

Research Article

Taxonomic redescription of subfamily Scymninae (Coleoptera: Coccinellidae) from Haryana, India

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How to CiteSingh, V. et. al. (2024). Taxonomic redescription of sub family Scymninae (Coleoptera: Coccinellidae) from Haryana, India. *Journal of Applied and Natural Science*, 16(2), 842 - 853. <https://doi.org/10.31018/jans.v16i2.5461>**Abstract**

The ladybird beetles of Scymninae, a subfamily of Coccinellidae are efficient biocontrol agents. Many earlier studies document their protective role associated with many crops. This subfamily is represented by 5 tribes, 15 genera and 138 species in the Indian subcontinent. However there is no scientific record of taxonomic description of the subfamily Scymninae within the Coccinellidae family of beetles (Coccinellidae: Coleoptera) in Haryana, India. In the present study, seven species from three genera and two tribes of sub-family Scymninae i.e. *Nephus* (Bipunctatus) *bipunctatus* (Kugelann, 1794), *Nephus regularis* (Sicard), *Scymnus* (Pullus) *coccivora* Ramakrishna Ayyar, 1925, *Scymnus* (Pullus) *latemaculatus* Motschulsky, *Scymnus* (Scymnus) *nubilus* Mulsant, *Scymnus* (Pullus) *posticalis* Sicard and *Stethorus aptus* Kapur were identified. It included the generation of keys to the tribes, genera, subgenera and species found during the study. It provided detailed taxonomy of the identified species based on various morphological characteristics such as coxal lines, antennae, mandibles, and male and female genitalia. This study marks the first taxonomic exploration of species within the Scymninae subfamily in Haryana, India. It will significantly contribute to understanding the biodiversity of beetles in the region and will lay the groundwork for further research and conservation initiatives.

Keywords: Beetles, Coleoptera, Diversity, Scymninae, Taxonomic resistance genes, *Proteus mirabilis*, Plasmids, Virulence genes

INTRODUCTION

Coleoptera, commonly known as beetles, constitute the largest order of class Insecta with nearly 390,000 species worldwide grouped in 176 families (Zhang, 2013; Stork, 2018; Reddy et al., 2023; Teja et al., 2023). Among these families, Coccinellidae comprises approximately 6,000 species distributed across two subfamilies, 30 tribes 360 genera (Slipinski 2007, Ślipiński and Tomaszewska, 2010), inhabiting various habitats including cities, gardens, grasslands, mountains and sea coasts (Hawkeswood, 1987; Majerus and Kearns, 1989; Khan et al., 2007). In India, Coccinellids diversity is reported to have 550 species in 90 genera and 16 tribes (Poorani, 2019; Slipinski, 2007). Owing to their crucial role in the biological control and pollinators in

agriculture, the faunal diversity of Coccinellidae holds significant economic and ecological importance (Vasista et al., 2020).

Coccinellids, commonly called ladybirds are the most familiar group of insects characterized by their vibrant colour pattern. Ladybirds are small-sized insects, typically ranging from 1 to 10 mm in size, with round to oval shapes, colourful elytra, short legs and antennae. They are renowned for their efficacy in biological control, although their predatory potential varies across different prey and ecosystems. Diversity of Coccinellidae is categorized into 6 subfamilies including, Epilachninae, Chilocorinae, Coccinellinae, Coccidulinae, Sticholotidinae and Scymninae, with members exhibiting phytophagous and predaceous feeding habits (Sasaji, 1968). According to modern system of clas-

sification given by Slipinski (2007), this family is divided into two subfamilies i.e. Microweiseinae and Coccinellinae because many taxa defined by Sasaji (1968) were non-monophyletic assemblages. However the classification given by Sasaji, 1968 is followed in the present studies.

In the Indian subcontinent, the subfamily Scymninae is represented by five tribes, i.e. Aspidimerini, Hyperaspidini, Oratilini, Scymnini and Stethorini, comprising 15 genera and 138 species (Poorani, 2004). Members of the subfamily Scymninae are predominantly aphidophagous, coccidophagous and arachnophagous, making them valuable biological control agents (Giorgi, 2009). These insects typically possess small to medium-sized bodies, with compactly articulated pronotums and elytra. Their antennae are usually short, about two-thirds as long as the head width, and are situated ventrally. The clypeus is not strongly expanded laterally, and the maxillary palpi are not strongly securiform. Additionally, the elytral epipleura is narrow and short (Sasaji, 1971). Poorani (2015) described and illustrated two new species, i.e. *Horniolus sororius* and *Scymnus* (Pullus) *rajeshwariae*, from Karnataka, with notes on their biology and related species. Vidya and Bhasker (2017) had undertaken an extensive survey of the diversity of Scymnini fauna feeding of sucking pests and during that study, 14 species associated with 19 species of sucking pests were identified with male genitalia study. *Scymnus* (Pullus) *utilis* is added to Indian fauna along with 13 species from other subfamilies encountered during study of specimens sent for identification and confirmation (Poorani and Rojeet, 2019). *Scymnus latemaculatus* and *Pseudaspidimerus trinotatus* were

form family Scymninae among 14 species recorded from Nasik district (Maharashtra), India (Yasmeen and Dugaje, 2020)

Despite their ecological importance, the taxonomic identification of Scymninae species is often challenging due to their small size. Previous studies on Scymninae from Haryana have primarily focused on their biological control role (Kedar *et al.*, 2011). Coleoptera fauna of Haryana state, 2020 included 19 species of Coccinellids among them only two i.e. *Scymnus* (*Scymnus*) *nubilus* and *Scymnus* (Pullus) *coccivora* Ayyar represents subfamily Scymninae (Ghosh *et al.*, 2020). Therefore, there is a critical need for taxonomic studies to elucidate the morphological characteristics of these fascinating and ecologically significant insects. The present study aimed to describe the taxonomic characters of seven Scymninae species from Haryana, based on male genitalia, antennae, and coxal lines.

