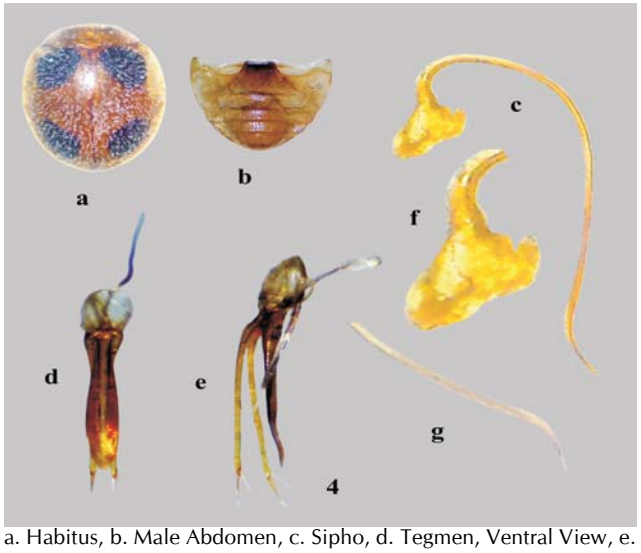
a. Habitus, b. Male Abdomen, c. Sipho, d. Tegmen, Ventral View, e. Tegmen, Lateral View, g. Sipho Apex

Figure 2: *Henosepilachna kathmanduensis* Miyatake, 1985



a. Habitus, b. Male Abdomen, c. Sipho, d. Tegmen, Ventral View, e. Tegmen, Lateral View, g. Sipho Apex

Figure 3: *Henosepilachna vigintioctopunctata* (Fabricius, 1775)



a. Habitus, b. Male Abdomen, c. Sipho, d. Tegmen, Ventral View, e. Tegmen, Lateral View, f. Sipho Capsule, g. Sipho Apex

Figure 4: *Jauravia quadrinotata* Kapur, 1946

lateral part of tarsi (especially first) with rows of hair.

Distribution: India, Bhutan, Nepal (Poorani, 2012); Taiwan, China (Yunnan) (Kovar, 2007).

Found on: They were found on the plants of *Duranta erecta*.

***Pharoscymnus flexibilis* (Mulsant, 1853)**

Scymnus (Diomus) flexibilis Mulsant, 1853, *Scymnus flexibilis* Crotch, 1874, *Pharus flexibilis* Weise, 1900, *Pharoscymnus flexibilis* Korschefsky, 1931.

Material(s) examined: Khumaltar, Lalitpur, 2018.ix.25 (male) Khumaltar, Lalitpur, 2018.x.10(female) .

Description: A small brownish convex bodied beetle about 1.6-1.8mm in length and 1-1.2mm in width. Elytra have setae. One blackish spot on basal part of elytron disc followed by a similar spot on the suture. A prominent black spot in transverse median line on the disc of elytron and one blackish spot in subapical part of elytron, *i.e.* 7 spots on the full elytra. Venter brownish with sternum and first abdominal sternite fuscous.

Distribution: India, Pakistan (Poorani, 2012); Afghanistan, Iran (Kovar, 2007), Nepal (NBAIR).

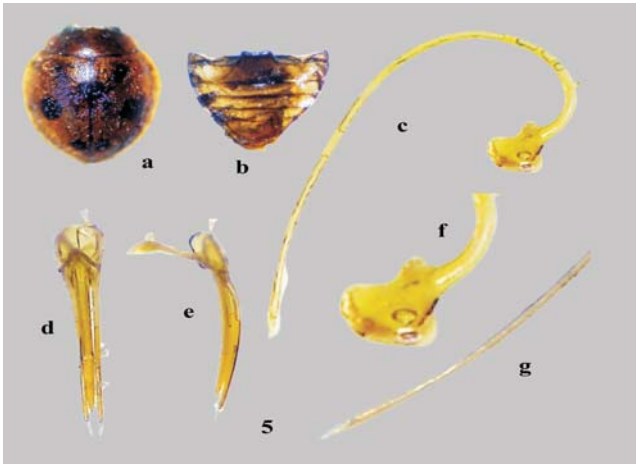
Found on: It was abundantly found on Prunus plants and some on Pumelo.

***Novius cf. pumilus* (Weise, 1892)**

Rodolia okinawensis Miyatake, 1959, *Rodolia pumila* Weise, 1892.

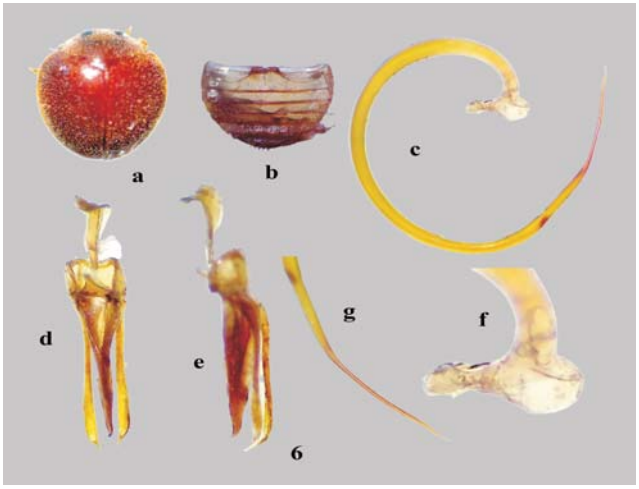
Material(s) examined: Khumaltar, Lalitpur, 2018.x.04(male) Khumaltar, Lalitpur, 2018.x.08(female) .

