



EFFECT OF RELATIVE HUMIDITY LEVELS ON LIFE PARAMETERS OF *MICROTREMES UNICOLOR* SNYDER (ISOPTERA: TERMITIDAE) FOR COLONY FORMATION UNDER LABORATORY CONDITIONS

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Effect of different relative humidity levels on the observable events i.e construction of copularium, oviposition period, eggs laid per female, eggs hatching, incubation period, development of workers, development of pre-soldier, and longevity of reproductive of *Microtermes unicolor* were studied in the laboratory at Nuclear Institute for Food and Agriculture (NIFA), Peshawar, Pakistan. Seventy seven pairs of the fungus growing termite *M. unicolor* were collected from the swarming and incipient colonies were established in the laboratory at 31, 45, 51, 63, 76 and 92% relative humidity levels in controlled temperature at 27 ± 2 °C. Maximum (413) eggs laid per female, maximum hatching of eggs (14.28%), minimum incubation period (21 days), minimum 49 and 47 days for worker and soldier formation respectively, and maximum survival (130 days) were recorded on the 92% R.H. It was found that 92% R.H. was the best in all respects of termite activities. On other relative humidity levels, the primary reproductive survived only for a period of 2 to 3 weeks as well as the eggs laid by them remained unhatched.

Keywords: *Microtermes unicolor*, Relative humidity levels, Controlled temperature, Longevity, Nymphs, Eggs, Eggs hatched

1. Introduction

The genus *Microtermes* belongs to the fungus growing subfamily Macrotermitinae. It is commonly found in Pakistan. It is not a mound building termite but has the habit of living in small communities underground or in the mounds of other termites, in close association with members of other genus of the same subfamily, *Odontotermes* sp.[1]. It is very common termite of Peshawar area and has been reported that 90% of the adults collected from light trap in different localities belong to *M. unicolor* [2].

M. unicolor as the most destructive species attacking sugarcane crop, it alone has contributed 65% and 53.07% of the total damage in Nowshera and Charsadda tehsils respectively [3]. Damage to the fruit trees by *M. unicolor* has been observed from 5.68 to 7.0% to pear and apricot orchards in Lala Kali, Nowshera [4]. Survey of an orchard in NWFP Agric. University, Peshawar showed almost every tree attacked by *M. unicolor* and *O. lokanendi* playing an intra and interspecific behavior [5]. The alates of *M. unicolor* shed their wings quickly by rubbing against rough and moist surface similarly as observed in *Heterotermes indicola* [6]. *M. unicolor* like other termites show tandem behavior, normally a male dealate may follow a female dealate but some times an alate

male follows a female dealate. Tandem formation involving three or more than three individuals was also observed. In such cases all the individuals are usually male. This abnormal behaviour is the result of disturbance caused in the dealates by shaking or tapping the dish containing the insects [7]. According to Buchli [8] any moving object would make the dealates, irrespective of their sex to follow it.

For an effective control of termite, a sound knowledge of the various aspects of their biology is a pre-requisite. Although several workers [9-15], have tried to develop colonies in the laboratory of different termite species other than *M. unicolor*. In Pakistan limited studies on the laboratory rearing of *M. unicolor* have been conducted by a few workers [2, 16]. It has been reported that the humidity plays an important role in colony formation and development of termite [17]. Keeping in view the economic importance of the *M. unicolor* and the significance of various humidity levels, the present studies was conducted accordingly in the laboratory.

2. Material and Methods

Single swarm of 183 alates of termite *Microtermes* sp. was collected after dusk, next day

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after rainfall during first week of August from the village Regi, Peshawar. The sex ratio was 1:1 (Male: Female) for the studies of colony formation. The collected alates were brought to the laboratory of Entomology Division, Nuclear Institute for Food and Agriculture (NIFA) Peshawar and were allowed to dealate (in a glass petri dish with a pair of moist blotting paper). Pairs were segregated during their tandem formation.

Each pair was introduced in a petri dish having bait composed of sawdust (Mulberry) and soil in 1:1 ratio, dried at 80°C for 2 hrs. and then thoroughly mixed with distilled water. There were 7 treatments with 10 replicates including control.

Six different relative humidity levels were maintained by means of saturated salt solutions in distilled water of Na₂CO₃ (92%), NaCl (76%), NH₄NO₃ (63%), Ca (NO₃)₂ 4H₂O (51%), K₂CO₃ (45%) and CaCl₂ .6H₂O (31%) [18, 19, 20]. Control humidity was established at 60 ± 5 % with 27± 2°C temperature. A period of 48 hrs. was allowed to sustain different relative humidities in the desiccators. All experimental dishes with pairs of termites were kept at random. Observations were recorded daily. Parameters studied were construction of copularium egg-laying capacity, percent egg hatchability, development of workers, developments of pre-soldier and longevity of reproductives.

