

Pakistan Entomologist



Journal homepage: www.pakentomol.com

REDESCRIPTION OF THREE SPECIES OF THE GENUS *COCCINELLA* (COLEOPTERA: COCCINELLIDAE) FROM SINDH, PAKISTAN

*Muhammad Ali, Rokhsana Perveen, Nighat Yasmeen Siddique and Rafiq Hussain

Department of Zoology, University of Karachi, Karachi, Pakistan

ARTICLE INFORMATION

Received: May 4, 2012 Received in revised form: June 2, 2012 Accepted: June 11, 2012

*Corresponding Author:

Muhammad Ali Email: ali_zoology@yahoo.com

ABSTRACT

All coccinellids belonging to the tribe Coccinellini are aphidophagous. Six to seven species of the genus *Coccinella* have been reported from Pakistan. A very little taxonomic works on the family Coccinellidae have done from Pakistan. Three species of the genus Coccinella were redescribed from Sindh for the first time. This paper provides a detailed redescription of *Coccinella septumpunctata*, *C.undecimpunctata* and *C. transversalis*. Structures of genitalia and key to the species of the genus.

Keywords: Polyphaga, coccinellini, Coccinella, redescription, ladybirds, Sindh

INTRODUCTION

The family Coccinellidae, commonly called Ladybirds or Ladybugs, belong to the superfamily Cucujoidea and the Coleoptera suborder Polyphaga (Kovar, 1996; Hunt et al., 2007). Numerous species of Coccinellids are major biological control agents of pests such as aphids, mealvbugs, scale insects, thrips and mites in all parts of the world (Moreton, 1969; Hawkeswood, 1987; Majerus, 1994, Khan, 2001). Vandenberg (2002) noted that this family comprises about 360 genera and nearly 6000 species. Dobzansky (1932) laid the foundations of the modern classification of the genus Coccinella, he was the first to precisely define essential characters of the genus, using peculiarities in the colour pattern, especially in the structure of male and female genitalia to separate the genera Synharmonia Ganglbauer (now Oenopia Mulsant) and Coccinula Dobzhansky. Brown (1962) revised this genus in an excellent way giving a key to species and species synonymies. Among the important works on genetalia as well as on morphology of these beetles are of Chapin (1965), Robert (1985), Pope (1988) and Slipinski et al. (2007).

Poorani (2005) established a complete checklist of the coccinellidae of Indian subregion in which these three species were also included and Kumar (2006) worked on the taxonomy of the subfamily coccinellinae from India. Some

previous studies (Ghani and Muzafar, 1974; Inayatullah and Siddique, 1978, 1979, 1980; Shah, 1983; Mughal et al., 1985; Irshad, 2001) have been carried out on some morphological, taxonomic, distributional, ecological and biotic potentials of coccinellids from different areas of Pakistan. Hashmi and Tashfeen (1992) worked on Coleoptera of Pakistan and also confirmed these specimens including coccinellids from the Museum of Natural History London. They recorded seven species of the genus Coccinella. Rafi et al. (2005) wrote an informative book on the predatory ladybirds including these three species from Northern parts of Pakistan. Rahatullah et al. (2011) recorded these species from Districts Chitral and Dir Lower of Pakistan. The above cited literature reveals that a very little taxonomic works have done on these beetles in Pakistan. In the present study a comparative rediscription has been made for three species of the genus Coccinella specially based on male and female genitalia.

MATERIALS AND METHODS

Coccinellids were collected from different localities of the Sindh Province. The specimens were mounted then boiled in 10% KOH for 10-15 minutes. Various body parts were separated and mounted in Canada balsam after a brief dip in Xylol. Different structures including genitalia were studied

Cite this article as: Ali, M., R. Perveen, N.Y. Siddique and R. Hussain, 2012. Redescription of three species of the genus *Coccinella* (Coleoptera: Coccinellidae) from Sindh, Pakistan. Pak. Entomol., 34(2): 167-171.

under a Kruss Binocullar Measurements and drawings of the body and other structures were made by using a micromillimeter scale and an ocular grid. The terminologies for various taxonomic structures including genitalia and procedures used by Innayatullah and Siddique (1978) was generally followed. The taxonomic structures especially male and female genitalia after illustration were preserved in microvial with glycerine and pinned with specimen. All diagrams are to the given scales and all measurements are in millimeters.