Description: About 3-4mm in length and 2.1-2.8mm in width. Oblong convex pubescent orange colored body. Head orange. Clypeus pubescent. Eyes posterior pubescent. Posterior margin of head black. Pronotum sparsely pubescent. Scutellum glabrous. Margins and posterior parts of elytra more pubescent and central parts have very sparse hair. Very small punctations. Sternums deep brown and the color extends to the bases of



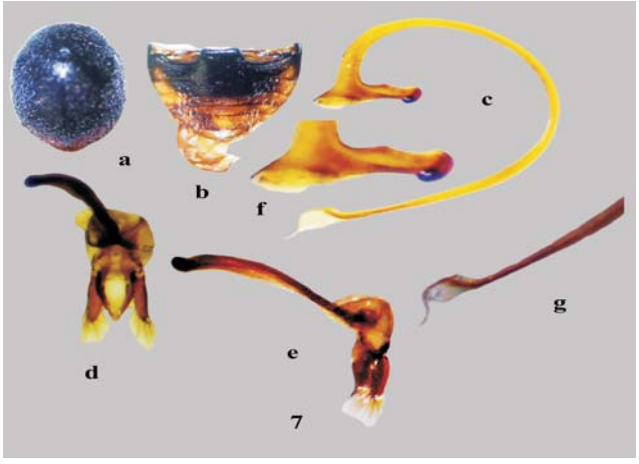
a. Habitus, b. Male Abdomen, c. Sipho, d. Tegmen, Ventral View, e. Tegmen, Lateral View, f. Sipho Capsule, g. Sipho Apex

Figure 5: *Pharoscymnus flexibilis* (Mulsant, 1853)



a. Habitus, b. Male Abdomen, c. Sipho, d. Tegmen, Ventral View, e. Tegmen, Lateral View, f. Sipho Capsule, g. Sipho Apex

Figure 6: *Novius cf. pumilus* (Weise, 1892)



a. Habitus, b. Male Abdomen, c. Sipho, d. Tegmen, Ventral View, e. Tegmen, Lateral View, f. Sipho Capsule, g. Sipho Apex

Figure 7: *Scymnus (Pullus) posticalis* Sicard, 1913

mid and hind femurs. Forelegs as well as other appendices are orange. Claws slightly browner though. No tibial spurs.

Distribution: Japan, China (Yunnan, Guizhou, Fujian, Guangxi, Guangdong, Hainan), Hong Kong, Taiwan, India, Vietnam, Micronesia (Pang *et al*., 2020).

Found on: It was found on Pumelo trees.

**Novius* of Asia needs a proper revision. This species differs from *N. pumilus* described by Forrester, 2008 mostly in a sense that the tip of basal lobe of tegmen doesn't have a notch. However, according to Dr. Janakiraman Poorani (personal communication, Oct 15, 2018, 11:17 AM) this is *Novius (=Rodolia) pumilus* in which the variations in genitalia are minor and are probably intraspecific. Assuming this is *Novius pumilus*, this would be a species new to Nepal.

***Scymnus (Pullus) posticalis* Sicard, 1913**

Scymnus (Pullus) posticalis Korschefsky, 1931, *Scymnus hilaris* Weise, 1879, *Pullus hilaris* Ohta, 1929, *Pullus hilaris ab. awanus* Ohta, 1929, *Scymnus (Pullus) hilaris* Sasaji, 1971, *Scymnus (Scymnus) ishidai* Araki, 1963, *Scymnus (Nephus) inops* Smirnoff, 1973

Material(s) examined: Khumaltar, Lalitpur, 2018.ix.27 Khumaltar, Lalitpur, 2018.x.11

Description: About 2.1-2.4mm in length and 1.1-1.6mm in width. Short convex pubescent body more oblong than round. Head orange. Margins of pronotum orange. Eyes black. Apices of elytra testaceous. Pronotal epipleuron testaceous. Elytral epipleuron black. Sternum black. Legs testaceous. Medians of 4th and 5th abdominal sternites fuscous and the rest is testaceous.

Distribution: India, Nepal, Japan, Myanmar (Poorani, 2012); Bhutan, China (Fujian, Gguandong, Guizhou, Guangxi, Henan, Hubei, Sichuan, Shaanxi, Yunnan), South Korea, Taiwan (Kovar, 2007)

Found on: It was found on *Justicia gendarussa* plants.

ACKNOWLEDGEMENTS

This study was supported by Nepal Agricultural Research Council (NARC, Khumaltar, Lalitpur), Entomology division. The authors express gratitude to Dr. Prem Nidhi Sharma and Dr. Ram Babu Paneru from NARC, for their relentless help and support. They would also like to thank Dr. Janakiraman Poorani (India) and Guillermo González (Chile) for providing the necessary papers and helping in some identifications.

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