

First Record of the Predator Ladybeetle, *Hyperaspis Trifurcata* (Schaeffer) (Coleoptera: Coccinellidae) Feeding on the Cochineal Scale Insect, *Dactylopius Opuntiae* (Hemiptera: Dactylopiidae), in Jordan

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Abstract:- The ladybird beetle *Hyperaspis trifurcata* Schaeffer is a predator of the cochineal scale *Dactylopius opuntiae* (Hemiptera: Dactylopiidae) that was recorded for the first time in the northern region of Jordan (Jerash, Irbid and Ajloun) where the prickly pear plant *Opuntia ficus-indica* (L.) Miller (Cactaceae) is cultivated and widely attacked by the cochineal scale insect. The cochineal insect population was monitored in conjunction with the activity of the predatory beetle in six farms. Feeding activity of *H. trifurcata* on nymphs in cochineal colonies was recorded. This confirms and indicates its predatory being as a natural enemy.

Keywords:- Cochineal scale insect, Prickly-pear cactus, predator ladybeetle, Geographic distribution, north region, *Hyperaspis trifurcata*.

I. INTRODUCTION

The cultivation of the prickly pear plant *Opuntia ficus-indica* (L.) Miller (Cactaceae) is widespread in various regions of northern, eastern and central Jordan (400 - 800 m) above sea level. It is an important traditional plant that contributes to meeting some of the needs of low-income rural families. It does not require much care and its cultivation is inexpensive for farmers, due to its tolerance of drought and pests and is suitable for most types of soil. Its cultivation depends on rainwater in the winter, and it is characterized by the abundant production of desirable fruits required for the local consumer in the summer, where they are consumed fresh. Most aloe vera is grown as fences around farms or on independent farms.

In 2017, an invasive pest was recorded on cactus plants in northern Jordan, Cactus pear Cochineal scale, *Dactylopius opuntiae*, (wild cochineal) which is a sap-sucking insect that causes a negative impact on both the production of fresh fruit and rural agricultural holdings. As a continuation of the efforts made to combat it, we have worked at NARC, in cooperation with ICARDA, to carry out a survey of prickly pear farms in Jordan. Sawsan Hassan et al. (2021) in order to evaluate the spread of the cochineal pest and search for its natural enemies as an attempt to find an alternative to chemical control which results in damage to the environment and human health. During the summer season, when the cochineal insect is active, a ladybird beetle Individual was

observed on the heavy-infested cladodes of prickly pear plants, beetles belong to the order Coleoptera. Before the Cactus pear Cochineal scale reached Jordan, its presence was recorded in several countries in the Mediterranean basin, especially in Israel, where two Mexican predators; *Leucopina bellula* (Diptera: Chamaemyiidae) and *Hyperaspis trifurcata* (Coccinellidae) were used to combat it, with promising results Zvi Mendel (2017).

II. MATERIALS AND METHODS

Our research study was conducted at the Division of Entomology, National Agricultural Research Center, Jordan, during the summer season from April to September 2021. Our survey covered the governorates of Irbid, Ajloun and Jerash. Specimens of these Ladybird beetles associated with *D. opuntiae* in heavily infested prickly pear holdings were collected from different localities by manual picking and using an aspirator from infected cladodes recorded in (Table 1). The specimens were kept with 75% alcohol in small test tubes and then taken to the anatomy lab in the National Agricultural Research Center NARC for identification, in the meantime one specimen in a tightly closed tube was shipped by DHL to the Natural History Museum in the UK to ensure our identifications and they were identified as *Hyperaspis trifurcata* (Coleoptera: Coccinellidae). Moreover, specimens of adult photos were sent by Email to Ph.D. Leslie Mertz, KnowYourInsects.org, and Alain Migeon, INRAE - CBGP Montpellier France, confirmed the same result. The specimen's locations decimal latitude, and longitude were pinned using the location app on a smartphone and shared with the GIS department in NARC for mapping (Figure 1). In the entomology lab at the National Agricultural Research Center, males were separated from females based on the characteristics of each; male insects have yellow clypeus colour (Figure 5) while female insects have black one (Figure 4) according to Vanegas-Rico et al. (2016), The protocol of insect mounting and dissecting was followed which had been described by Chelliah (1965). The specimens were put in hot water to soften their bodies. Then, the abdomen was detached from the body and boiled in a 10% potassium hydroxide solution. Then, washed in hot water and dipped in glacial acetic acid. After washing in 70% Ethanol to be dehydrated, soaked in clove oil. The abdomen was put in a cavity slide and glycerin. The dissecting needles were used to isolate

