

Morphotaxonomic Studies on Ladybird Beetles (Coccinellidae: Coleoptera) in Southern Telangana Region

Neethu Roy D., Uma Maheswari T.,
Sridevi G., Raghavender B.

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ABSTRACT

A total of 735 specimens of ladybird beetles were collected, examined and recorded 12 species belonging to four subfamilies during the present study *kharif*, 2019-2020 in College of Agriculture, Rajendranagar, PJTSAU, Hyderabad, Telangana. They are eight species namely, *Aneglies cardoni* (Weise), *Cheilomenes sexmaculata* (Fabricius), *Coccinella transversalis* (Fabricius), *Harmonia octamaculata* (Fabricius), *Hippodamia variegata* (Goeze), *Illies cincta* (Fabricius), *Micraspis discolor* (Fabricius) and *Propylea dissecta* (Mulsant) belonged to subfamily, Coccinellinae and tribe, Coccinellini; two species namely, *Brumoides suturalis* (Fabricius) and

Chilocorus nigrita (Fabricius) belonged to subfamily, Chilacorinae and tribe, Chilacorini; one species namely *Scymnus nubilus* (Mulsant) belonging to subfamily Scymninae and tribe, Scymnini and another one species, *Henosepilachna vigintioctopunctata* (Fabricius) belonging to the subfamily Epilachninae and tribe, Epilachnini. The detailed diagnostic description of adult were provided along with color plates. Discussion pertaining to taxonomy, taxonomy status, regional record of distribution and morphometrics are given for each species.

Keywords Coccinellids, Ladybird beetles, Taxonomy, Agriculture, Southern Telangana.

Neethu Roy D.*
PhD Scholar
University of Agricultural Sciences, Raichur 584101, Karnataka, India.
Uma Maheswari T.
Associate Dean
Agricultural College, Siricilla
Sridevi G.
Principal Scientist and Head, AINP on Pesticide Residues,
Professor Jayashankar Telangana State Agricultural University,
Telangana, India.
Raghavender B.
PhD Scholar
College of Agriculture, Rajendranagar
Professor Jayashankar Telangana State Agricultural University,
Telangana, India
Email : neethu.roy96@outlook.com
*Corresponding author

INTRODUCTION

Ladybird beetles belong to the largest insect order, Coleoptera and the family, Coccinellidae. Coccinellidae comprises 490 genera and 6,000 described species worldwide which is divided into six subfamilies: Stictolotidinae, Chilacorinae, Scymninae, Coccidulinae, Coccinellinae and Epilachninae along with recent phylogeny suggesting seventh subfamily, Ortaliinae (Fursch 1990, Slipinski 2007). Indian subcontinent (excluding the subfamily Epilachninae) has a distribution of 400 species (including six subspecies) under 79 genera, 22 tribes and 5 subfamilies (Poorani 2002). Due to their predatory nature, coccinellids play a major role in biological control of pests like aphids, leafhoppers, whiteflies, mealybugs, and scales. The

feeding potential of one grub of a predatory beetle can be about 50 aphids per day and these group of beetles are important for the reduction of arthropod pest populations on variety of fruit, vegetable, forage and field crops, in addition to the ornamental plants (Kring *et al.* 1985). Hence, coccinellids have become key predators that could be conserved and augmented in agricultural ecosystem to achieve pest reduction as a part of IPM. Exceptionally members of Epilachninae are phytophagous destroying vegetable crops, among which *Henosepilachna vigintioctopunctata* (Fabricius) and *Epilachna implicata* (Fabricius) are destructive to Solanaceous and Cucurbitaceous plants, respectively (Megha *et al.* 2015). Beetles of some tribes feed on fungi which causes mildew disease in plants (Iperti 1978).

Ladybird beetles vary in their appearance with wide range of colors and patterns i.e., banded, spotted, striped, ocellate, checkered, metallic with punctuation marks, radial lines on the body surface possessing broadly rounded to elongate body form, being convex dorsally and flattened ventrally, clavate antennae, securiform maxillary palpi, postcoxal line on the first abdominal ventrite. Tarsal formula though is 4-4-4, but appearing as 3-3-3 with minute third tarsomere hidden within the broad triangular second tarsomere known as Cryptotetramerous or pseudotrimerous. In addition, different species show variation in the structure of male genitalia that could be useful in distinguishing species of ladybird beetle. As Coccinellids are important natural enemies of agricultural pests, it is important to know the taxonomy with some of the scientific evidences including morphometric specifications which ultimately help in proper identification of these predators. Therefore, morphotaxonomic studies of ladybird beetles were carried out at Department of Entomology, College of Agriculture, Rajendranagar, PJTSAU, Hyderabad 2019-2020.