RESULTS

Coccinella septumpunctata Linnaeus, 1758 (Fig.1A)

Coccinella 7-punctata Linnaeus, 1758: 365 (LSL)

Coccinella septempunctata: Korschefsky, 1932: 486 (cat.); Schaefer & Semyanov, 1992: 125-134 (world parasite list & bibliography).

Coccinella divaricata Olivier, 1808: 1001 (lectotype; UCCC); Korschefsky,

1932: 457 (cat.); Mader, 1936: 375 (syn.); Sudha Rao, 1962: 1341 (status);

Gordon, 1987: 13 (lectotype design.).

Coccinella confusa Sudha Rao, 1962: 1341 (status rev., morphs (Fig. D).

Size and general shape

Length 5.2-9.0 mm; width 4.0-6.5 mm; body rounded oval, convex and nearly hemispherical.

Colouration

Head black with a large triangular whitish spot adjacent to each eye; pronotum black with a small quadrate pale spot in each anterior angle; elytra yellow to dark red with 3 black spots on each elytron plus one at the anterior junction and a white mesal apex; tergites dark brown; sternites dark black.

Head

Length 1.4 mm-1.6 mm; width 2.0 mm-2.2 mm; eyes small with minute facets; labrum with anterior margin emarginated, tormae somewhat triangular; distigalea beak like; anterior margin of ligula straight.

Thorax

Length of pronotum 2.0-2.5, width 3.0-3.5, anterior margin of pronotum slightly emarginated; prosternal process narrower bearing relatively longer and well marked carina; posterior portion of basisternum of mesothorax having vertical mesal sides; mesocoxal line curved.

Abdomen

Postcoxal line slightly curved meeting the posterior margin of 3rd sternite more towards laterally; 8th sternite in male bears four groups of very long setae on the anterior, posterior and on either sides of the depression.

Male genitalia (Fig. B, C)

Sipho sharply curved; siphonal capsule consisting of a larger, slightly lobed opposite and a sharply curving, blunt adjacent arm bearing a ventral hook at its base, distally siphon flattened bearing a triangular process; basal piece cup shaped with deep emarginations at the anterior margin; basal lobe hollow, blunt apically, lateral sides bent ventrad and then narrowing down gradually diverge and merge with dorsal margin; trabes narrow proximally, curved, flattened and pointed distally.

Female genitalia (Fig. D, E)

Lateral plates with deeply curving mesad; genital plates oval with long, narrow anterior portion almost perpendicular to the basal portion and outer s-shaped margin; thick walled spermathecal capsule annulated, deeply curved appearing as a sign of interrogation; cornu lobe like; ramus shorter; nodulus narrow and longer; base of infundibulum well sclerotized and rounded.



Material examined

Several specimens $(\mathcal{J}, \mathcal{P})$, in NHM, Karachi, Pakistan: $2\mathcal{J}, 3\mathcal{P}$, Tandojam, 15. iv. 1972, Tehmina, lucern; $2\mathcal{J}$, Malir, 10. v. 1979, Israr, Cabbage; $1\mathcal{P}$, Karachi, 5. x. 1980, Khan; $1\mathcal{P}$, Karachi, 10. vii. 1982, Mehdi; $1\mathcal{P}$ and $1\mathcal{J}$, Landi, 15. xii. 1967, Nisa, Wheat; $6\mathcal{J}, 5\mathcal{P}$, Hyderabad, 20. v. 2009, Ali, lucern.

Comparative note

It is most closely related to *C. transversalis* in shape of siphonal capsule and spermatheca but separated by the pattern of spots on elytra, metacoxal line, and arrangement of setae on the 8^{th} sternite and shape of tegmen.

Coccinella undecimpunctata Linnaeus, 1758 (Fig. 2A)

Coccinella undecimpunctata Linnaeus, 1758: 366 (lectotype: LSL); Mulsant, 1846: 71; 1866: 85; Iablokoff-Khnzorian, 1979: 66; 1982;

1846: 71, 1866: 85, 1866861-Kinizonan, 1979: 66, 1982, 351; Pope, 1989: 651 (rev.).

Coccinella (*Dobzhanskia*) *undecimpunctata*: Iablokoff-Khnzorian, 1982: 71 (rev.).

