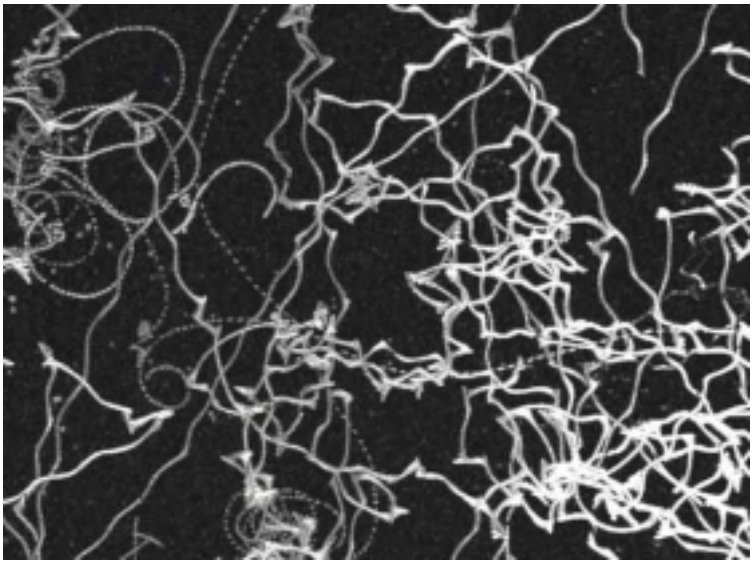

Fig. 3. An example of video picture for trajectories of paramecia

square of the distance from the starting point $<r^2>$ is proportional to the corresponding time t, while in the case of a straight forward movement $<r^2>$ is proportional to t. Here, the value $<r^2>$ corresponding to the time interval $t = m\Delta t$ for each trajectory is calculated as follows:

$$\left\langle r^2 \right\rangle_m = \frac{\sum_{i=1}^{N-m} \left[\left(x_{i+m} - x_i \right)^2 + \left(y_{i+m} - y_i \right)^2 \right]}{N - m},$$

where Δt is the time unit, on which the moving distances are measured, m an integer and N the total number of time steps in each trajectory. Here, we compare the relationships between $<r^2>$ and t in cases of $\Delta t = 2$ s (almost average time interval of LDC) with that in case of $\Delta t = 0.1$ s (minimum time unit in observation). In the former case the coordinates of a paramecium at every 2 seconds are extracted from the original data and the values of $<r^2>$ is calculated according to the above definition (actually the range of m is restricted so that $m < N/2$ in order to avoid few sample number cases).

3. Results

3.1. Classification of the components of trajectories

An example of the video pictures is shown in Fig. 3. Nine examples of the trajectories in the case without temperature gradient (Case-1, -2, -3) and nine with temperature gradient (Case-4, -5, -6) were shown in Figs. 4 and 5 respectively. In these figures the dots designate