MATERIALS AND METHODS

Collection

Ladybird beetle samples were collected from Student farm, College farm and ARI farm, Rajendranagar by net sweeping and hand picking at fort night intervals

during *kharif* 2019-2020. After collecting the beetles, they were killed by using ethyl acetate. The specimens were well dried in a hot air oven at 45-50°C for 4 to 6 hours.

The specimens were identified based on the morphological characters like pronotum, forelegs, middle legs, hindlegs and elytra. The dissected structures were photographed under stereozoom binocular microscope attached with camera.

Identification

The above collected specimens in different crop ecosystems were identified based on their morphological characters like antennae, spots on pronotum and elytra. All identifications were made using keys published in pertinent literature and check list (Poorani 2002).

Measurements

Measurements of structures like head, pronotum, elytra, forelegs, middle legs, hindlegs, and abdomen were taken under stereozoom binocular microscope attached with computerized pixel TCapture software. Ten specimens of each of the species used for taking measurements in millimeter.

RESULTS AND DISCUSSION

Subfamily	Chilocorinae
Tribe	Chilocorini

1 *Brumoides suturalis* (Fabricius)

External morphology

Head, antennae and pronotum were brown in color; elytra yellowish brown with two longitudinal black stripes on each elytron, starting from the humeral angle and ending before reaching the reddish area at the tip of the elytron. Legs were brown in color and ventral side of the body was brown to dark brown. Adult body was oval, glabrous and moderately convex above. Head has a prominent pair of eyes, when the head was retracted which was slightly covered by the pronotum. Frons remained widened posteriorly,

antennal insertions covered by the expanded clypeal margin. Antenna was 9 segmented with small sensory hairs all over. The pronotum has a pair of notches in front of the eyes and was having broadly curved posterior angles, separated from elytra. Anterior margin of the pronotum was deeply, trapezoidally concave and lateral portions were strongly descending below. Base of the elytra was distinctly broader than pronotal base. Scutellum was triangular and possess a median longitudinal black stripe which extended from scutellum to the apex of the elytra; Coxal line was complete, tibia angulate externally and tarsi with a pair of simple claws at the terminal tarsal joint (Fig. 1).

Chilocorus nigrata (Fabricius)

External morphology

The adult body was bright black in color, head ochreous brown, eyes black; pronotum black with brown lateral expansions; mouth parts were dark brown; scutellum and elytron black, venter of thorax and legs brown, abdominal terga dark brown, underside uniformly ochreous brown, hind wings were grey

and claws have deep brown color. Shape of the body was sub-globose, rounded, highly convex, widest in the middle. Head was finely punctate with short and yellowish pubescence; genae narrower, frons coarsely punctate and clypeus concave at the anterior margin. Antennae were eight segmented with small sensory hairs, slightly clavate. Pronotum remained strongly arched, narrower anteriorly with deep emargination; punctuations sparse all over and close, with pubescence at expansions; scutellum was triangular with base slightly shorter than side; elytron widest near the middle. Coxal line shallowly curved and reached (Fig. 1).

Subfamily : Coccinellinae

Tribe : Coccinellini

Anegleis cardoni (Weise)

External morphology

Adult body was medium sized, shiny brown and pronotum was brown with 2 black spots. Elytra bright pinkish yellow, each elytron with one black median stripe at the junction of elytra and two linear markings

