

MORPHOMETRIC ANALYSIS OF POPULATION SAMPLES OF *MICROTERMES MYCOPHAGUS* (DESNEUX) FROM PAKISTAN

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Abstract: Morphometric variations in the soldier caste of *Microtermes mycophagus*, were statistically analyzed for mean, variance, and coefficient of variability. Based on clustering procedure of correlation coefficient, the relationship among nine population samples is given.

Key words: Population samples, *Microtermes mycophagus*, morphometric variations.

INTRODUCTION

Microtermes mycophagus is a fungus growing termite and is more common in arid/desert localities of Pakistan. Akhtar and Sarwar (1993) declared it as desert termite. It has been frequently recorded from Bahawalpur, Bahawalnagar area but in addition to these localities it is distributed in Mianwali, Bakkar, Lahore, Muzaffargarh, Khanpur, Multan, Chichawatni, Pirawala, Jhelum, Sibi, Karachi and Hyderabad. As far as its distribution in India is concerned it has been recorded from Rajasthan, Delhi, Haryana and Punjab (Chhotani, 1997). As detailed information about morphometric variations of this desert termite was not available, the present study will provide useful data for future comparison of samples of the species.

MATERIALS AND METHODS

The data generated in the present study is based on the preserved material in the collection of Prof. Dr. Muzaffer Ahmad and Prof. Dr. Muhammad Saeed Akhtar. Soldiers from these samples were measured under stereoscopic binocular microscope with built-in magnification changer. Measurements were taken with the aid of calibrated ocular micrometers. Taxonomic terms and measurements used in the present study are as explained by Ahmad (1965), Akhtar (1975) and Akhtar and Anwar (1991). The following characters were studied: Length of head to sidebase of mandible; Length of left mandible; Width of head; Length of pronotum; Width of pronotum; Length of postmentum and Width of postmentum. The data were analyzed for various statistical parameters like mean, standard deviation, variance and co-efficient of variability.

Data from different populations were analyzed statistically according to Sokal and Rohlf (1973). Cluster analyses were carried out to know grouping of related OUT's (operational taxonomic units) based on high similarity coefficient (Mayr and Ashlock, 1991). Samples from the localities are abbreviated as follows: Chishtian (A), Darogawala (B), Fort Abbas (C), Hangerwal (D), Korangi (E), Malir Cantt. (F), Miani Forest (G), Pirawala Forest (H) and Quaidabad (I).

MATERIAL EXAMINED

- A. Chishtian, soldiers and workers, collected by M. Ilyas Rashid is between 16-18 Dec. 1998, 20-22 Jan. 1999, 20 Feb. 1999 and 18 Dec. 1999.
- B. Darogawala, colony No. 35A, soldiers and workers, collected and determined by M.S. Akhtar, from Mulberry, 24.2.68; Darogawala, colony No. 34A, soldiers and workers, collected and determined by M.S. Akhtar, from *Z. jujuba*, 24.2.68; Darogawala, colony No. 29B, soldiers and workers, collected by M. Abdul Aleem, from roots of *Z. jujuba*, determined by M.S. Akhtar, 24.2.68.
- C. Fort Abbas, soldiers and workers, collected by M. Ilyas Rashid in between 22-23 Nov. 1998, 22 Jan. 1999 and 20-21 March 1999.
- D. Hangerwal, colony No. 19A, soldiers and workers, collected and determined by M.S. Akhtar, from a mound, 22.2.68.
- E. Korangi, colony No. 455A, soldiers and workers, collected and determined by M.S. Akhtar, from a stump, 11.3.69.
- F. Malir Cantt., colony No. 433A, 434A, 436A and 463A soldiers and workers, collected and determined by M.S. Akhtar, different trees and mesquites on 6 March, 1988 and 5-6 March 1969.
- G. Miani Forest, colony No. 464A and 465A, soldiers and workers, collected and determined by M.S. Akhtar, from *populus* stumps, 13.3.69, Miani Forest, colony No. 471A and 476A, soldiers and workers, collected and determined by M.S. Akhtar, from ex *Acacia arabica* and from ex log, 14.3.69, 15.3.69.
- H. Pirawala forest, colony No. B-43, soldiers and workers, collected by M. Abdul Aleem, from stump of a tree, determined by M.S. Akhtar, 3.3.68; Pirawala forest, colony No. 52A, soldiers and workers, collected and determined by M.S. Akhtar, from *Delbergia sissoo*, 3.3.68; Pirawala forest, colony No. 79A, soldiers and workers, collected and determined by M.S. Akhtar, from a tree, 5.3.68;

Pirawala forest, colony No. 100A, soldiers and workers, collected and determined by M.S. Akhtar, from simple stump, 6.3.68.

