

SDH-ACTIVITY DURING THE LARVAL GROWTH AND METAMORPHOSIS OF *COCCINELLA SEPTEMPUNCTATA* LINN. (COL., COCCINELLIDAE)

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ABSTRACT. - KUMAR, N., S.S. DHILLON, D.S. SIDHU, and S.P. KAUR, Zool Dep, Punjabi Univ, Patiala, India, - SDH-Activity During the Larval Growth and Metamorphosis of *Coccinella septempunctata* L. (Col., Coccinellidae) L. - Acta entomol. Jugoslav., 1984., 20(1-2): 95-100. (Engl., Croat. Summ.)

The first instar larva of *Coccinella septempunctata* Linn. possesses less activity as compared to the subsequent larval instars. The SDH-activity rises as the larval growth proceeds, and a quite high level is discernible at the end of fourth instar larva. The event of each larval-larval moult is also marked by high value of SDH. The latter remains high during the prepupal life, but at the incidence of larval-pupal ecdysis, it declines. SDH level rises between 64 and 72 hours, but declines between 84 and 132 hours of pupal life. However, SDH-activity enhances again during the later pupal development of *Coccinella septempunctata*.

Coleoptera - Coccinellidae, *Coccinella septempunctata*, succinate dehydrogenase (SDH), postembryonic development, metabolism, enzymes, mitochondria.

Introduction

Succinate dehydrogenase (SDH) is a mitochondrial enzyme and is firmly associated with inner mitochondrial membrane. The level of SDH in a tissue is an index of its capacity for the oxidative metabolism. Bhakthan and George (1963) and Crabtree and Newsholme (1975) have expressed the opinion that SDH-activity in the flight muscles of those insects which make sustained flight, is higher than the vertebrate muscles. There is a great dearth of information with regard to the SDH-activity. The changes in SDH-activity have not been followed during the development of insects. But whatever few reports are available, deal mostly with the SDH-activity in different tissues generally and in flight muscles, particularly. As this

enzyme is an important one in the oxidative metabolism, so the present work has been designed during the development of *Coccinella septempunctata* Linn., a carnivorous insect.

Material and Methods

The adults of experimental insects. *Coccinella septempunctata* Linn., were collected from the fields of *Brassica campestris* (Kali Sarson) and *B. napus* (Peeli Sarson) and *Solanum melongena* plants, infected with aphids *Lipaphis erysimi* (Kaltenbach) around the campus of Punjabi University, Patiala (India). The insects after being collected from the mustard fields, were reared in the laboratory according to Singh (1972) at a temperature ranging between 25°C to 27°C and 70 ± 5 per cent relative humidity, and at a photophase of 10 hours. All the larval instars, prepupae and pupae of different chronological ages were taken from the laboratory culture and proceeded for the estimation of SDH-activity. The methods employed for the quantitative determination of SDH-activity and soluble proteins were that of Nachlas et al. (1960) and Lowry et al. (1951) respectively. The specific activity represents as µg diformazan formed/mg soluble protein/min. at 37°C.

Results and Discussion

The first instar larva of *Coccinella septempunctata*, shows a very low level of SDH-activity, thereby indicating that this instar after 24 hours of hatching possesses potentially less active glycolytic enzymes. The specific activity of SDH goes on increasing during the subsequent larval growth, which touches a quite high value at 72 hours of the fourth instar larval life (Fig. 1). The slightly lower level of SDH-activity in the first instar larva as compared to the subsequent instars, depicts the low rate of oxidative metabolism and in the last three instars, it gains momentum. Botev and Bankova (1975) have demonstrated the occurrence of a strong SDH-activity in the larval muscles. The present observations somewhat coincide with the findings of Kaur (1984), who has also reported that the activity of SDH increases during the growth of fourth instar larva of *Zabrotes subfasciatus* Boh. upto 48 hours, subsequently, however, the activity decreases. At the incidence of each larval-larval moult in *C. septempunctata*, the activity of SDH increases abruptly to touch a high value (Fig. 1). Thus, it is clear enough that during this period of transformation from one instar to another, a good amount of energy is needed, which can only be provided through an efficient mechanism and that is aerobic respiration, during which the SDH is quite active.