MATERIALS AND METHODS

Study area

Specimens of the subfamily Scymninae were collected from various locations across Haryana, including agricultural fields and sacred groove areas. The collection sites were exclusively within Haryana and were located between approximately 27°37' to 30°35' North latitude and 74°28' to 77°36' East longitude. Altitude of collection sites ranged between 200 meters above sea level to 1200 meters above sea level. This altitudinal range can significantly influence the habitats and ecosystems within the state.

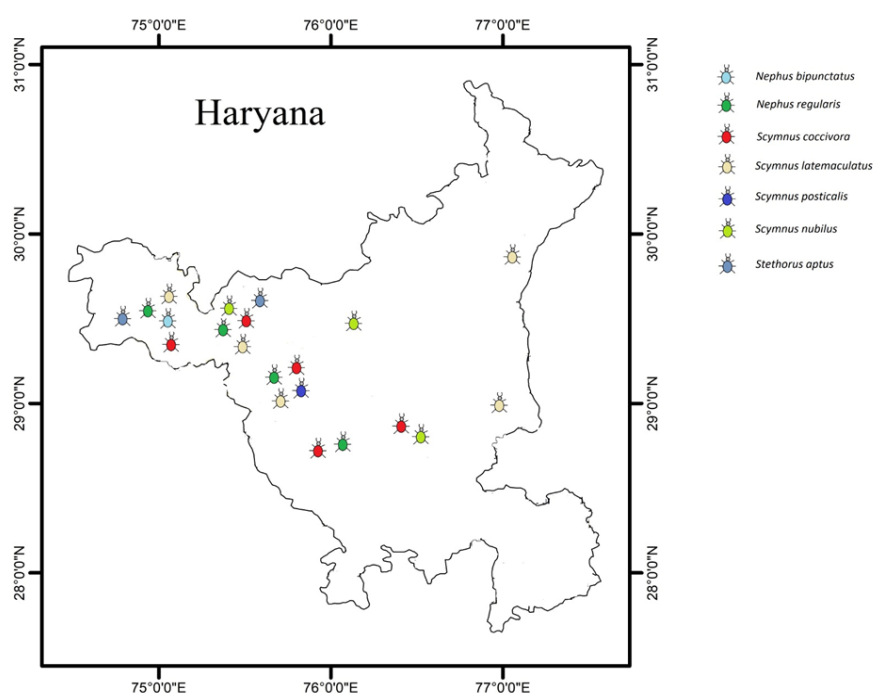


Figure. 1. Map of Haryana showing distribution of ladybirds

Collection and Preservation

Specimens were collected by the sweep net technique and handpicking over the period from 2020 to 2023. Collected beetles were killed with fumes of ethyl acetate in the glass bottles.

Taxonomic character study

The specimens were observed under a stereo-zoom microscope (TMC-220 Microne) to assess various taxonomic characteristics. Adults were photographed using a Canon 1100D Canon camera with a macro lens (100 mm). Roy *et al.* (2013) methodology was followed for genitalia extraction with some modifications. The extracted genitalia were treated with 10 per cent KOH overnight to dissolve soft parts. After the removal of debris and abdominal plates, the genitalia were put in pure acetic acid for five minutes and then washed in water. After dehydration in alcohol concentrations, it was cleared in clove oil and mounted in glycerol. Coxal lines, antennae and male genitalia were photographed by attaching an 1100 DSLR camera to the trinocular microscope (TMC-220 Microne). All measurements are in mm and were taken with a stage micrometre attached to the microscope. Scale lines indicating measurements were included in photographs, with adult coccinellids measured at 1 mm and taxonomic features at 0.1 mm. The collected specimens were deposited in the museum of the Department of Zoology at Maharshi Dayanand University Rohtak, Haryana.

Identification

The identification of specimens was conducted using available keys, checklists, and descriptions, as per Sasaji (1971), Gordon (1985), and Poorani (2002).

RESULTS

Seven species from three genera and two tribes of the subfamily Scymninae are collected and redescribed in this paper. These species include *Nephus* (*Bipunctatus*) *bipunctatus* (Kugelann, 1794), *Nephus regularis* (Sicard), *Scymnus* (Pullus) *coccivora* Ramakrishna Ayyar, 1925, *Scymnus* (Pullus) *latemaculatus* Motschulsky, *Scymnus* (Scymnus) *nubilus* Mulsant, *Scymnus* (Pullus) *posticalis* Sicard and *Stethorus aptus* Kapur.

Subfamily: Scymninae

Key to the tribes of the subfamily Scymninae recorded from Haryana.

- 1(2) Body size small, clypeus emarginate around the antennal bases and prosternum not arcuately produced in front, not concealing mouth parts.....**Scymnini**
 2 (1) Body size very small, clypeus not emarginate around the antennal bases and the prosternum arcuately produced in front, partly concealing mouth

parts.....**Stethorini**

Tribe: Scymnini

Diagnosis: Body size small, usually less than 4.00 mm; rarely medium-sized. Body shape elongated oval to hemispherical; dorsum always distinctly pubescent. Clypeus does not widely and strongly expand laterally as in *Chilocorus*. Eyes not covered by the extension of head capsule anteriorly and bear fine setae. Antennae are eight to eleven segmented and short. Terminal segments of maxillary palpi were not distinctly convergent; not strongly divergent apically. Prosternum's anterior margin is generally flat or weakly excavated, rarely convex. Elytral epipleura were very narrow without any distinct foveae for the reception of the tip of the femora. Tarsi were trimerous or cryptotetramerous. The abdomen has six visible segments. The tegmens of male genitalia are not very slender. Genital plates of female elongate triangular to transverse oval usually provided with a distinct stylus.

