P: ISSN No. 0976-8602 RNI No. UPENG/2012/42622 VOL.-III, ISSUE-III, JULY-2014
E: ISSN No. 2349-9443
Asian Resonance

Fluctuation in Differential Haemocyte Count (DHC) During Postembryonic Development of the Red Cotton Bug Dysdercus Koenigii

Abhay Kumar Gupta
Deptt. of Bio-Technology
J.J.T. University,
Jhunjhunu, Rajasthan

Ashutosh Mishra
Deptt. of Zoology
K.N. Govt. P.G. College,
S.R.N, Bhadohi

Abstract

During post embryonic development six types of haemocytes are recognized viz. Prohaemocytes (PRs), Plasmatocytes (PLs), Granulocytes (GRs), Adipohaemocytes (ADs), Oenocytes (OEs) and Vermicytes (VEs). Among these PRs and PLs are dominating in 3rd instars, but in later instars GRs becomes more. In early age of instars PRs more in proportion but in late age of instars PLs and GRs. ADs, OEs and VEs are shows presence only in late of 5th instars.

Keywords: DHC, Prs, Pls, Grs, Oes, Ves, Postembryonic Development

Introduction

Insects haemocytes (Blood Cells) present in the haemonymph (Blood) are categorized into several types. They perform various physiological functions like phagocytosis, encapsulation, detoxification, synthesis and transport of nutrient and hormones for proper growth and wound healing by way of connective tissue formation (Sorrentino et al 2002, Fegueirado et al 2006, Merchant et al 2008, Pandey et al 2010). Knowledge of normal haemocyte of insects is necessary to physiologist, biotechnologist and biochemists, as alteration in structure, types and number of cells reflects change in physiological and biological processes. PLs and GRs are described as the main cell types involved in defense mechanism.

PRs serves as stem cells, these cells show transformation into other and vice versa. Sometimes the increase or decrease in some types of haemocytes corelated to their interconversion (Bhagwati and Mahanta 2012, Pandey and Tiwari 2012).

No doubt many literatures available on types of haemocytes, DHC and their function but mostly they are limited to one or two instars only therefore the present study has been taken to investigate and findings are discussed.

Materials and methods

The red cotton bugs, Dysdercus koenigii were collected as experimental insects from the cotton field in the vicinity of Banaras Hindu University and lady's finger cultivated fields in the nearby villages. The insect were raised in glass jars in a BOD incubator set at 28°± 1°C; 16 hr. photoperiod and 75% RH. They were fed on water soaked cotton seeds. With experience different nymph instars can be recognized by their size. The 1st and 2nd instars nymph being too small to yield adequate blood sample were excluded, the remaining 3rd , 4th, and 5th instars of both sexes were sorted out and cut their antennae for haemonymph or blood drop sample taken at 24hr.intervals to determine the DHC, at least 100 cells chosen from random areas of stained blood smear were counted on a laboratory blood counter and their percentage of cells was calculated (Berger et al,2003).

Results

Table 1 and Figure 1

Table - 1
DHC in III through V Instars (both Females and Males)