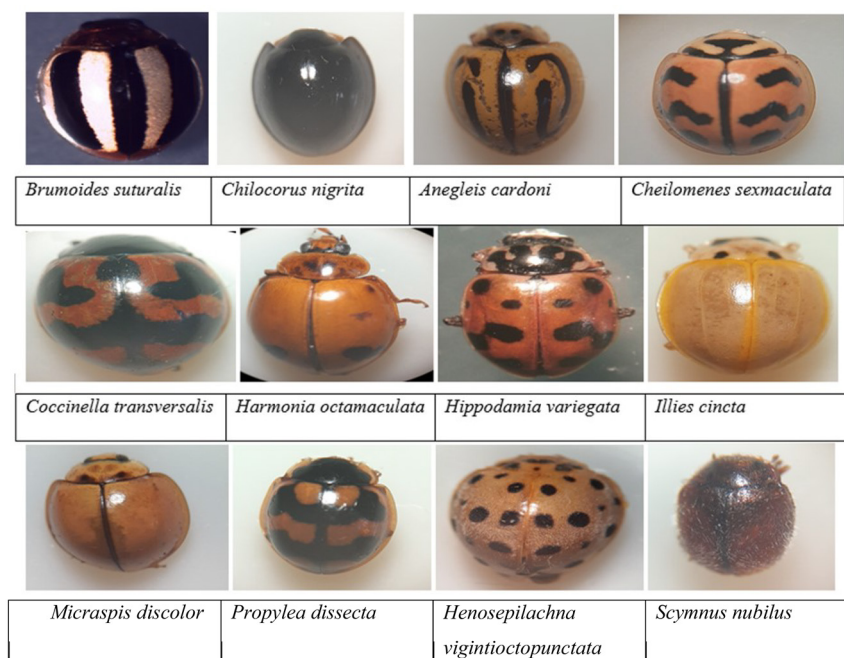


Fig. 1. Ladybird beetles recorded *kharif* 2019-2020 in Southern Telangana zone.

on each elytron; the anterior end remained curved inward but outward, curved posteriorly. One small rounded black spot was found towards the posterior end of each elytron (Fig. 1).

Cheilomenes sexmaculata (Fabricius)

External morphology

Adult body appeared nearly rounded, glabrous with variable color pattern. Pronotum was yellowish brown with a transverse black brownish band in the middle near the posterior margin and another smaller black transverse band anterior to first one and both are connected to each other in the center. Elytra was generally brownish yellow with black spots in the form of transverse zig zag patches. On each elytra, the first patch was small and inverted V- shaped whereas the second was completely W- shaped and the third remained rounded. A narrow longitudinal brownish black band was observed along the line of elytra junction. Ventral side of the body was brown in color and legs appeared brown to black in color. Body remained medium to large where the females were larger than males. These were elongated oval beetles with glabrous nature and the dorsum highly convex. Head narrowed than half of pronotum and punctuate. Antennae was 11 segmented, clavate and scape being larger than pedicel. Pronotum was trapezoidally excavated and densely punctuate. Scutellum was wider and triangular. Elytra was sparsely punctuate and epipleuron well developed. Coxal line remained straight and reached the anterior margin. Femoral line was strongly curved reaching the posterior margin of the sternum. Legs possess pseudotrimerous tarsi and tarsal segments were densely hairy ending with a pair of claws (Fig.1).

Coccinella transversalis (Fabricius)

External morphology

Adult body was oval, strongly convex with dark yellowish orange to brick red color. Head remained black with yellow spot, mouthparts black to dark brown, antennae dark brown; eyes black; pronotum black with anterior lateral areas, orange to yellow; scutellum black and elytra coloration was variable.

Elytra has black markings, commissural line black, ventral side and legs were fully black in color. Body size was larger in females than males and oval in shape and were strongly convex dorsally. Head was wider with a pair of prominent compound eyes. Frons punctate and clypeus straight. Antenna 11 segmented, where last segment was enlarged and rounded. The scape remained broad and longer than pedicel. Pronotum was broad and finely punctate. Elytra was sparsely punctate and epipleuron was well developed. Coxal line was curved and complete femoral line was angulate. Legs were pseudotrimerous ending with a pair of claws (Fig. 1).

Harmonia octamaculata (Fabricius)

Adult body was oval, longer than broad, dorsally convex and widen at the middle of the body or middle of elytra. Head was orange to pale brown with black eyes; antennae and mouth parts were reddish brown in colour. Pronotum reddish brown; elytra reddish brown to brown in color with black maculae on posterior end of the elytra. The commissural line of the elytra brown in color and ventral side was dark brown. Epipleuron also reddish brown and scutellum dark brown. Legs were reddish brown in color. Head broad with a pair of prominent compound eyes; frons punctate, intraocular margin divergent apically. Antenna was 11 segmented and the last segment was bulged. Pronotum strongly and trapezoidally excavated, surface punctate; scutellum triangular and basal margin was longer than lateral margin. Elytra was sparsely punctate and the epipleuron with an inner carina that may reach the elytral apex or well developed epipleuron. The post coxal line remained strongly curved and almost reached the anterior margin. Femoral line angulate, legs were simple with 4 segmented tarsi ending with a pair of claws (Fig. 1).