Key to the genera of tribe scymnini recorded from Haryana

1. (2) Prosternal carina absent, femoral line incomplete. Head visible from above and distinctly transverse. Terminal labial palp segment normal and not very short. Scape and pedicel of antenna entirely fused and flagellum usually nine segmented.....*Nephus* Mulsant
 2. (1) Prosternal carina present, coxal line complete or incomplete, if it is incomplete, its lateral end bend basally.....*Scymnus*
 3. (4) Coxal line completesubgenus. *Pullus* Mulsant
 4. (3) Coxal line incomplete.....subgenus *Scymnus* Kugelann

Genus *Nephus* Mulsant

Nephus Mulsant, 1846

1846. *Scymnus* (*Nephus*) Mulsant: 237.

Diagnosis: Body oval, usually more elongate than *Scymnus*, dorsal side moderately or weakly convex above and pubescent. The antenna pseudo eleven segmented; the first and second segments (scape and pedicel) are ankylosed in type species; the antenna is often ten-segmented with fused scape and pedicel; the terminal segment of maxillary palp is usually elongated and nearly parallel-sided. The femoral line of the first abdominal segment is incomplete; the lateral part of the line has not strongly recurved basally; if continued, it would have reached the lateral margin of the sternum. All the tarsi trimerous; tarsal claw with a sharply pointed basal tooth.

Key to the species of genus *Nephus* Mulsant found in Haryana:

- 1 (2) Elytron black coloured with a reddish spot, siphon apex bifurcated.....*Nephus*

(*Bipunctatus*) *bipunctatus* (Kugelann)

2 (1) Elytron dark brown with a large yellowish coloured spot, siphon apex hook-like.....*Nephus regularis* (Sicard)

Species description:

1. *Nephus (Bipunctatus) bipunctatus* (Kugelann, 1794)

Diagnosis: Body length 1.80 mm; width 1.00 mm. This was a microladybird. Body shape convex and oval; dorsum pubescent. Pronotum black. Scutellum black and triangular. Elytra black; the posterior end of each elytron also bears a reddish-brown spot (Plate-1). The postcoxal line is incomplete, reaching 3/4th length of the segment and then bends towards the lateral margin (Plate-2).

Male genitalia: Siphonal capsule with smaller outer lobe than inner lobe; siphonal tube curved with uniform thickness; apex of siphon bears bifurcated tip like a snake tongue. Tegmen with the large oval basal piece; basal lobe slightly smaller than parameres and pointed at the terminal end, parameres setose at the apex (Plate 2).

Female genitalia: It could not be described because of the lack of a female specimen.

Material studied: 2♂

Remarks: This species represents the first record from Haryana. It belongs to the *Nephus bipunctatus* group and its identification was challenging due to its male genitalia similarity to *Nephus quadrimaculatus* (Ren *et al.*, 2009). Recently recorded from Iran by Biranvand *et al.*, (2018) and West Bengal, India in mulberry fields preying on a Hemipteran, *Maconellicoccus hirsutus* (Poorani and Lalitha, 2018). This species was still not part of the Indian coccinellid fauna, so it is recommended that this species be included in future updates on the Indian coccinellid fauna.

Distribution: World: Russia, Iraq; India: West Bengal; Haryana: Sirsa.

Habitat: Specimens were collected from *Ailanthus excelsa* and congress grass.

Seasonal occurrence: Species was recorded in November and December months.

2. *Nephus regularis* (Sicard)

1929a. *Scymnus* (*Nephus*) *regularis* Sicard: 183 (lectotype ♂; BMNH).

Diagnosis: Body length 1.50-1.70 mm, width 1.00 mm. Body oval; usually more elongated than *Scymnus*; dorsal side moderately or weakly convex above and pubescent. The pronotum and anterior parts of the elytra are dark brown and the posterior part of the elytra is light brown with two broad yellowish spots. Antennae pseudo eleven-segmented, with the first and second segments (scape and pedicel) jointed. The terminal seg-

ment of the maxillary palp is usually elongated and nearly parallel-sided (Plate 3). The femoral line of the first abdominal segment is incomplete, with lateral part of the line not strongly recurved basally, potentially reaching the lateral margin of the sternum if continued (Plate 4). All tarsi trimerous, claw with a sharply pointed basal tooth. The mandible features both an apical tooth and basal tooth; with a rounded external border.

Male genitalia: Siphonal capsule asymmetrical with a narrow inner arm and broad outer arm; siphonal tube evenly thickened; apex of siphon hook-like. The tegmen includes a tetragonal basal piece, with the basal lobe equal in length to the parameres and pointed at the terminal end. Parameres are finger-like; bearing setae at their apices (Plate 4).

Female genitalia: Spermatheca having smooth cornu and bearing ring over the ramus and nodulus part (Plate-4).

