

The 'Omajowa' or 'Termitenpilz', *Termitomyces* sp. (Agaricales) of Namibia

G.C.A. van der Westhuizen* and A. Eicker

Department of Botany, University of Pretoria, Pretoria, 0002 Republic of South Africa

*Present address: 225 Carinus St, Meyerspark, 0184 Republic of South Africa

Accepted 18 October 1990

The 'Omajowa' or 'Termitenpilz' which grows in groups around the bases of tall termite mounds, is illustrated and described. It is identified as *Termitomyces schimperi* (Pat.) Heim. Available evidence indicates that *Macrotermes michaelseni* (Sjöstedt) is the associated termite, an association previously unrecorded. The biology and distribution of *T. schimperi* in Namibia are discussed.

Die eetbare sampioen, die 'Omajowa' of 'Termitenpilz' wat in groepe rondom die basis van hoë termiethope groei, word geïllustreer en beskryf. Dit is geïdentifiseer as *Termitomyces schimperi* (Pat.) Heim. Gegewens wat daarop dui dat dit met die termiet, *Macrotermes michaelseni* (Sjöstedt) geassosieër is, word verstrek. Hierdie assosiasie is nog nie voorheen aangeteken nie. Die biologie en verspreiding van *T. schimperi* in Namibië word bespreek.

Keywords: Fungal association, termite association, *Termitomyces*, termitophilic fungus

*To whom correspondence should be addressed

Introduction

During a study of the South African species of the termite-associated mushroom genus *Termitomyces* Heim (van der Westhuizen & Eicker 1990), two collections from Namibia were found in the herbarium of the National Collection of Fungi in Pretoria. At that time, a passage from a book by the well-known South African travel writer, Lawrence G. Green (1972), came to our attention. He stated, 'South West Africa has other items of *veldkos*, ranging from truffles that a perigord pig would disdain, to *termitenpilz*, mushrooms growing on the heaps of the white ant.' This in turn reminded us of a picture postcard from Namibia depicting a tall termite mound surrounded at its base by white mushrooms entitled 'Omajowa mushroom, termite hill'. The postcard which is reproduced in Figure 1, appears to confirm the statement by Green (1972) and the use of common names for this mushroom indicates that it may be common and well known in Namibia.

The two Namibian collections had been examined by the late Miss Edith L. Stephens of the University of Cape Town, who named them *Termitomyces albus*. The 'Termitenpilz' is known by this name in scientific circles in Namibia (Dr E. von Koenen, pers. comm.). However, the name was not included by Heim (1977) in his comprehensive work on the genus *Termitomyces*. Neither could this name be traced in a search of the literature. It therefore appears that the name *Termitomyces albus* Stephens was not validly published. No reference to a species of *Termitomyces* from Namibia could be found either. Apparently the identity of this mushroom has not been investigated fully. It was therefore decided to conduct further studies to establish the identity of the 'Amajowa' and collect more information on various aspects of its biology. The results of this investigation are presented in this paper.

Materials and Methods

Specimens in the herbarium of the National Collection of Fungi in Pretoria (PREM) as well as specimens and notes in

the Edith L. Stephens Collection, housed in the National Collection of Fungi, were examined. Correspondence and notes in the E.L. Stephens Papers in the Manuscripts and Archives Department, University of Cape Town Libraries, were studied, as well as communications from interested persons. Specimens recently received from Namibia were deposited in the Fungus Collection (PRUM) of the H.G.W.J. Schweikerdt Herbarium of the University of Pretoria.

