

# TYPES OF HEMOCYTES IN SCORPION *MESOBUTHUS TAMULUS* TAMULUS

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## KEY WORDS

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## ABSTRACT

The present study was undertaken to recognize and study the hemocytes in scorpion *Mesobuthus tamulus tamulus*. Light and phase contrast microscopic observations have showed seven distinct types of hemocytes; prohemocytes (PRs), plasmocytes (PLs), granulocytes (GRs), spherulocytes (SPs), adipohemocytes (ADs), oenocytoids (ODs) and coagulocytes (COs). Total and differential counts of hemocytes were studied in adult male, female and pregnant scorpions.

## INTRODUCTION

Study of arthropod hemocytes is one of the most active areas of research in invertebrate Zoology. The hemocytes are responsible for many vital functions. They are variable in morphology and function (Ratecliffe *et al.*, 1985). The hemocytes of lepidopterous insects have been studied in wide range of species (Arnold, 1982). Information is also available for some of the crustaceans, arachnids, and myriopods (Gupta, 1979). The scorpions have been more or less neglected. There are very few reports on hemocytes of Indian scorpions. The scorpion represents a very primitive surviving group with status of "living fossil". In fact these represent an example of perfect adaptation to extreme conditions. Hence present study has been focused on scorpion. The nomenclature of hemocytes in arthropod is confusing since long back. In the confusing situation the identification key used in this present study was proposed by Gupta (1985). The study of hemocytes preferentially focused on insect in Arthropoda, the scorpions remain more or less neglected. The present study is focused on scorpion.

## MATERIALS AND METHODS

The scorpions used in the present investigation were collected from Dadaswadi, Taluka- Atpadi, Dist- Sangli and were kept in perforated plastic jars and fed with small cockroaches. The animals were maintained for a month without any significant mortality.

Hemolymph was collected from the living animals as per the method of Padmanabha (1967). Depending upon the size of the specimen, the volume of hemolymph varied, but on an

average about 1 to 3 mL was collected.

In general, the technique employed was a modification of those used in the study of vertebrate blood cells. However, none of the individual method was entirely satisfactory for all types of cells. Hence, combinations of different techniques were used. Cytological methods were used for qualitative study, while quantitative methods included the determination of Total Hemocytes Count (THC) and Differential Hemocytes Count (DHC). Both fixed and unfixed hemolymph films were observed for identification and characterization of different hemocytes. The films of hemolymph, unfixed and fixed were processed for different staining methods. For THC Neubauer's hemocytometer (Wittig, 1960) was used and total number of hemocytes were calculated after Jones (1962).

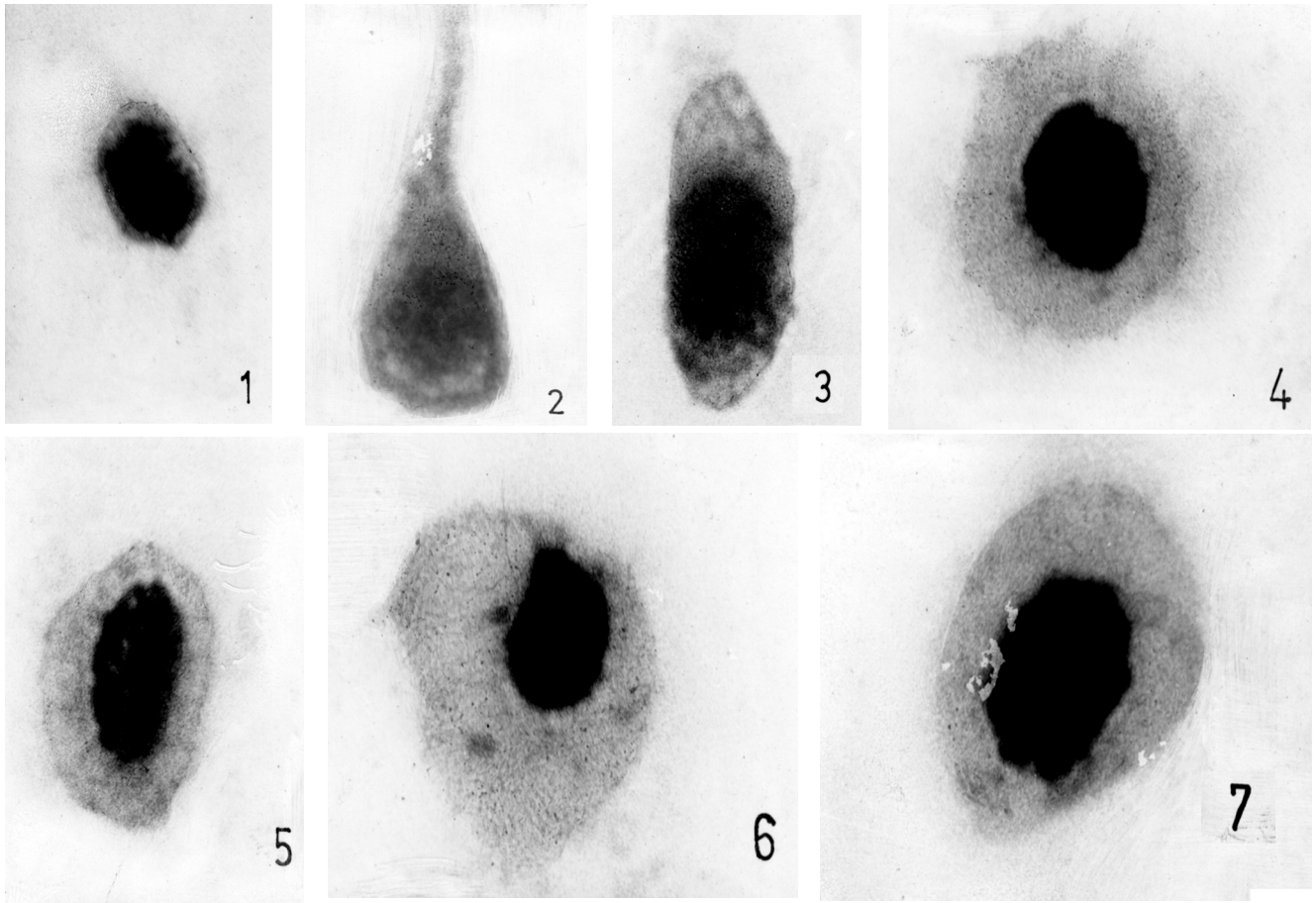
For DHC, the cells were counted using the random sampling method. Five slides were examined and about 100 cells were counted and classified. The hemocytes types were identified according to identification key proposed by Gupta (1985).