Remarks: This micro ladybird species poses challenges for naked-eye identification often requiring examination of the male genitalia for confirmation. Its lectotype and paratype were recorded by Pang and Gordon (1984) from India, specifically Punjab, and Lyallpur, with specimens deposited in the British Museum of Natural History. Earlier this species was recorded from Haryana by Kedar *et al.*, (2011) in association with mealybug in the cotton fields of Hisar.

Material examined: 5♂ and 4♀

Distribution: World: Pakistan, China and several states in India including Andhra Pradesh, Karnataka, Tamil Nadu and various regions in Haryana like Hisar, Sirsa, Fatehabad and Bhiwani.

Habitat: Species was found from china rose, okra and dhatu commonly infected with mealybug.

Seasonal occurrence: Species was recorded in May and June.

Genus *Scymnus* Kugelann, 1794

1794. *Scymnus* Kugelann: 545

Diagnosis: Body small, usually short oval; dorsal side strongly convex and pubescent. Head capsule transverse quadrate with rounded corners. Eyes were of medium size, and not strongly emarginated by post antennal process. Clypeus was nearly as broad as or narrower than the distance between antennal insertions. The antenna is usually eleven-segmented, sometimes ten-segmented, but the scape and pedicel are not fused and are distinctly divided. Terminal segment of maxillary palp longer than wide, usually weakly broadening apically. Pronotum weakly excavated throughout in entire width, not extending to cover the head. Prosternum T shaped. The elytral epipleuron was very narrow and nearly horizontal. Abdomen with six visible segments. Legs moderately short and stout, tibia not strongly modified, without distinct spur, tarsi always cryptotetramerous.

Subgenus *Scymnus* Kugelann, 1794: Antenna always eleven segmented. Poststernal carinae were distinct. The femoral line of the first segment is incomplete, its lateral part distinctly recurrent basally, if continued it would reach the basal margin of the sternum; the area surrounded by the femoral line is more or less smooth or more sparsely punctate at part along the line than at basal part.

Subgenus *Pullus* Mulsant, 1846: This subgenus could be separated from the subgenus *Scymnus* by the complete femoral line, which reaches the margin of the sternum.

Subgenus *Scymnus* (*Pullus*) Mulsant, 1846

1846. *Scymnus* (*Pullus*) Mulsant: 241.

Key to the subgenus *Scymnus* (*Pullus*) Mulsant, 1846 found in Haryana:

1 Body length 1.00-2.00 mm, ground colour of elytra black.....3, 4

2 Body length 1.00 -1.40 mm, ground colour of elytra brown..... 5

3 Posterior one-third of elytra reddish-brown, apex of siphon bifurcated with a hook-like structure on the outer side.....*Scymnus* (*Pullus*) *posticalis* Sicard

4 Black elytra with two reddish spots on each.....*Scymnus* (*Pullus*) *latemaculatus* Motschulsky

5 Elytra brown with black spots, apex of siphon is cone-shaped..... *Scymnus* (*Pullus*) *coccivora* Ramakrishna Ayyar

3. *Scymnus* (*Pullus*) *coccivora* Ramakrishna Ayyar, 1925

1925. *Scymnus coccivora* Ayyar: 491 (?TNAU).

Diagnosis: Body length of 1.00-1.20 mm, width of 1.00 mm. Body moderately convex and elongated oval. The dorsal side was pubescent. Brownish head, pronotum and elytra with a V-shaped dark brown area around the scutellum and variable black markings on the posterior half. Most of the collected specimens were having an hourglass-shaped marking, sometimes with two posterior markings and sometimes completely devoid of any marking (Plate 5). Mandible with one bifid apical tooth and broadly rounded outer margins. Antenna 11-segmented, second segment fused with the first, third longer than broad, the fourth to seventh equal in size, and the last four forms an antennal club with a small rectangular terminal segment. Complete the postcoxal line with a smooth semicircular area adjacent to the postcoxal line (Plate-6). Legs with bifid tarsal claw and basal tooth.

Male genitalia: Siphonal capsule with a deep notch in the middle dividing into a short and a long arm. The apex of the siphon was cone-shaped. Lateral lobes are smaller than the median lobe and later were pointed at the apex while lateral lobes are spindle-shaped (Plate 6).

Female genitalia: Comma-shaped spermatheca with

keratinized cornu, ramus and nodulus. Female genital plates are elongated and setose at ends (Plate 6).

Remarks: Earlier the species was recorded from Hisar, Haryana in association with mealybugs (Kedar et al., 2011).

Material examined: 4♂ and 3♀

Distribution: World: Pakistan, Bangladesh, Sri Lanka and Malaysia. India: Uttar Pradesh, Karnataka Tamil Nadu Goa and Andhra Pradesh. Haryana: Hisar, Bhiwani, Rohtak, Fatehabad and Sirsa.

Habitat: Specimens were recorded from *Ailanthus excelsa* with mealybugs.

Seasonal occurrence: Speciestypically found in July.

4. *Scymnus* (*Pullus*) *latemaculatus* Motschulsky

1858. *Scymnus latemaculatus* Motschulsky: 121 (Lectotype; UM)

Diagnosis: This species measures 1.90 mm in length and 1.00 mm in width, featuring a moderately convex and oval body shape with a pubescent dorsum. Pronotum black with brownish sides and lateral margins; scutellum black and triangular. The elytra have a black ground color with two pairs of brownish spots, with the anterior pair being squarish and large, and the posterior pair small (Plate-7). Antennae are eleven-segmented, with the second segment very short and the third segment longest. Among the last three segments forming the club, the tenth segment is the broadest and the eleventh is the smallest. The ventral side is black and uniformly pubescent. Complete postcoxal line, the area enclosed along the postcoxal line is smooth and sparsely punctate in the middle (Plate-8). Legs brownish-red in colour.