- I. Quaidabad, colony No. 443A, soldiers and workers, collected and determined by M.S. Akhtar, from Deodar wood, 7.3.69.

The number of samples collected from Chistian (22), Darogawala (17), Fort Abbas (18), Hangerwal (10), Korangi Colony (09), Malir Cantt. (17), Miani Forest Colony (19), Pirawala Forest Colony (25) and Quaidabad Colony (08). The total samples were 145.

RESULTS

Morphometric variations of different parameters are given in Table 1. For the length of head to side base of mandible coefficient of variability ranged from 2.34 to 6.11 (Table 1). Maximum variability in this parameter was 6.11 and recorded in the sample from Fort Abbas (C). However, longest length for head capsule was recorded in specimens from Hangerwal (D), Lahore and shortest from Karachi, Malir Cantt. (F). Length of left mandible, which is considered very important in identification of different species of genus *Microtermes*, varied from 0.61-0.70mm. Longest mandible was recorded in specimens from Hangerwal (D) and shortest from Quaidabad (I). For this character coefficient of variability ranged from 1.66-5.91 (Table 1). Maximum variability was 5.91 for specimens from Chistian (A). More variation has been recorded in the width of head with coefficient of variability 2.47-7.97 (Table 1). Narrowest head was found in specimens from Malir Cantt. (F) and widest in those from Hangerwal (D). Maximum variability in the width of head was recorded 7.97 in specimens from Fort Abbas (C).

Length and width of pronotum was also found variable. The coefficient of variability for length and width of pronotum ranged from 2.42-6.50 and 2.47-7.39 (Table 1), respectively. Shortest and narrowest pronotum was noticed in specimens from Malir Cantt. (F), while widest from Hangerwal (D) and longest from Hangerwal (D) and Miani Forest (G). Maximum variability in length of pronotum was 6.50 and width of pronotum was 7.39 found in Fort Abbas (C). Similarly, length of postmentum was also found more variable than any other taxonomic character. The coefficient of variability for length of postmentum of nine population samples varied from 2.37-7.38 (Table 1). The coefficient of variability for the length of postmentum from pooled data was 7.27 and was the highest value of variability amongst all the measured characters. Largest postmentum was noticed in specimens from Chistian (A) and Hangerwal (D) while shortest from Malir Cantt., (F).

Table 1: Biometric analysis of various parameters of samples (A-I) pooled together.

Sr. No.	Parameters	O.R	Mean±SD	C.V	S ²
1	Length of head to side base of mandible	0.80-1.05	0.91±0.051	5.63 (2.34-6.11)	0.0026
2	Length of left mandible	0.58-0.78	0.65±0.033	5.06 (1.66-5.91)	0.00108
3	Width of head capsule	0.76-1.09	0.87±0.054	6.17 (2.47-7.97)	0.00288
4	Length of pronotum	0.35-0.43	0.39±0.020	5.15 (2.42-6.50)	0.00040
5	Width of pronotum	0.52-0.78	0.64±0.038	5.97 (2.47-7.39)	0.00146
6	Length of postmentum	0.35-0.56	0.47±0.034	7.27 (2.37-7.38)	0.00116
7	Width of postmentum	0.33-0.52	0.43±0.024	5.62 (1.89-7.45)	0.00058

Abbreviation used: O.R (observed range), C.V. (coefficient of variability), S² (variance); each figure in the table was average of 145 samples.

MANHATTAN DISTANCE

For working out Manhattan distance, ranges in the length were coded as three characters: Character range of the maximum number of individual was coded as one, less than this range as zero and more than that range as 2. Later on some of absolute differences between the character states of each character for each possible pair of population samples collected from different localities were worked out.

On the basis of Manhattan distance, population samples of *Microtermes mycophagus* from locality B (Darogawala) and locality C (Fort Abbas) formed first primary cluster at value 1, samples from locality E (Korangi) and locality I (Quaidabad) formed second primary cluster at value 1 and samples from locality A (Chishtian) and locality H (Pirawala) formed third primary cluster at value 1 (Fig. 1), indicating highest resemblance in the quantitative morphological parameters. Samples from locality G (Miani Forest) joined with first primary cluster *i.e.*, BC at an average value of 2.5 to form first secondary cluster BCG, samples from locality F (Malir Cantt.) joined with second primary cluster *i.e.*, EI at an average value of 2 to form second secondary cluster EIF and samples from locality D (Hangerwal) joined with third primary cluster *i.e.*, AH at an

average value of 4.5 to form third secondary cluster AHD. Cluster BCG joined cluster EIF at an average value of 5.7 to form first tertiary cluster, while cluster BCG also joined with cluster AHD to form second tertiary cluster at an average value of 6.3.