3. Results

Effect of different relative humidity levels on the observable events i.e construction of copularium, oviposition period, eggs laid per female, eggs hatchability, incubation period, development of workers, development of pre-soldier, and longevity of reproductive of *M. unicolor* in the laboratory are presented in Table-1.

3.1. Construction of copularium

Seventy pairs out of 77 were successful as evidenced by the eventual construction of copularium. Copularium was formed at the base of petri dish after 4.0, 3.5, and 3.0 days in 92, 76, 63, 51; 45, 31; and 60 ± 5 R.H. % (control treatment) respectively.

3.2. Pre oviposition period

Pre-ovipositor period was 5.0; 6.0; 6.5; and 8.5 days in 51, 92; 63; 31, 76, 45; and 60 ± 5% R.H. respectively.

3.3. Eggs laid per female

Eggs are kidneys shaped, of creamy white colour with a gummy material on the surface, laid singly, kept clustered at one place. Eggs laid per female were 413, 340, 276, 268, 225, 198, and 135 in 92, 76, 51, 60±5, 45, 63, and 31% R.H. respectively.

3.4. Eggs hatching

Hatching eggs rupture longitudinally along the entire length. Maximum hatching of eggs was 14.28 followed by 8.52 and 1.81% in 92, 76 and control (60± 5 % R.H.) respectively, while in other relative humidity levels i.e. 63, 51, 45, and 31%, none of the egg hatched due to combined effect of fungus and less moisture.

3.5. Incubation period

Incubation period was 23.5, 27 and 26 days in 92, 76 and 60 ± 5% R.H. (control) respectively.

3.6. Development of workers

Nymph survived for 48 days and was changed to worker on 49th day in 92% R.H. In spite of the fact the nymphs lived for 73 day in 76% R.H., no worker was formed while in 60 ± 5% R.H. nymphs lived only for 7 days.

3.7. Development of pre-soldier

In 92% R.H. on 47th day pre-soldier was observed and this was transformed to soldier after 8 days.

3.8. Longevity of reproductive

Maximum survival 130 days followed by 114, 5-54, 5-35, 3-31, and 17 days of reproductives were observed in 92, 76, 60±5, 63, 51, 45 and 31% R.H. respectively.

4. Discussion

Most of the reproductives started constructing the copularium within three days. While in some others, this was delayed until the 5th day except 60 ± 5% R.H. where copularium was constructed on 2nd day. Similar results were recorded by Elbakri *et al.* [11].

It has been reported by Weesner [21] that in *Reticulitermes flavipes* the initiation of egg laying may be influenced, among other factors by the age and time of flight during the swarming season. Akhtar [16] reported 2-3 days pre-oviposition period. In the present studies a 5-12 days pre-oviposition period at 60 ± 5% R.H. may be due to delayed copularium formation (2-5 days), which was, reported only 10 minutes by Akhtar [16] and

Table-1. Effect of different relative humidity levels on the observable events of *M. unicolor* in the laboratory

Treatments (% Relative humidity levels)	Mean Copularium formed after (days)	Maximum pre- oviposition (days)	Eggs laid/ female	Eggs hatched (%)	Maximum incubation period (days)	Development of workers (days)	Development of Pre-soldier (days)	Maximum longevity of reproductive (days)
92	4	7	413	14.28	26	49	55	130
76	4	8	340	8.52	27	73	-	114
63	4	7	268	0	-	-	-	43
60 ± 5 (Control)	3.5	12	276	1.81	26	7	-	54
51	4	5	225	0	-	-	-	35
45	3	12	198	0	-	-	-	31
31	3	7	135	0	-	-	-	17

due to late swarm of August compared to July. He also recorded incubation period as 22-26 days. In the present studies almost similar incubation period of 26 days was recorded at 60 ± 5% R.H. These results are in conformity with aforesaid workers.

In our findings the first worker appeared as early as 49 days at 92% R.H. However, Elibakri *et al.* [8] reported worker development from 33-59 days while Akhtar [16] recorded 38-39 days but in the present studies no worker developed in 60 ± 5% R.H., nymph survived only for 7 days.

Soldier caste is the 1st to develop in the incipient colony [9] in *Bifiditermes beelsoni*, similarly pre-soldier was formed 47 days after egg laying. Soldier was produced when there were 16 nymphs in the colony. No wing padded production from nymph means that production of imagoes begins very late after the production of 1st soldier. Ahmad *et al.* [22] found that *B. beelsoni* females lived more than males. In this study with *M. unicolor* on the average females lived for longer period than males with a few exceptions where males survived longer than females. Moreover survival of reproductive was directly correlated with increase in relative humidity (Table I). The greatest longevity of reproductive (survival) was 58.3% and 44% at 92% and 76% R.H. level respectively. There was no significant difference between these two humidities in respect of adult longevity while for other parameter studied i.e. number of eggs laid per female, number of eggs hatched, longevity of nymph and their development to workers and soldiers. 92% R.H. was at the top. At all other relative humidity levels colony development was significantly lower.

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