Male genitalia: Recorded for the first time in Haryana, the siphonal capsule is funnel-shaped, with the siphonal tube of variable width, thickest in the terminal part and marked by a leaf-like process at the starting point of the thick portion. The apex of the siphon is bifurcated with a hook-like structure on the outer side. The basal piece of tegmen is elongated and triangular; the median lobe of tegmen is slightly longer than the lateral lobes and bears a deep notch on lateral sides just before the terminal point (Plate-8).

Female genitalia: Spermatheca V-shaped with well-developed cornu, ramus and nodulus (Plate-8).

Remarks: This is an aphidophagous ladybird species closely resembles the new species *Horniolussororius* and *Pharoscyms horni* (Weise) in morphological features but can be confirmed with male genitalia (Poorani, 2015). *Pharoscyms horni* (Weise) is differentiated by its rounded body shape instead of oval, as seen in the other two species mentioned.

Material examined: 3♂ and 7♀

Distribution: World: Bangladesh, Thailand, Sri Lanka and Taiwan; India: Karnataka, Tamil Nadu and Goa; Haryana: Sirsa, Fatehabad, Hisar, Sonapat and Karnal.

Habitat: Species was collected from *Callotropis*, *Amaranthus*, and *Ailanthus excelsa*. Species found in wild areas; no specimen was traced from cultivated fields.

Seasonal occurrence: Recorded from the last week of April to June.

5. *Scymnus (Pullus) posticalis* Sicard

1913. *Scymnus posticalis* Sicard: 503 (lectotype ♂; BMNH).

Diagnosis: The body was 1.20 mm long and 1.00 mm wide. Body highly convex, small and rounded anteriorly and squarish posteriorly. The dorsum is pubescent, with greyish-colored setae arranged specifically on the pronotum directed inwards and on the elytra directed outwards. The pronotum is reddish-brown on the anterolateral sides and black in the center, while the scutellum is black and triangular. The elytral ground colour is black but the posterior one-third is reddish-brown (Plate 9). The ventral side also bears similar colours as the dorsal side, anterior and abdominal parts are reddish-brown and the middle portion constituting pro, meso and metathorax is black. Elytral epipleuronafoveate, wide anteriorly and narrow down posteriorly. Postcoxal line complete.

Remarks: Lectotype and paralectotype were designated by Pang and Gordon (1984). They also provided synonyms for *Scymnus (Pullus) ishidaei* M. araki and *Scymnus hilaris* Motschulsky. Only one specimen of this species, feeding on aphids was recorded from the study area, so male-female genitalia were not illustrated. This species was recorded for the first time from Haryana.

Material examined: 01♀

Distribution: World: Nepal, China, Japan, and Myanmar; India: Himachal Pradesh, Assam; Haryana: Hisar

Seasonal Occurrence: This species was found in Botanical Garden HAU, Hisar in March

Subgenus *Scymnus (Scymnus)* s. str.

Key to species of Subgenus *Scymnus (Scymnus)* s. str. found in Haryana: Only one species i.e. *Scymnus (Scymnus) nubilus* Mulsant recorded from Haryana.

6. *Scymnus (Scymnus) nubilus* Mulsant

1850. *Scymnus nubilus* Mulsant: 972 (lectotype; HEC, OU)

Diagnosis: Body 2.00 mm long and 1.00 mm wide; moderately convex and oblong oval. Dorsal pubescence greyish white. Pronotum black with lighter anterior and lateral margins. The elytra are brown with a black sutural stripe, while the scutellum is black (Plate-10). Incomplete postcoxal line, running parallel to the posterior margin for some distance; area enclosed by postcoxal line was coarsely and densely punctate. Antenna eleven segmented; the second segment was very small almost fused with the first; the last three forming club second last was the largest among club forming segments; the last segment is like a trapezium. Mandibles feature one bifid apical tooth, with a rounded outer

surface (Plate-11). The ventral side was black, and the legs are reddish-brown, while the epipleuron is very narrow.

Male genitalia: The siphon with asymmetrical siphonal lobe (narrower inner arm and broader outer arm); the siphonal tube thickest from the central region; the apex of the siphon is also thickened with a flap of soft structure and hook-like sclerotized structure. Tegmen with the expanded basal piece; median lobe pointed and equal in length to lateral lobes (Plate-11).

Female genitalia: Sub-triangular female genital plates; styli with long setae. Spermatheca bent at right angle cornu, ramus and nodulus keratinised very well developed (Plate-11).

Remarks: This species also feeds upon aphids. The species could be distinguished from a very similar-looking species i.e. *Scymnus (Neopullus) hoffmanni* by comparing their male genitalia. The species name *Scymnus nubilus* was given by Booth and Pope (1989) after synonymizing it with *S. latralis* and *S. curtisi*.

Material examined: 4♂ and 6♀

Distribution: World: Pakistan, Bangladesh, Sri Lanka, Myanmar, Nepal and China;

India: Assam, Karnataka, Orissa, West Bengal, Goa and Lakshadweep Island; Haryana: Rohtak, Jind and Fatehabad.

Habitat: Species found on the Indian tree of haven, peach plant, Indian rosewood tree.

Seasonal occurrence: Specimens were recorded during the April and May months.