genitalia under a stereo zoom binocular microscope, then it was examined morphologically after a fuchsine dye was added, then washed with 70% ethanol and mounted on a slide. Measurements of the parts of male genitalia were achieved with a compound microscope connected with computerized pixel TCapture software for identifying the genital parts that depend on the difference in structure and size of genitalia; The form of the Siphon and Siphonal capsule, the basal or median lobe being symmetrical or asymmetrical, and the shape with the length of the parameres, in comparison to the shape of the median lobe. *Neethu Roy (2021)*. (Figure 2).

III. DESCRIPTION AND DIAGNOSIS

Body measurements: 2.9 mm×2.30 mm. with convex oval shape. The colour pattern of Elytron is black interspersed with white in both males and females (Figure 4). Extra pubescence on the clypeus and labrum, the pronotum (that covers the dorsal surface of the thorax) is relatively long and black with a narrow yellowish lateral border. The postcoxal line is evenly curved throughout not connected with the posterior margin of the first sternum, The Alutaceous line is densely punctured. Male genitalia are shown in (Figures 2, 3).

IV. DISCUSSION

All identification results confirm that this ladybird beetle is *Hyperaspis trifurcata* Schaeffer a member of The Coccinellidae family in Coleoptera containing more than 6,000 species (LiHen et al. 2021). Most of this family are entomophagous. They feed mainly on (scales and mealybugs), (aphids), (Psyllids) and (whiteflies) Lundgren (2009) and nymphs of Dactylopiidae (Vanegas. 2010). *Hyperaspis trifurcata* is a species associated with plants of the family Cactaceae, 400 species included in the Genus of *Hyperaspis* (Raimundo. 2006). It is known as a predator of the cochineal insect *Dactylopius coccus*, *D. opuntiae*. in Mexico and Texas in the U.S. (Gordon 1985). This study reveals the existence of this insect ladybeetle (*Hyperaspis trifurcata*) in Jordan as an important predator of the cactus mealybug (*Dactylopius opuntiae*. Cockerell), which appeared in the north of Jordan in 2017 (Ahmad M. Katbeh 2019).

QUOTE TEXT

“Members of the genus Hyperaspis can be distinguished from other genera of Hyperaspidini by the following combination of characteristics: an oval to round moderately convex body, dorsally glabrous; yellow heads in males (Figure 5) and blackheads in females (Figure 4); antennal insertion exposed in front of the eyes; antennae are of 10–11 segments, scape and longer than wide; terminal maxillary palpomere slightly emarginated at the apex; mandible is bifid apically, basal tooth strongly curved with rounded apex. long, apically distinctly emarginated Clypeus, laterally smoothly, abruptly or obliquely joined to front, often concealing the entire or most of labrum; short, narrow and weakly sclerotized labrum, large, wider than long scutellum; narrow elytral epipleuron, usually grooved and foveate medially; prosternal process slightly convex, usually with two carinae of variable length. The Tibia of the pro-leg is usually slender and rarely flanged. Tarsal claw with or without a basal tooth. Abdominal postcoxal lines are incomplete. The

sixth abdominal ventrite in males is weakly modified apically, and rounded in females, (Gordon and Canepari 20014). “

