Experiment 3a. August 14, 1975. Release site, home direction and distance as in exp. 1a. Both groups consisted of 13 birds, but the vanishing point of 1 experimental pigeon could not be recorded (Figure 3a). Control birds were oriented not randomly ($z = 3.717$, $p < 0.05$) and flew home ($u = 2.545$, $p < 0.005$), whereas the experimental birds were oriented at random ($z = 1.649$, $p > 0.10$) and did not show homeward tendencies ($u = -1.347$, $p > 0.10$). The difference between the 2 sets of bearings was significant ($u = 6.59$, $p < 0.05$). All birds homed, except for 1 experimental and 1 control; no differences in homing performances resulted ($U = 83.5$, $p > 0.10$).

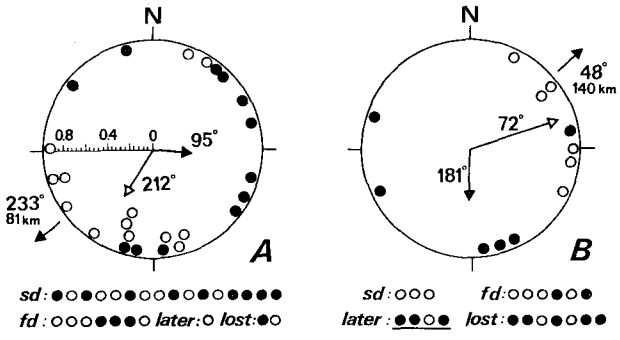

Fig. 3. Initial orientation and homing performances (bottom) in the 3rd experiment. A) Test release from Birrfeld (exp. 1a), B) from Avully (exp. 1b). The open symbols refer to the controls, the filled to the experimentals. For the birds from Avully which homed after 3 days or more, the time of re-entry was not recorded and they were classified as having the same homing time (underlined symbols). sd, birds homed the same day as released; fd, birds homed the following day. Other explanations as in Figure 1.

Experiment 3b. September 22, 1975. Release site Avully. Home direction 048°, home distance 140 km. The birds were a part of the group used in the exp. 3a; between the 2 tests they had been released from Courtelary (28 km NW). However, the rôles were inverted, the past controls being used as experimentals and viceversa (except for 1 bird, which was used as experimental in both releases). 10 experimentals and 10 controls were released, but only 6 vanishing points for each group were recorded (Figure 3b). As in the previous experiment control birds were not oriented randomly ($z = 4.418$, $p < 0.01$) and flew home ($u = 2.708$, $p < 0.005$), whereas experimental birds were oriented at random ($z = 1.292$, $p > 0.10$) and did not show homeward tendencies ($u = -1.095$, $p > 0.10$). However, the difference between the 2 sets of bearing was not significant $B = 7.46$, $p > 0.10$). 5 experimentals and 2 controls did not home. In contrast with the exp. 3a, a difference in homing speeds resulted, the experimental birds homing slower ($U = 19.5$, $p < 0.025$).

The results of the present experiment add further evidence that homing pigeons use olfactory cues for navigational purposes and that outward journey detours influence their initial orientation. In our opinion, further experiments on American pigeons would be appropriate to ascertain whether pigeons from other strains or regions actually use or can switch to alternate cues without the loss of accuracy.

Variance to Mean Ratio and the Spatial Distribution of Animals

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Summary. Biological and statistical aspects of the application of variance to mean ratio to describe spatial distribution of animals are discussed. It is shown that the parameter b in Taylor's power law $s^2 = a m^b$ shows intra-specific variation depending on the distribution of the constituent units of the population. a and b are only parameters of a very empirical way of describing the relation between variance and mean, which itself is an indicator for spatial distribution. Hence, a and b depend on the distribution behaviour of the animals, and not vice versa.

Variance (s^2) and mean (m) are the two statistical parameters commonly used to describe the spatial distribution of animals. In general, these two parameters are not independent, but tend to increase together. But, since a truly random distribution leads to a Poisson distribution, $s^2 = m$ becomes an indicator of randomness: every deviation from randomness indicates a deviation from this relationship. Taylor[2,3] has shown that the variances and means of the sample counts can be empirically related by a power law, such that,

$$s^2 = a m^b$$

when a is the sampling factor that affects the variance to mean ratio and b is the index of the spatial distribution characteristic of the species. a and b do not appear to have a known distribution function, and it is possible that b, instead of being specific, may show intra-specific variation depending on the distribution of the qualitative units of the population. This paper discusses this aspect with reference to the distribution of the Iulid diplopod *Trigoniulus lumbricinus* (Gerst) in the soil.

Materials and methods. Details about the study area and sampling procedures are given elsewhere[4]. 21 sets of samples, each made up of 15 units of 1 sqare m, were examined. A metal frame was used to form the quadrat during sampling, and the diplopod populations to a depth of 15 cm within these quadrats were sorted out according to their sex and developmental stages. Variances and means for each series were calculated and these were plotted on a log × log scale.

