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PHYSICAL AND CHEMICAL CONSTITUENTS OF FUNGUS COMBS OF *ODONTOTERMES MICRODENTATUS* ROONWAL AND SEN-SARMA AND *ODONTOTERMES OBESUS* (RAMBUR) (ISOPTERA : TERMITIDAE)*†

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ABSTRACT

The moisture content in the fungus comb of *Odontotermes microdentatus* and *Odontotermes obesus* remain very high throughout the year. The ash content is also high. The nitrogen content is higher than in normal wood. The lignin content is low and carbohydrate content is high indicating that masticated plant material forms the major component of the fungus combs in addition to some quantity of faecal matter. The calcium is higher than the potassium and phosphorus. Few polysacharide sugars possibly serving as binding material in the construction of the fungus combs are detected.

INTRODUCTION

The fungus combs found in the mounds of the termites belonging to the sub-family Macrotermitinae have attracted the attention of naturalists and biologists since Koenig (1779) first reported their existence. Since then a large group of workers have studied the shape size and origin of fungus combs in many species of termites (Petch, 1906, Hegh, 1922, Kemner, 1934, Heim, 1941, 1942 Grasse, 1944, Cheo, 1948). Fungus combs of the Indian termites belonging to the genus *Odontotermes* have been earlier investigated by Koenig (1779), Peth (1906, 1913), Annandale (1923, 1924), Mukerjee & Ray Chaudhari (1943), Mukerjee & Mitra (1949), Bakshi (1951), Das *et al.* (1962), Roonwal (1962), and Batra & Batra (1966). Sands (1969) has recently presented an excellent review on the association of termites and fungi. Hesse (1957) and Becker & Seifert (1962) have investigated some aspects of chemical constituents of fungus combs. Notwithstanding these, wide lacuna exists on the physical and chemical constituents of fungus combs which are likely to throw light on the origin and formation of fungus combs.

MATERIAL AND METHODS

Four samples of fungus combs of each species were collected every month from inner periecie region of mounds occuring at New Forest, Dehra Dun for determination of moisture content and three samples of fungus combs were analysed for physical and chemical constituents.

Moisture content of fungus combs were determined by the standard oven-dry method. The inorganic constituents were estimated by following the methods of Wright (1939) and Piper (1966). The ash and lignin contents were determined by Tappi methods (T^{15} for ash content and T^{13} for lignin content). The total carbohydrate was calculated by substracting the lignin percentage from the absolute

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percentage of material taken. Thus total carbohydrate also includes certain undetermined sustances. The qualitative analysis of sugar was done by hydrolysing the material with 72% sulphuric acid and subsequently analysing the filterate (Whatmann No. 1). The solvent system used was n-butanol : Pyridine : Water (6:4:3). The sugars were located on the chromatogram by spraying Aniline-oxalate and heating the paper in an oven at 105°C for 10 minutes.

Results and Discussion

Data on the seasonal variation of the moisture content have been presented in the figure for both the species. Data on the chemical constituents of fungus combs are given in Table.

Moisture contents : It is evident from Fig 1 that the moisture content of the fungus combs always remains high (50% and above). This is in conformity with the observations of Roonwal (1962) in *O. obesus*.. High moisture content of the surrounding soil (Hesse, 1955) and high humidity inside the mound (Agarwal unpublished , Agarwal & Sen Sarma unpublished) ; materially contribute to the high moisture content of the fungus combs which are known to be high hygroscopic as well. High moisture content in the fungus combs is needed not only to serve as a humidity regulator (Ghidini, 1938) but also to act as