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- Alain Migeon, INRAE - CBGP Montpellier France, photo identification.
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Fig . No	caption
Figure 1.	Distribution map of <i>Hyperaspis trifurcata</i> . new records. (NARC, 2021)
Figure 2.	male genitalia microscopic photo (NARC)
Figure 3.	b, c male genitalia . d, e dorsal view. (Gordon 1985).
Figure 4.	<i>H. trifurcata</i> (Female) NARC,2021
Figure 5.	<i>H. trifurcata</i> (Male) NARC,2021
Table 1.	<i>H. trifurcata</i> data Collection of specimens in prickly pear plant. 2021

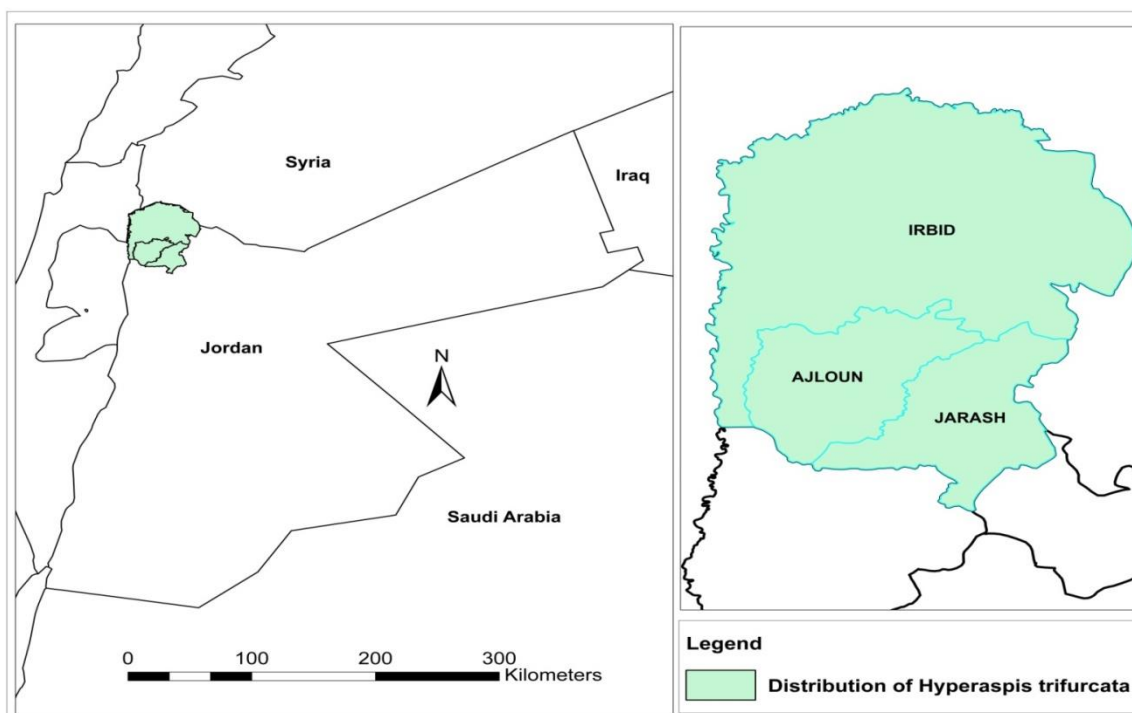


Fig. 1: Distribution map of *Hyperaspis trifurcata*. (New records. NARC, 2021)

place	Date	specimen	site		Temp C°	host plant	Collector
			Lat	Lon			
JERASH,Nbihod	Apr8	<i>Hyperaspis trifurcata</i>	32.24422	35.92097	27	<i>Opuntia ficus-indica</i>	Amer Mahasneh
JERASH,Kufair	Aug 5	<i>Hyperaspis trifurcata</i>	32.25635	35.84312	32	<i>Opuntia ficus-indica</i>	Amer Mahasneh
JERASH,Baleela	Aug 1	<i>Hyperaspis trifurcata</i>	32.39094	35.95394	31	<i>Opuntia ficus-indica</i>	Amer Mahasneh
IRBID, Hartha	Sep 2	<i>Hyperaspis trifurcata</i>	32.71301	35.75874	28	<i>Opuntia ficus-indica</i>	Mohammed Tawyah
IRBID, Juhfia	Aug6	<i>Hyperaspis trifurcata</i>	32.64632	35.72136	30	<i>Opuntia ficus-indica</i>	Mohammed Tawyah
Ajloun, Halawa	Apr12	<i>Hyperaspis trifurcata</i>	32.36867	35.65586	25	<i>Opuntia ficus-indica</i>	Mohammed Tawyah