Size and shape

Adult length 4.5-5.5 mm; width 2.7-4.1 mm; body elongate, oval, convex.

Colouration

Head black with a small oval pale spot adjacent to each eye; pronotum dark black with a larger pale spot in each anterior angle; elytra yellow to red with five black spots plus a common scutellar black spot; tergites dark brown; sternites dark black.

Head

Length 1.2-1.3 mm; width 1.5-1.7 mm; eyes large with minute facets; labrum with anterior margin emarginated; tormae somewhat elongated; distigalea blunt; anterior margin of ligula slightly pointed.

Thorax

Length of pronotum 1.7-1.9 mm; width 3.2-3.5 mm; anterior margin of pronotum deeply emarginated; prosternal process rectangular, much elevated with narrow carina; mesocoxal line vertical mesad.

Abdomen

Postcoxal line deeply curving meeting the posterior margin of 3^{rd} sternite, more towards centre; entire depression on 8^{th} sternite in male surrounded by setae.

Male genitalia (Fig. B, C)

Sipho slightly curved, distally bifid;siphonal capsule just flattened; basal piece elongated with slight emargination;basal lobe well thickened, broadest proximally, expanded medially and tapering distally;trapes short hollow with folded margins, left margin thick medio-distally.

Female genitalia (Fig. D,E)

Lateral plates slightly curving mesad and narrow cauded;

genital plates somewhat quadrangular, broadest posteriorly with narrow slightly curving laterad anterior portion; spermathecal capsule smooth, slightly curving; ramus broader and longer; nodulus short and thickened; base of infundibulum funnel shaped.

Material examined

Specimens (\mathcal{J}, \mathcal{P}), in NHM, Karachi, Pakistan: $1\mathcal{J}, 1\mathcal{P}$, Malir, 5.xii.1965, Ahmad, Lucern; $3\mathcal{J}$, Karachi, 10.viii.1972, Khan, Wheat; $2\mathcal{J}, 2\mathcal{P}$, Karachi, 12.v.2009, Ali, lucern.

Comparative note

It is slightly related to *C. septumpunctata* in having spots on elytra not patches, movement of metacoxal line towards lateral margin but separated entirely by the male genitalia.





Fig. 2

Coccinella transversalis (Fabricius), 1781 (Fig. 3)

Coccinella transversalis Fabricius, 1781:97 (lectotype $\stackrel{\circ}{+}$; BMNH); Mulsant, 1850: 126, 1022; Timberlake, 1943:14; Iablokoff-Khnzorian, 1979: 68; 1982: 391; Pope, 1989: 652 (rev.). 21

Coccinella repanda Thunberg, 1781:18 (lectotype $\stackrel{\circ}{+}$; UU); Mulsant, 1850: 1022

(syn.); Crotch, 1871: 3; 1874:117; Korschefsky, 1932: 483 (cat.); Pope, 1987: 62 (rev., lectotype design).

Size and shape

Adult length 6.0-7.5 mm; width 4.5-5.0 mm; body slightly elongated, convex..

Colouration

Head black with a medium sized triangular pale spot adjacent to each eye; prontum black with an antero-lateral orange spot in each anterior angle; elytra dull orange to yellowish brown with three black transverse patches plus the common scutellar spot in the form of a broad longitudinal black band along the inner junction of elytra; tergites brownish black; sternites dark black.

Head

Length 1.4-1.5 mm; width 1.9-2.3 mm; eyes small and minute facets; labrum with anterior margin emarginating; tormae narrow and pointed; distigalea narrow proximally; ligula notched anteriorly.

Thorax

Length of pronotum 2.1-3 mm; width 3.3-4 mm; anterior margin of pronotum slightly emerged; proternal process with a pair of carinae hardly extend beyond the level of the front coxae; mesocoxal line straight and not reaching to lateral margin.

Abdomen

Postcoxal line 'v' shaped not reaching the anterior margin of 2^{nd} sternite; the entrie depression on the 8^{th} sternite in male covered by small setae while the posterolateral margin of the segment bearing long setae.

Male Genitalia (Fig. B, C)

Siphon curved normally; opposite arm of siphonal capsule elongated, distally broader; adjacent arm small deeply curved ,distally narrow and pointed; basal piece elongated with well developed posterior emergination; basal lobe thick distally ,expanded thorough medially; trabes flattened, bending laterally and expanded distally.