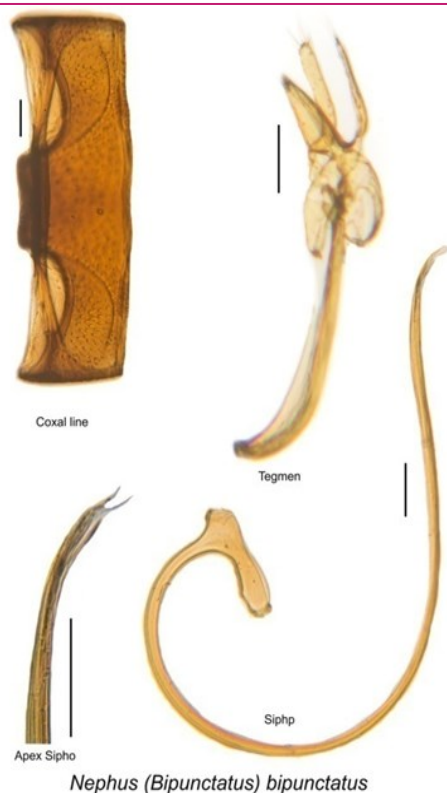
Tribe: Stethorini

Diagnosis: Dorsum uniformly pubescent. Eyes exposed anteriorly and finely pubescent. Antennae eleven segmented. The terminal segment of the maxillary palp is longer than wide and slightly convergent apically with a truncate apex. Prosternum with broad basisternum. The lateral wings of the mesosternum strongly approach to metasternum and mesoepisternum very short. Elytral epipleura without distinct foveae. Legs not strongly modified but rather simple, tarsi trimerous. Tegmen of male genitalia are usually thin and elongated, but rarely stout. Hemisternite of female genital plates always elongated.



Nephus (Bipunctatus) bipunctatus

Plate 1. *Nephus (Bipunctatus) bipunctatus*-Adult (Dorsal)



Nephus (Bipunctatus) bipunctatus

Plate 2. *Nephus (Bipunctatus) bipunctatus*-Taxonomic features

Key to tribe stethorini: From this tribe a single genus *Stethorus* Weise, 1885b was recorded from Haryana

***Stethorus* Weise, 1885b**

1885b. *Scymnus (Stethorus)* Weise: 65.

Diagnosis: Body short elongate-oval, very small, dorsum strongly convex and black, prosternal carinae absent. The abdomen is composed of six visible segments. First sterna with complete femoral lines. Tibiae slender, not angulated at the external margin. Elytral epipleura was very narrow and nearly horizontal without any distinct foveae.

7. *Stethorus aptus* Kapur

1948. *Stethorus aptus* Kapur 39(2): 297-320.

Diagnosis: This species measures between 0.80-1.20 mm in length and 0.50 mm in width, exhibiting an oval shape with moderate convexity and a pubescent dorsum. Both pronotum and elytra are black, bearing fine hair-like structures. Scutellum black and triangular. Ventral surfaces are uniformly black, contrasting with reddish-brown legs and mouthparts (Plate-12). The post-coxal line is complete and shallow, resembling a bowl. The antennae are short, eleven-segmented; the first two segments are large and oblong; the third is longer but thinner than the next four segments and the last four form an antennal club; the last segment is triangular. Mandible with bifid apical tooth and bicuspidate basal tooth (Plate-13).

Male genitalia: The male genitalia had whip-like siphon



Nephus regularis (Sicard)

Plate 3. *Nephus regularis* (Sicard)-Adult (Dorsal, Ventral and Lateral),

with a very different siphonal capsule which was bifid without inner or outer lobes; a notch present at the junction of the siphonal capsule and siphonal tube; the siphonal tube very long tapering structure; apex of siphon had a fine hair-like structure. Tegmen squarish; bilobed basal piece. The basal lobe long and stout structure ending in the form of the spine. Parameres extend up to the 2/3rd region of the basal lobe and bear a few setae at apices (Plate-13).

Female genitalia: The spermatheca is not fully sclerotized (Plate-13).

Remarks: This small, black-coloured ladybird species exclusively preys on mites. This has not yet been included in the checklist of Indian Coccinellid (Poorani, 2002). This was the first record from Haryana. This species was initially documented in China feeding on *Panonychus citri* (McGregor) on the citrus crop (Li et al., 1990). Later on it was recorded from the tea garden of North East India feeding on RSM *O. Coffeae* (Babu, 2012). Subsequently, it was found in the Kashmir Valley, preying on *Panonychus ulmi* in almond and apple orchards (Govindasamy and Khursheed, 2018).

Material examined: 3♂ and 4♀

Habitat: This species was exclusively found in wild areas of Sirsa and Fatehabad, primarily on *Ailanthus excelsa* (Indian tree of heaven) and okra, where it feeds on spider mites.

Distribution: World: China; India: Manipur, Himachal, J & K; Haryana: Sirsa and Fatehabad.

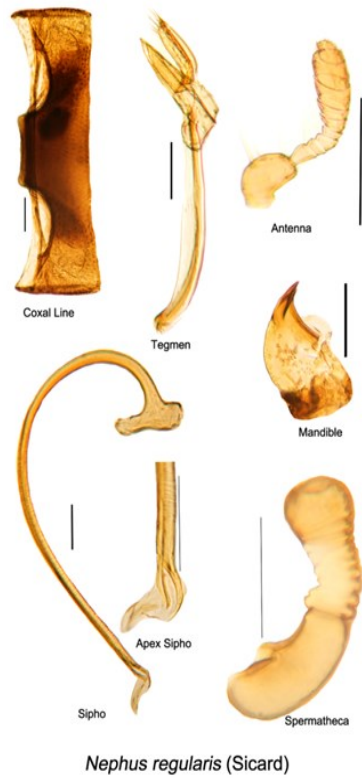


Plate 4. *Nephus regularis* (Sicard)-Taxonomic features



Plate 5. *Scymnus (Pullus) coccivora* Ramakrishna Ayyar-Adult (Dorsal, Ventral and Lateral),