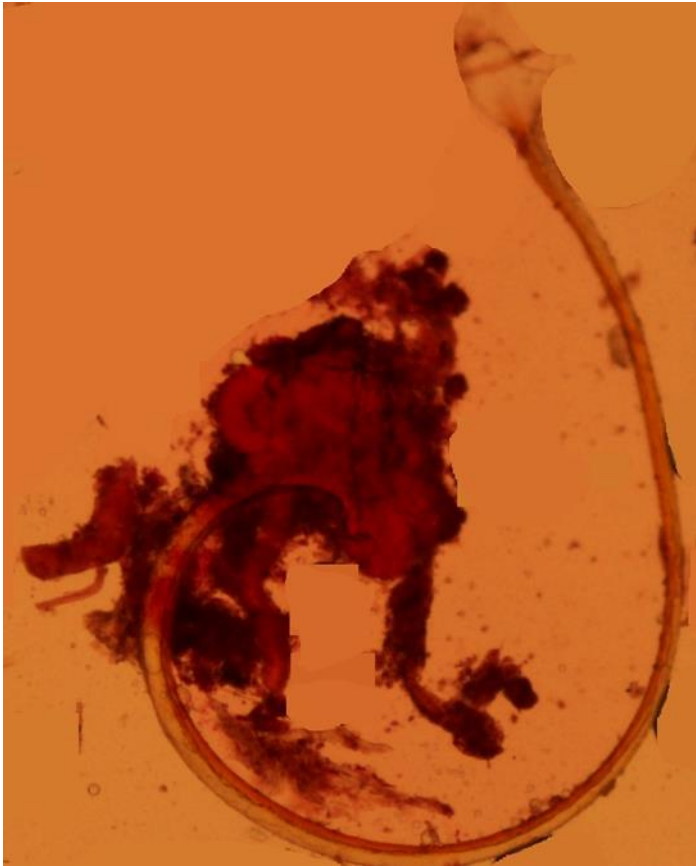


Fig. 1: Male genitalia microscopic photo (NARC)

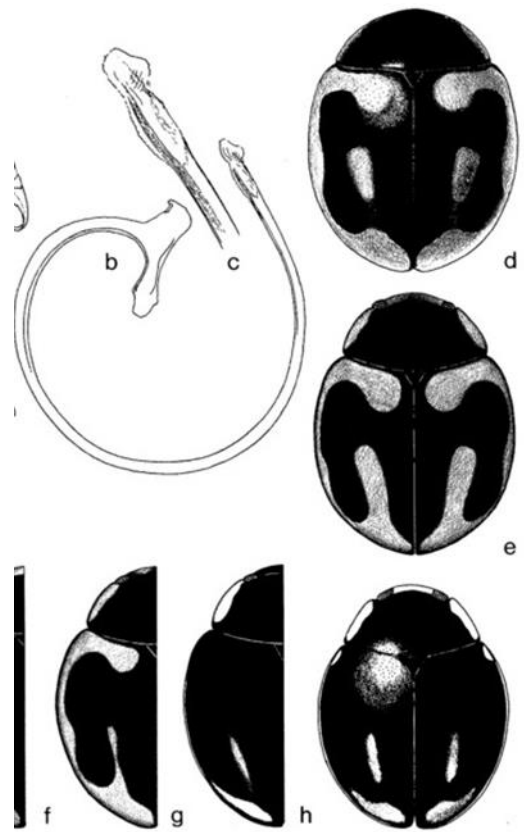


Fig. 2(b, c male genitalia . d, e dorsal view. (Gordon 1985.)



Fig. 5: *H. trifurcata* (Male) NARC,2021



Fig. 4: *H. trifurcata* (Female) NARC,2021