Effect of relative humidity on the longevity of starving workers and soldiers of Heterotermes indicola (Wasm.) (Insecta : Isoptera)t

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The influence of physical factors such as temperature and relative humidity on termites has been investigated by many workers, e.g., Strickland (1950), Ernst (1957), Collins and Richard (1966) in <u>Reticulitermes</u>; Gösswald (1941), Becker (1942), Ernst (1957), Klee (1960), Sen-Sarma (1965) in <u>Kalotermes</u>; Ernst (1957) in <u>Zootermopsis</u>; Sen-Sarma & Chatterjee (1966a & 1966b) in Microcerotermes Ernst (1957) in Nasutitermes, and Becker (1965) in Heterotermes. Termite species differ considerably in humidity requirements and the knowledge of humidity behaviour of a species is of great importance in culturing the species under laboratory conditions. In this investigation, humidity requirements of workers and soldiers of Heterotermes indicols (Wasmann) were determined on the basis of their longevity under different relative humidities. Soldier caste was included to record caste difference in humidity behaviour. For a better understanding of social behaviour, isolated single termites and termites in groups were tested in both the castes.

<u>Material.- Heterotermes indicola</u> (Wasm.) is a notorious wood-destroying termite damaging timber structures in buildings, houses, etc. It builds diffuse subterranean nests. Roonwal (1955) reports destruction of an entire township by this species. Test termites were collected from infested wood-works of a building at New Forest, Dehra Dun. These were maintained under laboratory conditions at a temperature of $28^{\circ}C \pm 1^{\circ}C$ and relative humidity of $95\% \pm 3\%$. Healthy active workers and soldiers taken out from the infested wood were randomised and used in these experiments.

Mathod.- Different relative humidities were regulated by means of saturated solution in distilled water of the following inorganic salts: K₂SO₄, KNO₃, KCl, NaCl,Ca(NO₂), 4H₂O, CaCl₂. 6H₂O. 100% r.h. and 10% r.h. were maintained by distilled water and ZnCl₂ (anhydrous, used as a dry salt) respectively. All experiments were carried out at a constant temperature of 28°C ± 1°C. Small desiccators were used for the maintainance of relative humidity. *Financed from P.L.480 Funds of U.S.D.A.

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The percentages of relative humidity obtained are as follows: H₂O, 100%; K₂SO₄, 98%; KNO₃, 92%; KC1, 85%; NaCl, 74%; Ca(NO₃). 4H₂O.,50%; CaCl₂. 6H₂O, 33%; ZnCl₂ (anhydrons) 10%. A fluctuation of ±2% was noticed in some cases when checked with a Lambrecht's hair hygrometer. For experiments on isolated termites and termites in groups, 10 individuals were used in case of worker caste and 5 individuals were used in soldier caste. Test termites, either kept singly or in groups, were kept in small plastic containers (diam. 2.5cm) which were arranged inside the desiccator containing the respective salt solution. To avoid any possible injury due to handling, each termite was collected individually on a moist filter paper and transferred to the plastic container by gently tapping the filter paper. During the course of the experiments no food was supplied to the experimental termites. Observations regarding mortality were made thrice daily, at 10 hrs., 14 hrs. and 16 hrs. Dead termites were taken out and examined under a binocular microscope to check mutilation of body parts in experiments with groups. It is worthy of mentioning that no cannibalism was observed during the course of the experiments, ensuring complete starvation. Three replications for each experiment were used.

Results. The results are presented in Table 1 and 2. It will be observed that the maximum and minimum period of survival, under different degrees of dessication, of termites, either kept singly or in groups were obtained in 100% r.h. and 10% r.h. respectively in workers and 98% r.h. and 10% r.h. respectively in soldiers. The maximum average longevity of ten workers was 157.0 hours in group and 106.0 hours when kept as a single individual at 100% r.h. In case of soldier caste, the maximum average longevity of five soldiers was 70.0 hours in groups and 69.0 hours in experiments with isolated individuals at 98% r.h. The difference in survival period of termites in group and kept individually was not marked in lower relative humidities (92% to 10%) in both the castes. It may be noted that no "huddling" behaviour was noticed in grouped termites.

Discussion.- It is evident from the results that survival time in both worker and soldier castes is longer in grouped termites than in termites tested singly. Grassé and Chauvin (1944) suggest that as a result of sensory stimuli among members comprising a group, survival period increases in groups in special insects, while others (Alibert, 1959; Sen-Sarma and Kloft, 1965; Sen-Sarma, 1965) have emphasized trophallactic exchange. According to Pence (1956), when clustering behaviour or "huddling" occurs in groups, a reduction of exposed evaporating surface may be responsible to extend the survival period in groups. In case of workers, trophallaxis seems to be the major, if not the sole, contributory factor to the operation of group effect. But as the soldiers cannot feed by themselves, factors other than trophallaxis appear to be involved in greater survival time in groups in soldier caste.

While marked caste difference in the survival period of worker and soldier castes in high humidities (985 -100%) has been observed, no such difference is apparent at relative humidities below 92%. Similarly, no difference is manifested in survival period for termites tested in groups and tested singly in both worker and soldier castes in an atmosphere having 92% or less relative humidity. This observation confirms the suggestion of Becker (1965) that <u>H. indicola</u> requires high relative humidity and cannot tolerate even minor desiccation. The mechanism to prevent desiccation fails to operate at a relative humidity of 22% and below. However, <u>H.</u> indicola can be called a stenohygrous insect on the basis of its preference to high relative humidity.

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Table - 1.

Longevity (in hours) of ten workers of <u>Heterotermes</u> <u>indicola</u> (Wasm.) either kept as isolated single individual or in group under different relative humidities.

Relative	Longevity of termi				es (in hours)	
bomidity	Isolated termites		Termites in		gr on D	
(%)	Range		Mean	Rai	lge	Mean
100		1.00	100.0	100	100	167 0
100	72 -	168	106.0	159 -	1.1.5	187.0
98	48 -	118	85.8	96 -	166	147.2
92	24 -	70	48.4	24 -	70	49.2
85	24 -	48	41.4	30 -	50	46.0
74	22 -	46	36.4	26 -	48	38.8
50	22 -	27	24.4	26 -	40	29.8
33	22 -	26	23.8	22 -	28	25.0
10	15 -	25	22.0	20	26	23.2

Table - 2.

Longevity (in hours) of five soldiers of <u>Heterotermes</u> <u>indicola</u> (Wasm.) either kept as isolated single individual or in group under different relative humidities

Relative) Humidity) (%)	Longevity of termites (in hours)						
	Isolated termites I Termites in group						
	Range	Mean	Range	Mean			
100	24 - 84	65.2	48 - 75	70.0			
98	42 - 96	69.0	65 - 75	70.0			
92	24 - 70	48.2	24 - 70	50.0			
85	24 - 50	46.0	24 - 54	49.0			
74	22 - 46	34.0	24 - 48	37.0			
50	22 - 29	25.6	22 - 30	25.9			
33	22 26	23.2	22 - 28	25.0			
10	15 - 27	23.2	15 - 29	25.0			