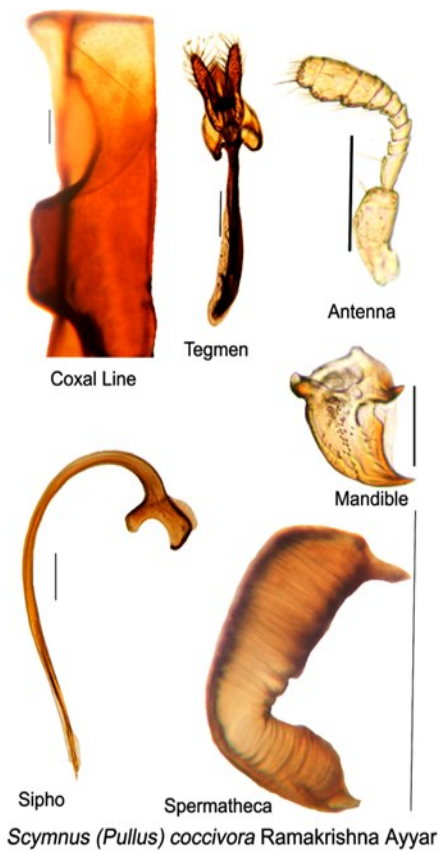


Plate 6. *Scymnus (Pullus) coccivora* Ramakrishna Ayyar-Taxonomic features,



Plate 7. *Scymnus (Pullus) latemaculatus* Motschulsky-Adult (Dorsal, Ventral and Lateral),

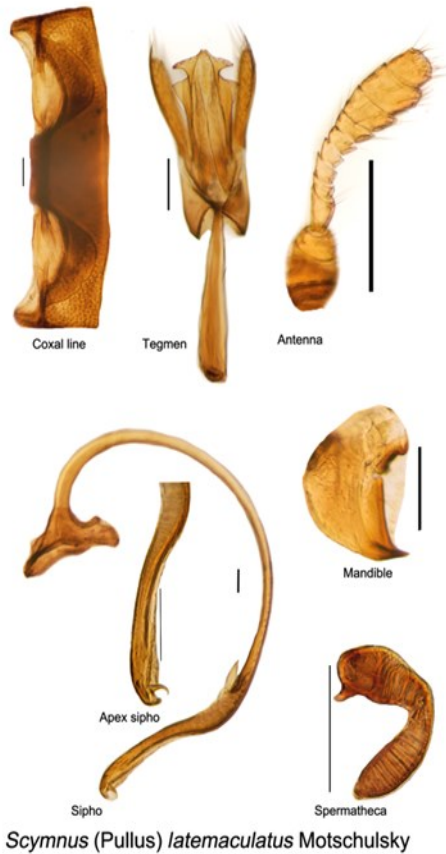


Plate 8. *Scymnus (Pullus) latemaculatus* Motschulsky-
Taxonomic features

Plate 9. *Scymnus (Pullus) posticalis* Sicard-Adult (Dorsal,
Ventral and Lateral)

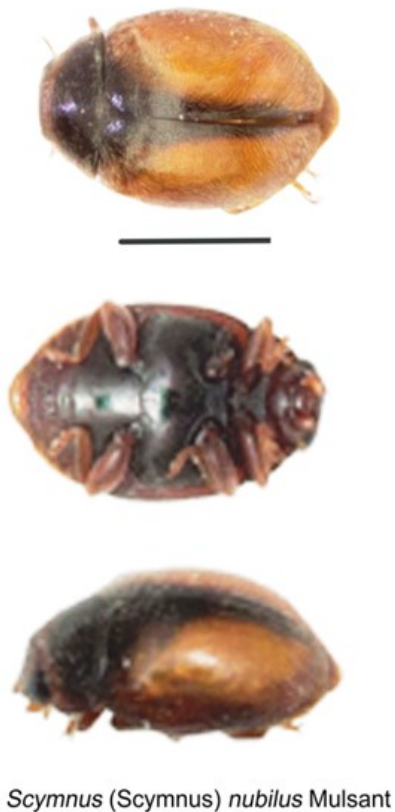


Plate 10. *Scymnus (Scymnus) nubilus* Mulsant-Adult
(Dorsal, Ventral and Lateral)

