Humidity Reaction of the Woodlice, Porcellionides pruinosus Brandt

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The reaction of woodlice to various humidities in light and darkness was investigated. Sulphuric acid solutions of varying strengths were used for setting up different humidities. A wooden case and a modified Olfactometer were employed for creating experimental conditions and confinement of the woodlice. It was indicated from these studies that the woodlice have a definite preference for higher humidities and show a marked ability to perceive small differences in humidities if a choice is provided. The preference for higher humidities is unaffected by light or darkness. The behaviour of these Isopods in selecting air with maximum possible moisture seems to be mainly responsible for their survival, they are said to be lacking morphological specializations to minimize transpiration from the body.

INTRODUCTION

The behaviour of terrestrial Arthropods, particularly the Isopods is quite interesting because they in general lack any adaptive morphological specialization to meet the conditions of desiccation. Edney (1957) places Porcellionidae the lice family, fourth in the order of morphological specialization among the families of Isopods and reports it to be found in drier conditions than the rest. He also pointed out that the transpiration from a woodlouse is affected by temperature and humidity in a way as if it were a physical body, except in extreme conditions. In natural conditions, woodlice are found in air almost saturated with water. In deficient circumstances, they not only make up for water loss by taking moist food but are also capable of taking water by oral and anal drinking. Woodlice lose water in all but saturated air. These terrestrial beings seem to be ill-equipped for life on land. There is no satisfactory protection against evaporation from the general surface, respiration is carried out by only slightly modified gills and the pseudotrachae are short bunches of invaginations which do not penetrate beyond the pleopods (Edney, 1954).

In spite of all these disadvantages the woodlice are not uncommon. Their survival can be attributed to the adaptive behaviourism which is so common in these creatures. This is said to minimize and is responsible for the make

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up for transpiration and thus helps select an optimal niche (Edney, 1954). It seemed desirable, therefore, that analysis of the orientation mechanism of the woodlice be undertaken by subjecting them to various humidities.

MATERIALS AND METHODS

The Isopods were reared in dark and at 100 per cent relative humidity. Replicates of 10 individuals were used. Fresh lice were used in all experiments. Three experiments were carried with six observations in each up to four hours in each experiment.

Two kinds of experiments as per following set up were performed:

(A) A rectangular wooden case covered with glass on the upper side was used. A lengthwise partition of a copper network divided the case into an upper and a lower chamber. Sulphuric acid solutions of various strengths were prepared according to Solomon (1951) and kept in the lower chamber. A humidity gradient was thus created in the upper chamber where the lice were kept during observation. The lice were introduced in the upper chamber through a small hole in one corner of the case. In order to check whether a proper humidity gradient resulted in the upper chamber, the evaporimeter as used by Smerka and Hodson (1959) was used. Time required for the evaporation of coloured water in the evaporimeter when kept along the length of the upper chamber was noted. This indicated that actually a humidity gradient existed across the upper chamber. The gradient, however, changed to some extent with the passage of time.

At first, sulphuric acid solutions of the strengths to create 10, 30, 50, 70, 90, and 100 per cent R. H. (relative humidity) were arranged along the length of the wooden case. Next, to demarcate further only two different humidities were arranged, one at the either end of the case. Counts were taken as to the presence of the woodlice in the regions of these humidities. Those lice which were present at the middle margin of the two humidities were not included in the count.

(B) The wooden case mentioned above had some drawbacks. The humidities were not maintained accurately over a period of time and the experiments could not be carried in controlled light. Further studies were therefore carried using a Modified Olfactometer. This instrument, relatively complex in structure and with improvements was suggested by Wilson and Bean (1959). Two different relative humidities were maintained by passing constantly, the air, through sulphuric acid solutions of proper strengths in two rather isolated circular chambers but connected with each other by a small doorway. An optimum flow of air and pressure was maintained in both the

chambers. With the efficiency this type of instrument gave, it was possible to subject the woodlice to precise relative humidities rather than a gradient. Two kinds of experiments were made using the Olfactometer. One maintaining darkness in which the light was switched on only when taking observations and the other with light. The light and darkness were maintained on one or both the chambers of different R. H. alternatively.

The lice were released in the upper chamber of the wooden case or in one of the chambers of Olfactometer. A period of ten minutes was allowed before any counts were taken after their introduction into the chambers. It had been determined earlier that the woodlice remained alive for the period that was involved in these experiments.

RESULTS AND DISCUSSION

The results of all the experiments are presented in the Table 1. When a humidity gradient of 10 per cent R. H. through 100 per cent R. H. was provided the woodlice showed definite preference to gather at the higher humidity end of the wooden case. When only two different humidities were set both in the case of the wooden case and the Olfactometer similar results were obtained. The fact that these Isopods can perceive small differences in relative humidities is well supported by the data. These crustaceans were able to distinguish such small differences as between 88 and 90 per cent R.H., 86 and 90 per cent R. H. and between 82 and 90 per cent R. H.

The preference for higher humidities was unaffected by varying conditions of light. The woodlice behave independent of light or darkness as far as humidity is concerned.

A minority of woodlice were observed at lower relative humidities even if the choice for higher humidities was available. Since the simulated conditions even at the higher humidities were not the optimum ones, the woodlice were constantly searching for better environment. In doing so they travelled through the lower humidity areas. The woodlice did come back to the more favourable humidity. This may be presumed that the woodlice indicated as present at lower relative humidity may not be the same individuals at every observation. When a single woodlouse was observed in case of the Olfactometer it was observed that the louse introduced in the higher humidity chamber, left this chamber and entered the chamber of lower humidity. The crustacean went around the latter chamber and returned to the chamber of higher humidity and seemed to have settled for at least next few minutes. Since even this humidity plus other environmental conditions were not at the optimum it is understandable that the woodlouse would start its journey again.

TABLE 1. *Preference of Woodlice for various relative humidities.*

	A. Wooden Case			B. Olfactometer	
Expt. No.	Per cent R. H.	Per cent Lice	Expt. No.	Per cent R. H.	Per cent lice
1.	10	5	1.	92	70
	30	0		76	30
	50	6	2.	90	64
	70	15		60	35
	90	21	3.	90	76
	100	52		88	20
2.	90	66	4.	90	80
	70	30		86	10
3.	90	60	5.	90	82
	30	16		84	8
4.	70	62	6.	90	76
	50	29		82	20
5.	70	66	7.	60	78
	30	30		50	22
6.	30	68	8.	56	64
	30	30		50	26

From these studies it is indicated that the woodlice have the ability to select the best available of the moisture within the reach of their moving capacity. This should explain to a great extent their survival and abundance in high numbers despite the high humidity requirements and lack in morphological adaptations to minimize transpiration from the body.

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