Age in Days	Hacmo-cyte Types	Instar III		Instar IV		Instar V	
		Female % ± SD	Male % ± SD	Female % ± SD	Male % ± SD	Female % ± SD	Male % ± SD
0	PRs	53.7 ± 2.71	51.6 ± 2.31	43.3 ± 1.45	44.8 ± 1.63	26.4 ±0.79	29.1 ± 1.26
	PLs	25.3 ± 1.82	26.4 ± 1.43	26.8 ± 1.53	25.2 ± 2.14	30.2 ±1.53	31.2 ± 1.17
	GRs	21.0 ± 1.61	22.0 ± 1.57	29.9 ± 1.72	30.0±1.81	43.4 ±2.33	39.7 ± 1.62
1	PRs	49.2 ±2.43	49.8 ±2.64	37.4 ± 1.80	42.3 ± 1.97	24.7 ±0.81	21.8 ± 1.13
	PLs	27.9 ± 1.92	26.9 ± 1.42	32.5 ±2.43	26.7 ± 1.55	35.8 ± 1.45	39.7 ± 1.15
	GRs	22.9± 1.51	23.9 ±2.05	30.1 ± 1.81	31.0 ± 1.66	39.5 ± 1.32	38.5 ± 1.74
2	PRs	45.6 ± 2.83	45.1 ±3.33	30.4 ± 1.67	36.3 ±1.57	13.8 ±0.67	13.5 ±0.56
	PLs	29.2 ± 2.15	30.7 ±1.11	35.4 ± 1.76	29.2 ±1.83	48.2 ± 2.81	44.1 ±2.63
	GRs	25.2 ± 1.32	24.2 ± 0.60	34.2 ±1.52	34.5 ± 1.64	30.6 ± 1.41	27.1 ± 1.17
	ADs	00.0 ± 0.00	0.00 ±0.00	0.00 ±0.00	0.00 ± 0.00	3.90 ±0.81	8.00 ±0.98
	OEs	00.0 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	3.50 ±0.34	7.30 ± 0.21
3	PRs	43.7 ±3.14	44.1 ±2.92	28.0 ± 0.76	33.4 ± 1.39	10.5 ±0.61	11.8 ±0.77
	PLs	29.6 ±2.55	30.9 ± 1.81	36.0± 1.12	29.7 ± 1.58	50.6 ±3.15	45.3 ±2.93
	GRs	26.7 ±1.24	25.9 ±1.53	36.0 ± 1.35	36.9±1.76	25.5 ± 1.27	24.5 ±1.12
	ADs	00.0 ± 0.00	0.00 ±0.00	0.00 ± 0.00	0.00 ± 0.00	7.70 ±0.71	11.2 ±0.69
	OEs	00.0 ± 0.00	0.00 ±0.0	0.00 ± 0.00	0.00 ± 0.00	5.70 ±0.52	7.20 ±0.19
4	PRs	43.0 ±2.95	43.3 ± 1.41	23.6 ±0.95	28.6 ± 0.88	8.40 ± 0.31	8.70 ±0.68
	PLs	30.0± 1.42	30.9 ± 1.53	36.3 ± 1.41	32.1 ±0.97	53.8 ±3.56	47.2 ± 2.93
	GRs	27.0 ± 1.75	25.8 ±1.84	40.1 ± 1.34	39.3 ± 1.12	21.6± 1.17	21.2 ± 1.13
	ADs	00.0 ± 0.00*	0.00±0.00*	00.00 ±0.00*	0.00 ± 0.00*	9.60 ± 0.80	14.0 ± 0.91
	OEs	00.0 ± 0.00	0.00 ± 0.00	00.00± 0.00	0.00 ± 0.00	6.60 ± 0.50	8.90 ± 0.54
5	PRs	-	-	-	-	4.50 ±0.41	6.90 ±0.39
	PLs	-	-	-	-	56.1 ± 3.15	48.8 ±2.86
	GRs	-	-	-	-	18.0 ± 1.12	13.8 ± 1.01
	ADs	-	-	-	-	12.2 ±0.43	20.3 ± 1.39
	OEs	-	-	-	-	7.20 ±0.31	8.20 ±0.76
	VEs	-	-	-	-	2.00 ±0.15*	2.00 ±0.12*

***Moulting occurs**

Shows the DHC in 3rd through 5th instars nymph. The PRs population starts with a maximum in day 0 of 3rd instars female, decline in the 4th and 5th instars reaching the lowest count in day 5 of 5th instars female. The PLs population gradually increases from day 0 of 3rd instars to day 5 of 5th instars. Its percentage slowly decline immediately after moulting in each instars. The GRs population start rising in the newly emerged 5th instars, decli ning thereafter and attains its lowest at the end of 5th instars. The Ads and OEs are not seeing in the 3rd and 4th instars, they appear on day 2 of 5th instars thereafter steadily increasing and attaining their maximum at the end of 5th instars. The VEs are seen on day 4 of 5th instars nymph and their population remains small throughout its life span. The DHC in male and female instars are more or less the same.

Discussion

It can be seen in the literature that PRs have their peaks in early instars larva in majority of species (Arnold 1979; Saxena et al 1988). This fact gives credence to the generally accepted view that PRs are the stem cells which give rise to other cell types (Gupta1979). In Dysdercus koenigii, their cells shows the highest number compare to all other cell categories in early instars indicate their role of stem cell. The PLs are said to be phagocytic cells engaged in cleaning foreign bodies from the haemocoel (Anderson et al,1973; Berger et al,2003). PLs before

moulting observed during the present study provides an indication that they may also have a phagocytic role during this stage. However, decline in PLs population immediately after moulting may possibly due to their disintegration. In the present insect, the increase in GRs from early 5th instars is possibly due to its inter conversion into Ads, which are essential for storage material. Since Ads are absent in 3rd and 4th instars in the present insect, they do not appear to be involved in moulting or any other processes. The population of the OEs represents to be low throughout the larval development of insect (Saxena et al 1988). The OEs have been implicated in phenol metabolism due to presence of tyrosinase in their several species (Essaway et al 1985; Pandey and Tiwari 2012) which indicate their role in cuticle formation, since in the present insect, these cells appears for the first time in 5th (ultimate) instars and their fluctuates, the role of these cells could not be correlated with cuticle formation. The VEs have been reported only in few insects, but whenever they have been reported, they are usually in the prepupal and pupal stage. However, no functions have been attributed to them. In the present insect VEs appearance and its small population agrees with earlier.

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Fig. 1
DHC in III through V instars (both females & males)