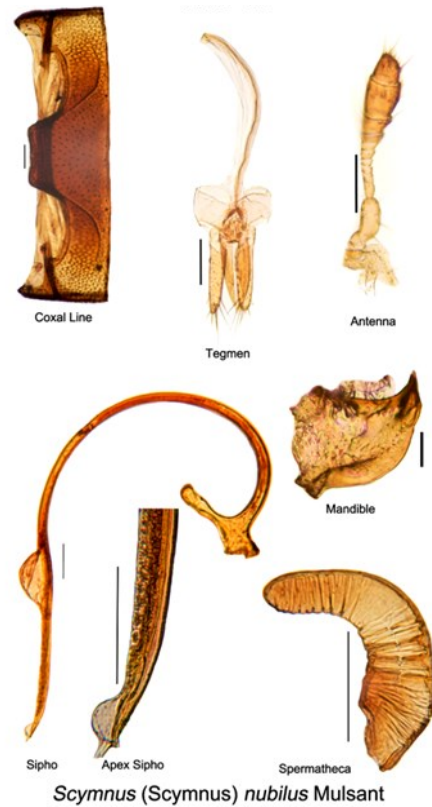


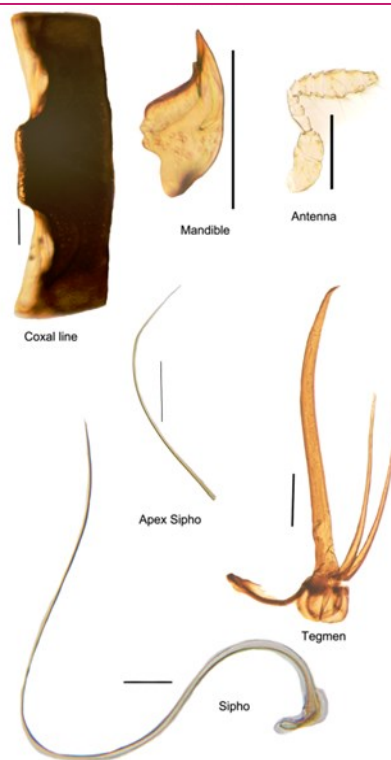
Plate 11. *Scymnus (Scymnus) nubilus* Mulsant-Taxonomic
features

*Stethorus aptus* Kapur**Plate 12.** *Stethorus aptus* Kapur-Adult (Dosal, Ventral and Lateral)

Seasonal occurrence: Found from the first week of April to the last week of June

DISCUSSION

Recent research on the Scymninae subfamily has seen contributions from all over the world. Chen *et al.* (2016, 2016a) from China, Slipinski *et al.* (2012) from Australia, Ali *et al.* (2015) and Ashfaq *et al.* (2015) from Pakistan, and Poorani (2015, 2017), Govindasamy and Khursheed (2018), Poorani and Lalitha (2018), Poorani (2019), Peng *et al.* (2023), and Poorani *et al.* (2024) from India, all have added valuable insights. Earlier studies in Haryana were primarily focused on host-parasite dynamics with respect to specific crops, emphasizing the potential of ladybird beetles as biocontrol agents (Rana, 2006; Kumar *et al.*, 2009; Ram and Saini, 2010; Kedar *et al.*, 2011, 2014). Kedar *et al.* (2011) documented *Nephus regularis* (Sicard) and *Scymnus* (Pullus) *coccivora* Ramakrishna Ayyar, 1925 in Hisar, Haryana, during investigations on biocontrol agents in the cotton fields against *Phenacoccus solenopsis* Tinsley. Chowdhury *et al.* (2015) also noted *Scymnus* (Scymnus) *nubilus* Mulsant in their study. This study reveals a rich diversity of ladybird beetles, including two tribes, three genera, and seven species within the family Coccinellidae and subfamily Scymninae, in Haryana, India. Among these species, *Nephus*

*Stethorus aptus* Kapur**Plate 13.** *Stethorus aptus* Kapur-Taxonomic features

(Bipunctatus) *bipunctatus* (Kugelann, 1794), *Scymnus* (Pullus) *latemaculatus* Motschulsky, *Scymnus* (Pullus) *posticalis* Sicard, and *Stethorus aptus* Kapur were documented for the first time in Haryana. Identifying *Nephus* (Bipunctatus) *bipunctatus* was challenging due to its male genitalia's similarity to *Nephus quadrimaculatus* (Ren *et al.*, 2009). *Scymnus* (Pullus) *latemaculatus* Motschulsky, an aphidophagous ladybird species, also closely resembled the new species *Horniolus sororius* and *Pharoscyms horni* (Weise) morphologically but was differentiated by male genitalia (Poorani, 2015). Pang and Gordon (1984) provided synonyms for *Scymnus* (Pullus) *ishidai* M. Araki and *Scymnus hilaris* Motschulsky for *Scymnus* (Pullus) *posticalis* Sicard. Only one specimen of this species, feeding on aphids, was recorded in the study area, so male-female genitalia were not illustrated. *Stethorus aptus* Kapur is the only mite-feeding species among the seven recorded during the study. Previously, this species was recorded in North East India feeding on Red Spider Mite *Oligonychus coffeae* (Babu, 2012) and in the Kashmir Valley, preying on *Panonychus ulmi* (Govindasamy and Khursheed, 2018). The present study identified and confirmed species by various taxonomical features such as male genitalia, coxal lines, antennae, mandibles, and female spermatheca. A key to all tribes, genera and species found during this study was also generated. These findings will significantly contribute to un-

derstanding Coccinellid diversity in Haryana, emphasizing the importance of further exploration and research to discover additional species. Such investigations are crucial for devising effective pest management strategies and conserving biodiversity in the region of Haryana.

Conclusion

Various studies have reported 550 species of ladybirds belonging to 90 genera in India. These insects serve as important biocontrol agents in different agroecosystems; hence, most scientific studies have focused on exploring the predator-prey relationship of ladybirds with agricultural pests. However literature is almost silent on the diversity of ladybirds in Haryana. The present study is the first scientific work associated with the taxonomy, documentation and redescription of seven species of ladybirds from the subfamily Scymninae with four new additions to the coccinellid fauna of Haryana. This is the first comprehensive genitalia-based study of this subfamily from Haryana. The findings will serve as baseline research for the ladybird diversity in Haryana and in North India. The present study highlights the importance of Haryana as a biodiversity site for ladybird beetles. It also emphasises the need for more scientific studies to explore the faunal diversity and ecological functions of Coccinellids.

Conflict of Interest

The authors declare that they have no conflict of interest.

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