When the mature fourth instar larva of *C. septempunctata* enters into the pre-pupal stage, the activity of SDH enhances slightly and this rise continues throughout its life (Fig. 2). Thus, it can be said that during the prepupal life, the rate of oxidative metabolism is high in the cells. This increase may also be due to the histolysis of larval tissues, which are rich in LDH-activity and with their loss the release of mitochondrial enzyme i.e. SDH takes place for aerobic type of respiration. Kaur (1984) has also claimed that the activity of SDH increased in the prepupal life of *Zabrotes subfasciatus*. At the time of larval-pupal ecdysis in *C. septempunctata*, it shows an attenuation (Fig. 2), which in turn corresponds to the rise in LDH-activity at this particular event in this

insect (Kumar, 1984). It seems thus, that anaerobic respiration predominates the aerobic respiration during the quiescent period of pupal life in *Coccinella*.

The increased level of SDH-activity during the period ranging between 64 hours and 72 hours of pupal life in *Coccinella*, clearly shows that more pyruvate is entering into the TCA cycle instead of being converted into lactate, because LDH-enzyme which catalyses the conversion of pyruvate into lactate in the cytoplasm, also shows a low level during this phase of pupal life in *C. septempunctata* (Kumar, 1984). Moreover, during this period, the differentiation of adult organs is going on, with the result that more energy is needed, which can be taken only by oxidative metabolism. A strong activity of SDH in the muscle fragments of the pupal life of *Musca domestica* (L.) has also been documented by Botev and Bankova (1975).

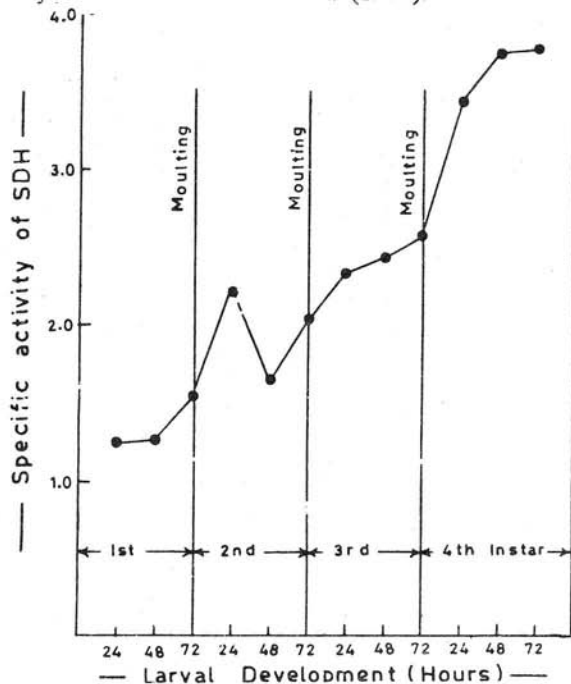


Fig. 1. The specific activity of SDH during the larval growth of *C. septempunctata* Linn.

The activity of SDH decreases during the period ranging between 84 hours and 132 hours of pupal life in *C. septempunctata* (Fig. 2), with a simultaneous decline in glycogen contents (Kumar, 1984). The LDH-activity during the same period, however, shows an upward trend in this insect (Kumar, 1984). It may be possible that during this period of histogenesis, the degradation of glycogen is taking place under anaerobic conditions, which consequently increases the activity of LDH, while simultaneously resulting in decrease in the SDH level. Tikhonrava (1972) has found out on the basis of her observations the activities of redox enzymes, cytochrome oxidase and SDH was chosen as an index of metabolic activity. She has also observed that the activity of these enzymes changes during the different developmental stages, and in accordance with intensity of metabolism.