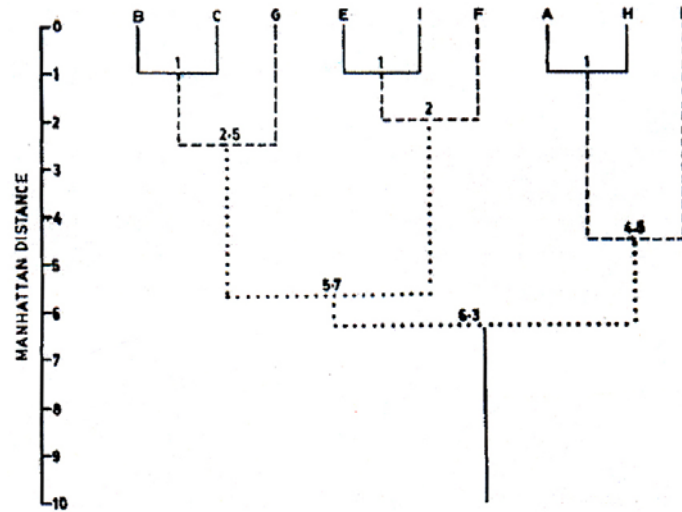


Fig. 1 (Phenogram): Manhattan distance of the *M. mycophagus*. Primary clusters are indicated by solid lines, secondary clusters by dashed lines, tertiary cluster by dotted line. The scale on the left is a distance measure.

DISCUSSION

There is scarcity of information about morphometric variation in termites. Only a few references are available in this regard (Roonwal and Sangal, 1957; Roonwal, 1970; Chhotani and Das, 1979; Chhotani, 1981; Akhtar and Ahmad, 1991; Akhtar and Anwar, 1991).

Microtermes mycophagus (Desneux) has been collected from different areas of Pakistan: Mianwali, Bhakkar, Lahore, Muzaffargarh, Khanpur, Multan, Chichawatni, Pirawala, Jhelum, Sibi, Karachi and Hyderabad (Akhtar, 1972). Besides this species has been reported from India: Rajasthan, Delhi, Haryana and Punjab (Chhotani, 1997).

Ahmad (1955) reported the following variations in the species and the study was based on 48 specimens of soldier caste: Head length without mandible 0.82-1.05 mm, width of head 0.77-0.97 mm, postmentum length 0.42-0.52 mm, width 0.37-0.46 mm, pronotum length 0.37-0.46 mm, width 0.56-0.70 mm. Ahmad did provide data regarding

standard deviation, coefficient variability and similarity matrix on the basis of Manhattan distance.

Chhotani (1997) has reported the following measurements regarding the morphological characters, but did not mention the number of individuals examined in this regard: Length of head to sidebase of mandible 0.85-1.03 mm, maximum width of head 0.78-0.95 mm, length of left mandible 0.58-0.65 mm, length of postmentum 0.43-0.53 mm, width of postmentum 0.33-0.45 mm, length of pronotum 0.35-0.48 mm and width of pronotum 0.55-0.70 mm.

The present study involve 145 soldiers from different localities, this would serve as standard of comparison for population samples of this species from the geographic range of this species and for comparison with other species of the genus *Microtermes*.

The present study revealed the following variations, which are reproduced, in a comparative form in Table 2. More variation has been recorded in width of head capsule, and length of postmentum.

Table 2: Comparison of measurements (in mm) of *M. mycophagus*.

Parameters	Ahmad (1955)	Chhotani (1997)	Present
Length of head to side base of mandible	0.82-0.105	0.85-1.03	0.80-1.05
Length of left mandible	---	0.58-0.65	0.58-0.78
Width of head	0.77-0.97	0.78-0.95	0.76-1.09
Length of pronotum	0.37-0.46	0.35-0.48	0.35-0.43
Width of pronotum	0.56-0.70	0.55-0.70	0.52-0.78
Length of postmentum	0.42-0.52	0.43-0.53	0.35-0.55
Width of postmentum	0.37-0.46	0.33-0.45	0.33-0.52

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