## RESULTS AND DISCUSSION

Seven types of hemocytes were observed as shown in Figs. 1 to 7.

Prohemocytes (PRs) – 5% hemocytes was prohemocytes. The cells were round with 6-10 $\mu$ m in diameter. The cytoplasm was agranular and weakly basophilic. The nucleus was strongly basophilic measuring about 4-8 $\mu$ m.

Plasmocytes (PLs) – These were fusiform having size 7-21 $\mu$ m in male and 4-11 $\mu$ m in female. Agranular cytoplasm, was weakly basophilic. The nucleus was round, 3-5 $\mu$ m in size with evenly distributed basophilic chromatin. DHC value is 71%.



**Figure 1 to7: Hemocyte types of *Mesobuthus tamulus tamulus*; 1: Prohemocyte, 2: Plasmatocyte, 3: Granulocyte, 4: Spherulocyte, 5: Adipohemocyte, 6,7: Oenocytoid, (Allx940)**

Granulocytes (GRs) – These were round measures about 9-14 $\mu$ m. The cytoplasm was granular, basophilic with round nucleus having 4-6 $\mu$ m in size. 13% hemocytes are granulocytes.

Spherulocytes (SPs) – These were characterized by spherules in the cytoplasm the size varies from 8-14  $\mu$ m in male and 4-9  $\mu$ m in female. The nucleus was round with 3-7 $\mu$ m in diameter. The value of DHC was 3%.

Adipohemocytes (ADs) – These were spherical or oval in shape having 9-25 $\mu$ m in size. 4% hemocytes were adipohemocytes. The cytoplasm having refringent lipid droplets. The compact chromatin was present in nucleus measuring about 3-8 $\mu$ m.

Oenocytoids (OEs) – 2% hemocytes were oenocytoids with largest size 10-30 $\mu$ m. Agranular cytoplasm was with centrally placed nucleus measuring about 4-6 $\mu$ m.

Coagulocytes (COs) – These contribute only 2% in DHC. These were spherical in shape having 10-25 $\mu$ m in size. The cytoplasm was agranular and intensely basophilic. The chromatin was evenly distributed and the size of nucleus was 3-5 $\mu$ m

The value of THC was 10900 in male, 10150 in female and 11150 in pregnant female. The numbers of hemocytes were more in male than female but less than the pregnant female.

As arthropodan hemocytes are pleomorphic, causes many

problems during its classification (Gupta, 1985). Very little work has been carried out in scorpion hemolymph and hemocytes. Only few reports were available on Indian scorpion (Dadas, 1989). The hemocytes in scorpion, *Mesobuthus tamulus concanensis* by Shah and Patil (2010). In the present study seven distinct hemocytes were recorded. All the arthropod groups do not possess all seven types of hemocytes. Aquatic Chelicerata having only one type of hemocytes (GRs), Onychophora having five types of hemocytes (Gupta, 1985). According to Gupta (1985) seven types of hemocytes can be regarded as primitive feature. Scorpion belonging to oldest arthropod group of terrestrial Chelicerata, which retain the primitive character. Gupta (1985) mention the occurrence of a hemocyanine producing hemocytes, the cynocytes in scorpion. But it is not observed in present study. In scorpion well defined haemopoietic tissue which consist of a series of cellular masses attached to nerve cord in the region of cephalothorax and preabdomen (Kollmann, 1908)

PRs having high nucleo-cytoplasmic ratio is the indication of the embryonic nature of these cells. These are regarded as stem cells during postembryonic period (Gupta, 1985). The large number of PLs in scorpion might be because of their phagocytic activities. GRs are with small cytoplasmic granules. These cells are capable of giving rise to SPs, Ads and COs (Gupta and Sutherland, 1966). ADs are with refringent fat

droplets. In scorpions fat bodies are absent, hence there is every reason to regard ADs as distinct hemocytes type. The present work support the above view with regard to ADs. The OEs in scorpion, *Palamnaeus swammerdami* are reported to be absent. In the present study 2% versene preserve these hemocytes and also responsible for prevention of hemolymph coagulation

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