Hippodamia variegata (Goeze)

External morphology

Adult body was slightly elongated and oval in shape and creamish red in color. Head was brown with prominent black eyes. Body has prominent black and white pattern behind the head and black spots on red forewings. Polymorphism was common, where

number of spots vary from few to 13. However, commonly six along with one spot on the mid-dorsal line of junction of elytra near the scutellum were observed. Among the spots, 4 were in line along the outer margin in which the first one was the smallest and the second being slightly larger than the first. The elytra were without hairs and finely pitted and were light yellow to orange yellow in color provided with brownish black spots of various sizes. The white lines that converge behind the head were common in all the individuals. Its pronotum always has a fine, raised margin along its basal edge. Pronotum was yellow white with brownish black large areas in the form of transverse brownish black, broad band along the posterior margin of the pronotum with 4 finger like thick anterior projections. Scutellum was brownish black. Head was triangular with large eyes. Mouthparts and antennae were brown yellow. Antennae were about 1.2 mm long and 11 segmented where terminal segment was nearly rounded in shape. Maxillary palpi 4 segmented and the terminal segment was widened apically and was longer than other segments. Labial palpi was 3 segmented, basal segment remained very small. Tibia and tarsi were brownish-yellowish; femora dark and abdomen was black (Fig. 1).

Illies cincta (Fabricius)

External morphology

Adult body was elongated, oval in shape and was dorsally convex, wider in the middle of the elytra. Head was yellowish with red eyes and pale yellowish antenna, mouth parts were yellowish to brown; pronotum transparent yellow and scutellum yellowish in color. Pronotum has pair of black round spots at the posterior end. Elytra was greyish yellow to pale yellow and shiny. Sometimes elytra light orange in colour and shiny. Elytral commissural line was yellowish and ventral side remained brown and legs being yellowish to brown in color. Head densely punctate and hairy. Frons was flat. Antennae 11 segmented, elongated, last segment of antennae bulged. Maxillary palpi characteristic, where last segment of maxillary palpi was enlarged, broad, axe-head shaped. Pronotum was strongly excavated, straight, broader than longer and finely punctate. Scutellum triangular. Prosternum anteriorly extended to cover mouthparts. Mesosternum

was broad and short. Elytra densely punctate than pronotum and apices of elytra remain rounded. Post coxal line was straight without reaching the anterior margin. Femoral line was slightly curved and reached the posterior margin. Legs were densely hairy, tarsus 4 segmented ending with a pair of claws (Fig.1).

Micraspis discolor (Fabricius)

External morphology

Head was yellow with black compound eyes, mouth parts and antennae being brown in color. Pronotum was pale yellow to yellowish white in colour with black spots or patches towards proximal end. Scutellum black, elytra orange in color with black commissural line. The ventral side was yellowish brown, fore legs brownish yellow and hindlegs dark brown. Females bright orange in color and highly convex dorsally. Males were pale yellowish to orange in colour, pronotum having half moon shaped black marking at posterior end. Adult body was oval, convex dorsally and glabrous. Head has a pair of compound eyes. Eyes were sparsely pubescent with very short, erect hairs. Antennae 11 segmented, last 3 segments formed club and enlarged. In males, the last antennal segment was beak shaped. Elytra was slightly pubescent. The post coxal line was straight and complete. Femoral line remained straight but incomplete. The elytral epipleuron continued up to the underside or epipleuron was well developed. Legs were simple, pseudotrimerous or cryptotetramerous tarsi with apically bifid claw (Fig. 1).

Propylea dissecta (Mulsant)

External morphology

Adult body was oval, moderately convex and variable in color. Pronotum black or half black and half pale yellow. Mid dorsal line of elytra was black. Epipleura was pale yellow. Elytra was yellowish orange with three black streaks all over the body of the insect. Pronotum has a black patch extending all along mid-dorsal line from proximal to distal end with a bulging appearance towards the distal end of the pronotum (Fig. 1).

Subfamily : Epilachninae
Tribe : Epilachnini

***Henosepilachna vigintioctopunctata* (Fabricius)**

External morphology

Adult body were medium to large size, ground color appeared as pale brown or reddish brown. Elytral apex was angled and elytral spots were variable from 12 to 28 but mostly 26. Exact identification could be made by examining male genitalia which has a well developed basal knife edge and apical thorn on median lobe. Siphonal tip remaining tapering on one side (Fig. 1).

Subfamily : Scymninae
Tribe : Scymnini

Scymnus nubilus

External morphology

Small beetles possessing dark brown head, black eyes, brown mouth parts and antennae; pronotum dark brown with small spot or patch, scutellum black;

elytra dark brown to brown in color having black line or patch along with commissural line of elytra broad at the anterior end and narrowed posteriorly and it forms V shaped patch and ventral side was dark brown to black in color with brown legs. Small sized body being oval or elongated and was highly pubescent. Head was densely punctate with a pair of compound eyes. Antennae was 9 segmented and last 2 segments were enlarged gradually and scale remained elongated twice than pedicel. Antennal scape was elongated twice than pedicel. Pronotum was densely punctate and pubescent; posterior margin of the pronotum was W shaped and broad; scutellum triangular, elytra heavily pubescent with yellowish hairs, epipleuron not well developed. Coxal line was curved, complete and femoral line straightly curved (Fig. 1).