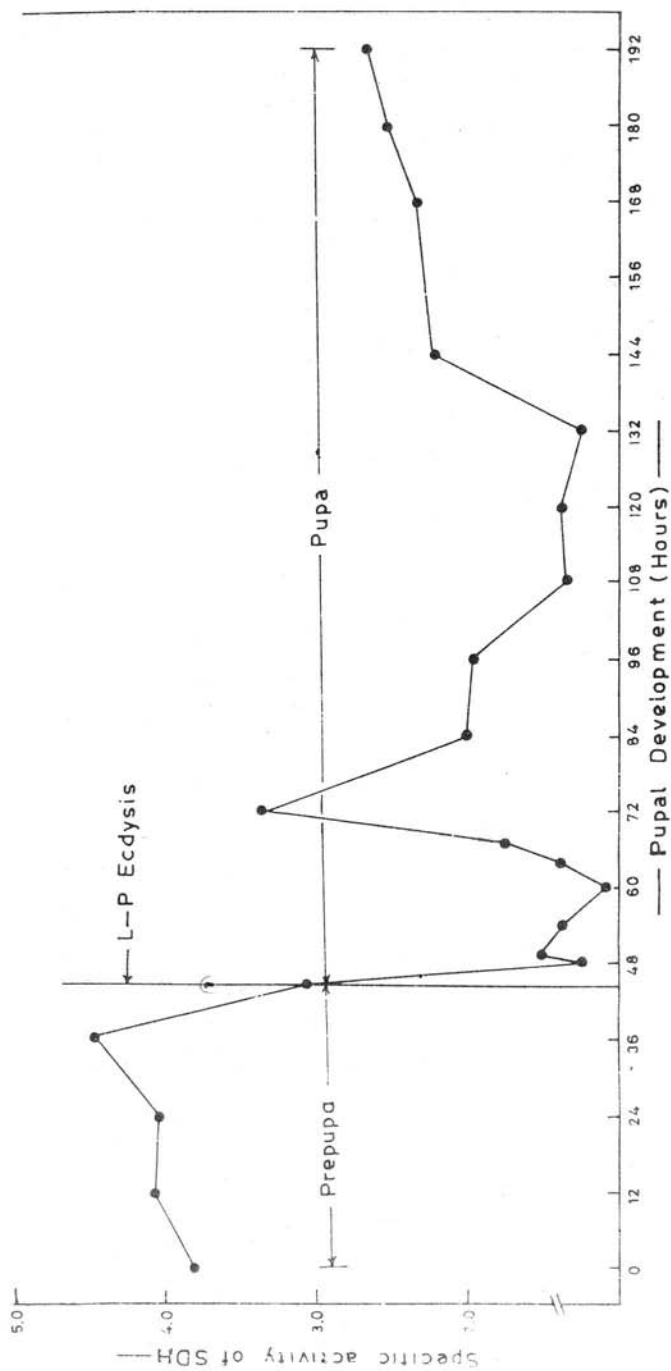


Fig. 2. SDH-activity during the prepupal (PP) and pupal (P) development of *C. septempunctata* Linn.

During the late pupal life of *C. septempunctata*, the SDH-activity increases with a parallel decline in LDH-activity and glycogen contents (Kumar, 1984). This means that during this pupal period, when adult organs are in the process of differentiation, the glycogen degradation is taking place, under aerobic conditions. Similarly, Kaur (1984) has also observed an increased level of SDH-activity during the later part of pupal life in *Zabrotes subfasciatus*. However, Botev and Bankova (1975) have reported a decreasing trend of SDH activity towards the end of pupal life in *Musca domestica*.

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Sažetak

**AKTIVNOST SDH ZA VRIJEME RASTA I METAMORFOZE LIČINKE
COCCINELLA SEPTEMPUNCTATA L. (COL., COCCINELLIDAE)**

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Sukcinat dehidrogenaze (SDH) je enzim membrane mitohondrija pa njegova razina u tkivu pokazuje sposobnost za oskidativne metaboličke procese. Prvi stadij ličinke *Coccinella septempunctata* L. pokazuje manju aktivnost u usporedbi s narednim stadijima. Aktivnost SDH počinje s rastom ličinke pa se prilično visoka razina razabire na kraju četvrtog stadija. Visokim vrijednostima SDH obilježeno je također doba za svakog presvlačenja ličinke. Ta visoka razina ostaje i za vrijeme prepupe, ali ona opada kada se javlja larvalno-pupalni ekdison. SDH zatim raste između 64 i 72 sata života kukuljice, da bi se smanjila između 84 i 132 sata. Međutim, ona se ponovo povećava za vrijeme kasnijeg razvoja kukuljice.

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