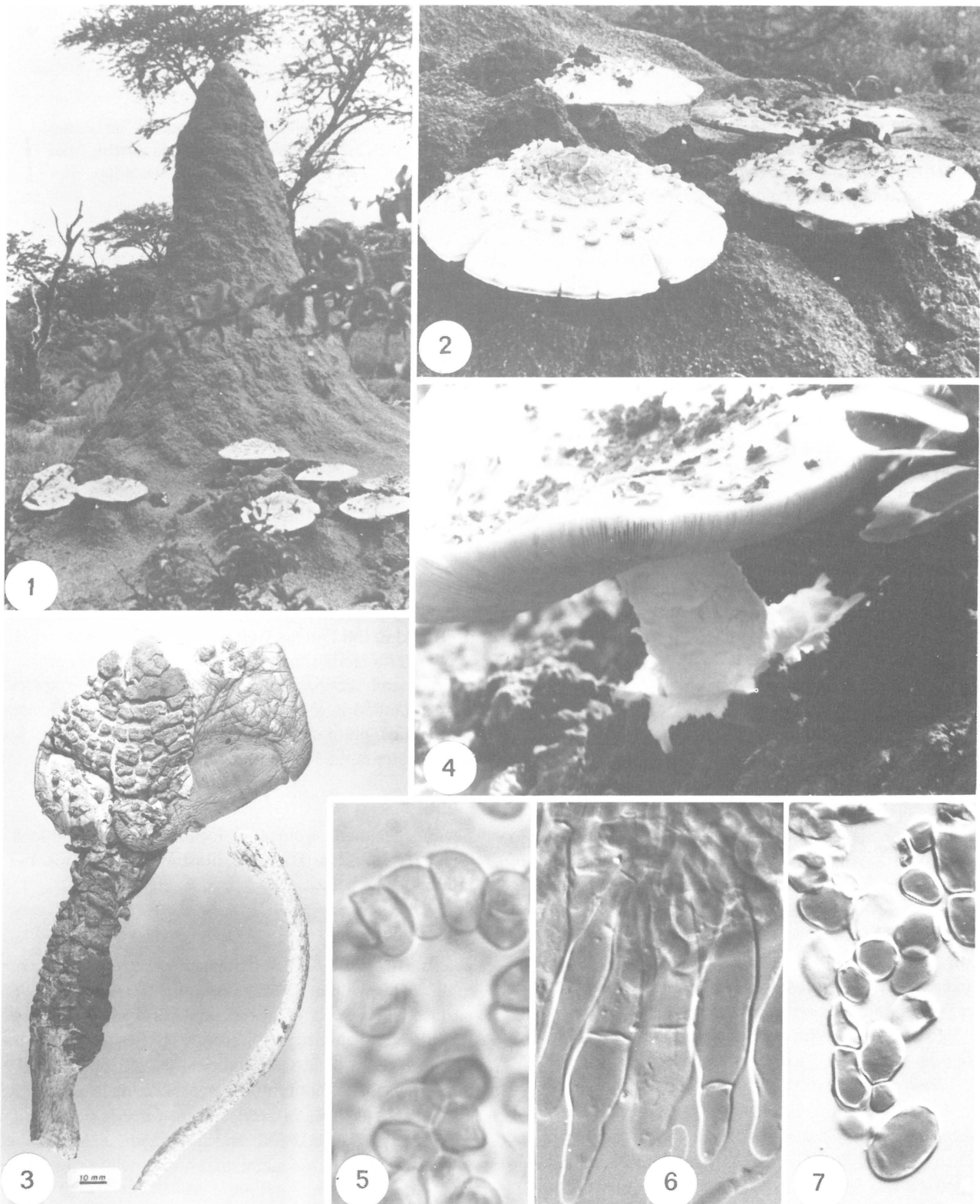
Free-hand sections from various parts of the sporocarps were mounted in a mixture of 10% KOH and 1% aqueous solution of phloxine for microscopic examination. Spores were photographed in lactophenol mounts.

Results

Seven specimens from five localities were examined. All were very similar. They are illustrated in Figures 1–7 and are described below.

Description

Pileus firm fleshy, subglobose expanding to convex-applanate, without perforatorium, 100–150 mm diam.; surface alveolately cracked and broken up into thick, pustulate squamules, ochraceous brown to rust brown, arranged more or less concentrically over most of the white surface, with an umbrinous, unbroken plate over the disc (Figures 1–4); *margin* entire, even; *lamellae* crowded, free to slightly adnexed, full and intermediate lengths, edges entire to crenulate or lacinate, creamy white to pinkish, up to 10 mm wide; *stipe* cylindric, 80–140 × 10–30 mm above soil level, white, smooth, slightly fibrous above a flaring annulus, below whitish, rough with thick, membranous squamules of velar remains and tapering or narrowing abruptly to a long, thin, whitish pseudorhiza, 8 mm or less in diam., solid, hard fibrous; context white, firm, to 12 mm thick, of loosely interwoven, hyaline, thin-walled, septate hyphae without clamps, many inflated to 16 µm, and numerous laticiferous elements, 6–12 µm diam.; *spore print* brownish-pink; *spores* broadly ellipsoid to ovoid, apiculate,