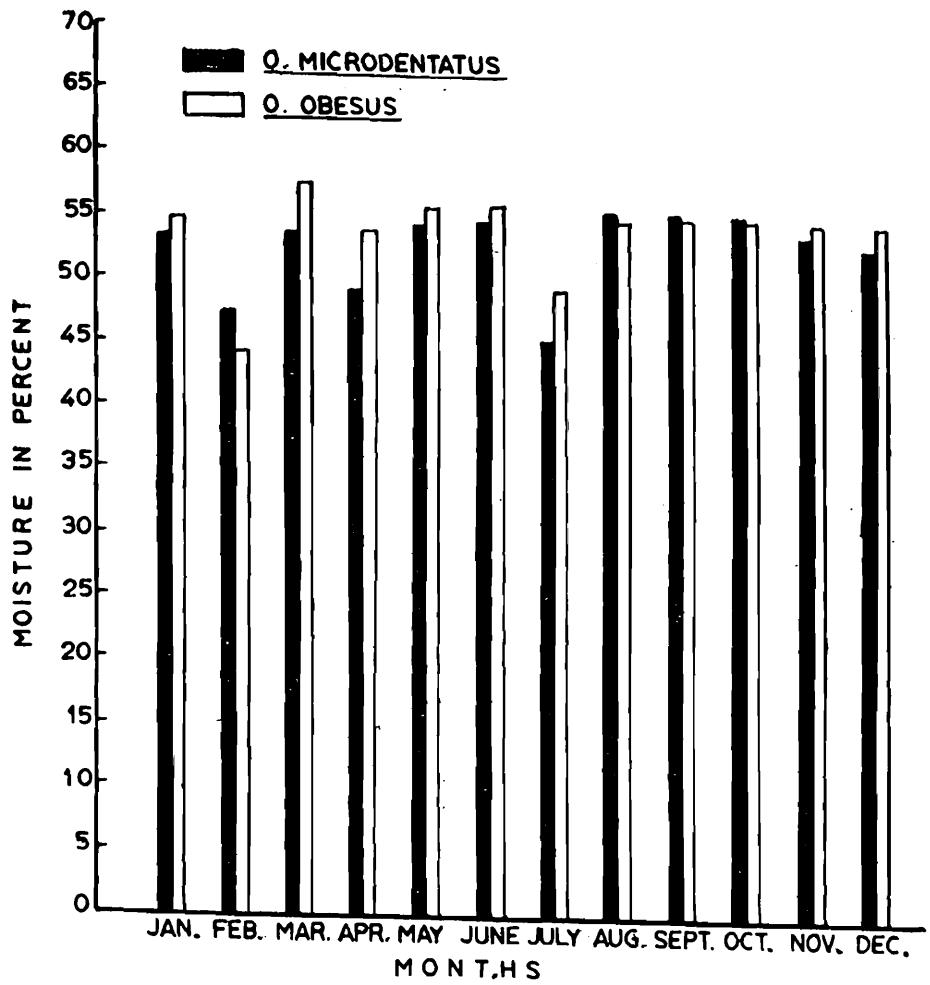

Fig. 1. The seasonal fluctuations of moisture content in the fungus combs of *Odontotermes microdentatus* and *Odontiotermes obesus*.

a suitable substratum for the growth of fungus belonging to genus *Termitomyces.*

Ash content : The high ash content indicates presence of greater quantity of inorganic matter in the shape of soil particles in the fungus combs.

Nitrogen : The fungus combs of *O. microdentatus* and *O. obesus* are rich in nitrogen content. Hesse (1957) also reported more than one percent nitrogen content in the fungus combs of three species of *Macrotermes.* Hungate (1941) has found higher nitrogen content in wood ingested by *Zootermopsis,* which he attributed to the presence of soil particles. The high nitrogen and ash content in the fungus combs of *Odontotermes* is probably due to soil particles present either as contaminant or used for the construction of the fungus combs. The high nitrogen content is of advantage to maintain nitrogen cycle for the colony (Batra and Batra, 1966).

Calcium Potassium and Phosphorus : Calcium more important of the mineral constituents is much higher than the potassium and phosphorus. Hesse (1957) also reported higher calcium than phosphorus in three species of *Macrotermes* in Africa which he explained due to the presence of calcium bicarbonate in the mound soil and consequently in the fungus garden.

Lignin and Carbohydrate : Low lignin content in the fungus combs as compared to high lignin content reported from the faecal matter of wood inhabiting termite and carton nests (Becker & Seifert, 1962) indicate that faecal matter which is primarily lignin does not form a major component in the construction of fungus combs although it is present in the fungus combs.

The average carbohydrate content in the fungus combs is high i.e. 60.0% and above in both the species. This supports the con-

TABLE 1 Analysis of fungus combs material of *O. microdentatus* and *O. obesus.*

Sample	Ash content %	Nitrogen %	Percentage soluble in Alcohol & Benzene mixture	Calcium %	Potassium %	Phosphorus %	Lignin %	Carbohydrate %
Odontotetermes microdentatus								
1.	16.56	2.6	23.00	2.4	0.15	0.10	40.80	59.20
2.	18.68	3.0	20.00	2.2	0.17	0.103	38.00	62.00
3.	17.42	—	21.00	—	—	—	41.00	59.00
Mean	17.55	2.8	21.33	2.3	0.16	0.11	39.93	60.07
Odontotermes obesus								
1.	17.84	2.19	20.00	2.2	0.16	0.11	35.00	65.00
2.	16.00	2.20	20.20	2.9	0.12	0.9	34.50	65.60
3.	16.34	—	21.00	—	—	—	37.00	63.00
Mean	16.73	2.20	20.40	2.6	0.14	0.10	35.50	64.50

tention of Grasse (1949) that undigested masticated plant material is also used in considere able proportion for the construction of th-fungus combs.

Polysaccharide ugars : Among the polysaccharide sugars glucoses, galactose , mamose, arabinose and Xylose are detected in the fungus combs. This shows that these sugars are however not fully utilized by the workers of *Odontotermes* during their digestion. As the polysachharide of hemicellulose group including Pentosans have the binding property (Singh & Bahuguna, 1973). their presence is useful as the binding material in the construction of fungus combs.

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