Among all the Coccinellid beetles collected, phytophagous *Henosepilachna vigintioctopunctata* is biggest in size followed by predacious *Harmonia octamaculata* whereas predacious *Scymnus nubilus* is smallest in size (Table 1).

Similarly, Joshi and Sharma (2008) mentioned the morphometrics of *Brumoides suturalis*, *Chilocorus nigrita*, *Anegleis cardoni*, *Cheilomenes sexmac-*

Table 1. Ground coloration and morphometric measurements of different Coccinellid beetle species.*

Sl. No.	Name of the species	Color	Shape	Size of the body (mm)			
				Female length	Width	Male length	Width
1.	<i>Anegleis cardoni</i>	Bright pinkish yellow	Oval	4.0	3.1	3.8	3.0
2.	<i>Brumoides suturalis</i>	Scutellum black, Elytra satiny white to creamy yellow in color with three black strips	Oval	4.2	3.8	3.9	3.7
3.	<i>Cheilomenes sexmaculata</i>	Yellowish to light brownish	Oval to sub-rounded	6.0	3.7	5.0	3.1
4.	<i>Chilocorus nigrita</i>	Shiny black colored	Almost semi-circular	4.2	3.9	4.0	3.9
5.	<i>Coccinella transversalis</i>	Black and dark red or orange color.	Elongate oval and convex	7.8	5.1	6.7	4.3
6.	<i>Henosepilachna vigintioctopunctata</i>	Reddish brown	Body usually oval dorsum strongly convex	9.8	6.5	9.3	6.4
7.	<i>Harmonia octamaculata</i>	Ground color orange yellow or red with black markings on pronotum and elytra	Elongate, oval moderately convex in shape, about three fourth as wide as long	8.7	5.6	8.0	5.2
8.	<i>Hippodamia variegata</i>	Orange to red color	Elongate-oval	5.8	3.7	5.4	3.5

Table 1. Continued.

Sl. No.	Name of the species	Color	Shape	Size of the body (mm)			
				Female length	Width	Male length	Width
9.	<i>Illies cincta</i>	Faint yellow with whitish yellow at lateral margins	Elongate oval convex	5.6	3.8	5.5	3.7
10.	<i>Micraspis discolor</i>	Dorsum orange brown/ yellowish	Hemispherical, glabrous	5.4	2.5	5.3	2.4
11.	<i>Propylea dissecta</i>	Yellowish with black spots	Elongate, convex	5.2	3.2	5.1	2.9
12.	<i>Scymnus nubilus</i>	Light to dark brownish	Elongate, moderately convex	2.8	1.6	2.7	1.4

* Average of 10 beetles.

ulata, *Hippodamia variegata*, *Illies cincta*, *Micraspis discolor* and *Propylea dissecta* ranging from 4.0-8.5 mm in length and 2.5-4.5 mm in width. Syed *et al.* (2012) reported that *Coccinella transversalis*, *Hippodamia variegata* and *Cheilomenes sexmaculata* are in range of 3.6-8.5 mm in length and 2.5-5.0 mm in width. Thite *et al.* (2013) mentioned the size of fungal feeder, *Illies cincta* was 4-5 mm in length and 3-3.6 mm in width. and also, Samik *et al.* (2015) mentioned that *Brumoides suturalis*, *Chilocorus nigrita*, *Coccinella transversalis*, *Harmonia octamaculata*, *Illies cincta*, *Micraspis discolor*, *Propylea dissecta* and *Scymnus nubilus* are ranging in 1.91-6.25 mm in length and 1.15-4.55 mm in width. Urooz and Ali (2016) recorded that *Menochilous sexmaculata* female body size was 4.5 mm and male was 3.6 mm resulting that females are in bigger in size compared to males.

CONCLUSION

Population of coccinellids varied from vegetative stage to crop maturity stage of the various crops. The peak population of coccinellid adults were during August and September when the crops were at flowering stage. *Cheilomenes sexmaculata* and *Harmonia octamaculata* were the most abundant species in different crop systems, while *Chilocorus nigrita* and *Brumoides suturalis* population was low. Whenever biological based technologies will be used, the specific identification of both pests and its natural enemy is essential. Therefore, it is recommended that efforts may be continued for further exploration of

fauna of this region which will yield more species of this region belonging to the family *Coccinellidae*. *Cheilomenes sexmaculata* and *Harmonia octamaculata* are abundant and prevailing almost in all crop ecosystems of this region, these species can be multiplied and supplied to the farmers as a part of IPM based management strategies especially against sucking pests in various crops.

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