Results and discussions. Considered as a whole, i.e. without any distinction between sexes and developmental stages, $b = 1.35$ (Figure A) indicates *T. lumbricinus*

[1] *Acknowledgments*: The work was developed whilst I was at the Department of Entomology, University of Nairobi. I am grateful to Professor T. R. Odhiambo for his interest. I thank the referee for comments.

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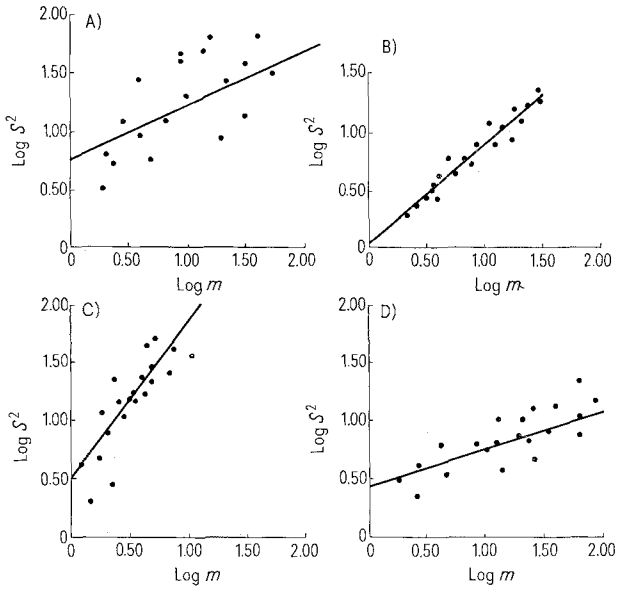
populations are aggregated. But when the males (Figure C), females (Figure B) and immature stadia (Figure D) in the populations are considered separately, b was 0.46 for males, 0.86 for females and 0.30 for immature stadia.



Plot of log variance and log mean for *Trigoniulus lumbricinus* (Gerst) A) entire population; B) female fraction of the population; C) male fraction of the population; D) immature stadia in the population.

For males and immature stadia $b < 1$ suggests the tendency for the individuals to be over dispersed for small means, and underdispersed, i.e. approaching a more regular spatial distribution, for larger means. Only for the females, the distribution is close to random because a and b are both close to 1.00. However, describing randomness on the basis of these two parameters is difficult because every pair of value a, b for which $a\,m^b = m$ holds will indicate randomness. This would be true not only when $a = 1$ and $b = 1$, but for all values satisfying $\log a = (1 - b) \log m$.

Even $b = 1$, $a > 1$ which indicates variance is proportional to the mean over the whole range of observations with the exponent K proportional to the mean m, such that $(1 + K/m) = a$, is a constant, is not a sufficient condition to indicate negative binomial distribution of the individuals. Many other distributions could lead to the same configuration: only certain negative binomial distributions could be described in this way.

Moreover, the distribution patterns of arthropods are known to vary according to the behaviour of the developmental stages of the animals[5], and even seasonally[6,7]. Consequently b as an index cannot remain constant for a species, but will vary according to the temporal distribution of the constituent units of the population, as indeed the males, females and immature stadia of *T. lumbricinus* show.

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Nucleolar Hypertrophy and Nuclear DNA Replication in Liver[1]

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Summary. Hypertrophy of nucleoli is associated with DNA synthesis in the hepatocytes of untreated rats just as it is in stimulated animals. Nucleolar enlargement is not a sufficient change to ensure that the parenchymal liver cell can make DNA.

In recent years, much attention has been given to defining the changes that endow a resting cell with the ability to replicate its nuclear DNA. One impediment, particularly with systems in vivo, has been the difficulty in distinguishing between the prereplicative alterations that are directly concerned with entry into the S period from those that serve other functions.

Increases in nucleolar size and function are among the early changes that take place in the parenchymal liver cells of rats that have been stimulated to make hepatic DNA by surgical as well as by nonsurgical means[2–4]. We have been interested to learn whether the same nucleolar changes occur in hepatocytes that are making DNA in the untreated rat. Occurrence of the alterations in the replicating cells of the untreated animal would lend support to a relationship between the nucleolus and the control of DNA replication. Absence of the changes would rule out an obligatory relationship between the nucleolar changes and DNA formation.

As a partial test of this question, nucleolar volumes were compared in replicating and resting hepatocyte nuclei from untreated rats. The main purpose of this report is to show that replicating liver nuclei from unstimulated animals contain a much greater volume of nucleolar material than do resting nuclei.

Material and methods. To compare nucleolar sizes in replicating and resting hepatocyte nuclei, rats (female, Fischer 344, Charles River Breeding Laboratories) were labeled with ^{3}H-thymidine and about 150 mg portions of liver were then removed and immediately homogenized in 10 ml of a buffered solution of formaldehyde and glutaraldehyde[5]. After fixation (4 h or more at ambient temperature), a nuclear fraction was prepared by centrifugation in sucrose and the nuclei were affixed to glass microscope slides as previously detailed[4]. Radioautography was with six-fold diluted Kodak Track Emulsion, type NTB 3 (4 day exposure). With diluted emulsion, but not with the undiluted preparation, all the silver grains were at the periphery of labelled nuclei, rather than over

[1] This work was supported by a grant from the National Cancer Institute.
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