Female genitalia (Fig. D, E)

Lateral plates with deep curving notched mesad and broader cauded; genital plates somewhat triangular, broader proximally with broad and short laterad anterior portion; spermathecal capsule with thick dorsal surface; deeply curved, narrow and elongated cornu; ramus short and thick; nodulus short and broader basally; infundibulum elongated with rounded base.

Material examined

Several specimens $(\mathcal{J}, \stackrel{\circ}{\uparrow})$, in NHM, Karachi, Pakistan: $1\mathcal{J}, 2\stackrel{\circ}{\uparrow}$, Tandojam, 10. iv. 1972, Tehmina, lucern; $2\mathcal{J}$, Malir, 15. x. 1979, Israr, lucern; $1\stackrel{\circ}{\uparrow}$, Karachi, 10. v. 1980, Razzaq, vegetables; $1\mathcal{J}$, Karachi, 12.vii. 1982, Mehdi, Wheat; 23° , 1° , Landi, 5.xii. 1967, Nisa; 13° , 1° , Hyderabad, 10.v.2009, Ali, Vegetables.

Comparative note

It is most closely related to *C. septumpuctata* in the shape of siphonal capsule and have slightly similar cornu of spermatheca but separated due the six patches on elytra, v-shape metacoxal line and shape of tegmen.



C. transversalis

Key to the species of the genus Coccinella

1- Elytra yellowish brown with 7 or 11 black spots; metacoxal line slightly or deeply curved meeting the posterior margin of 3^{rd} sternite; spermatheca with pointed cornu_____2 Elytra dull orange to yellowish brown with 6 transverse patches plus a longitudinal band on the inner junction; metacoxal line v-shaped not reaching the anterior margin of 2^{rd} sternite; spermatheca with broader cornu.

_____C. transversalis

2- Head with a pair of large triangular white spots adjacent to eyes; pronotum with a small quadrate white spot on each anterior angle; prosternal process narrower; 8^{th} sternite in male with four groups of long setae; siphonal capsule with adjacent arm; sipho broader terminally; basal piece with deep emarginations at the anterior margin; basal lobe broadest proximally and tapering distally.

C. septumpunctata

3- Head with a pair of small, spherical, white spots adjacent to eyes; pronotum with a large antero-lateral yellow spot on each anterior angle; prosternal process rectangular much elevated;8th sternite in male surrounded by long setae entirely; siphonal capsule without adjacent arm; sipho pointed terminally; basal piece with slight emargination at anterior margin; basal lobe medially expanded.

C. undecimpunctata

DISCUSSION

Dobzhansky (1932), separated the genus Coccinella from the genera Synharmonia Ganglbauer, 1899 (now Oenopia Mulsant, 1850) and Coccinulla Dobzhansky, 1925 based on colour pattern and male and female genitalia. On elytra seven and eleven black spots plus a common scutellar one in C. septumpuctata and C. undecimpunctata while six black patches with a longitudinal band on inner junction of elytra in C. transversalis are found. According to previous literature, the siphonal tip of C. septumpunctata bears a triangular process but of C. undecimpunctata is bifid like P. coccidivora, N. regularis and Illeis indica Timberlake while that of C. transversalis is narrower and pointed. Genital plates of C. septumpunctata are oval but that of C. undecimpunctata somewhat quadrangular while the base in C. transversalis broader and rounded. The medial lobe in C. septumpuctata is broadest proximally and tapering distally, in C. undecimpunctata expanded medially while in C. transversalis short and tapering distally, spermatheca in C. septumpunctata larger with slightly pointed cornu, in C. undecimpunctata medium sized with deeply pointed cornu and in C. transversalis it is short and broader .In Pakistan, Innayatullah and Siddiqui (1978,1979,1980) worked on the comparative anatomy of head capsule, thorax and abdomen of C. septumpunctata and C. undecimpunctata. Rafi et al. (2005) described the external morphology of predatory ladybirds from Northern parts of Pakistan.

ACKNOWLEDGEMENTS

The authors express his sincere thanks to Dr. Claudio Caneperi of Italy for his helps in identification and confirmation of these specimens kindheartedly. I express my gratitude to my worthy supervisor Dr. Rokhsana Perveen, Department of Zoology, University of Karachi for her guidance and cooperation to complete this research work.

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