Figures 1–7 *Termitomyces schimperi* 1. Postcard entitled 'Omajowa on termite hill', from photograph by W.A.O. Brons; reproduced by permission of S.W.A. Photo, Windhoek, Namibia. 2. Sporocarps from bottom right-hand part of Figure 1 showing thick scales over cap surface. Reproduced from colour photograph by W.A.O. Brons, Otjiwarongo, Namibia. 3. Dried sporocarp and part of pseudorhiza of *Termitomyces schimperi*, PREM 41964, showing thick, cracked, scales over pileal surface. 4. Sporocarp showing thick pileal scales, thin, crowded lamellae and thick, flaring annulus on soil surface. Reproduced from colour photograph by Dr C.J. Rabie. 5. Basidiospores from spore prints of 'Omajowa' made by Mrs C. Enslin, Omaruru (Edith L. Stephens collections; National Collection of Fungi), $\times 4\ 500$. 6. Septate and non-septate, fusiform to lageniform cheilocystidia from PREM 41964, $\times 1\ 800$. 7. Sphaerocysts from velar squamules of pileal surface of PREM 41964 $\times 900$.

hyaline, smooth, thin-walled, non-amyloid, $6.5\text{--}8.5 \times 3.6\text{--}5.0 \mu\text{m}$ (Figure 5); *basidia* clavate, $24\text{--}32 \times 6.0\text{--}9.0 \mu\text{m}$; *lamellar edge* heteromorphous; *cheilocystidia* numerous, hyaline, cylindrical to fusiform sometimes with thickened walls and one or occasionally two transverse septa, $34\text{--}90 \times 8\text{--}24 \mu\text{m}$ (Figure 6); *pleurocystidia* similar; *hymenophoral trama* bilateral, hyaline, subhymenium pseudo-parenchymatous. *Pileal* surface an epicutis of radially gelatinized hyphae, $1.8\text{--}2.8 \mu\text{m}$ diam.; *velar squamules* composed of an aggregation of sphaerocysts, with thin or thickened brownish walls and deeply staining contents, $14.1\text{--}47.2 \times 10.8\text{--}28.3 \mu\text{m}$ (Figure 7).

Specimens examined

- 1918 (Grootfontein): Grootfontein (–CA), *E.L. Stephens 1417, 1541* (PREM).
 —1920 (Tsumkwe): Tsumkwe (–DA), *Story 6278, 6290* (PREM 41964).
 —2115 (Omaruru): Karibib (–BD), *E.L. Stephens 1692* (PREM).
 —2217 (Windhoek): Windhoek (–CA) *Jankowitz* (PRUM 3021).
 Sandveld, Namibia, *Schoenfelder* (PREM 27811).
 Without locality, Namibia, *E.L. Stephens 1913* (PREM).

Biology

The sporocarps are the ‘size of a man’s fist’ on emergence (W.O.A. Brons, pers. comm.). They rapidly expand to 15–28 cm and may reach 40 cm diam. (E.L. Stephens Papers; W.O.A. Brons, pers. comm.). The caps are white but the thick, soft scales may be stained yellowish to reddish-brown by the soil of the mound. The scales are white underneath their uppermost layers. However, the scales may often remain unstained white. The pseudorhiza tapers downwards towards its origin in the termite nest and may reach a length of about 90 cm. The lower, narrow part is much harder in consistency than the above-ground part (E.L. Stephens Papers).

The sporocarps appear in groups of 5–10 around the lower part of the mound, up to about 50 cm above soil level (W.O.A. Brons, P.C.H. Böhmcker & J. Staby, pers. comm.). Up to 50 sporocarps have been seen around one mound (J. Staby, pers. comm.). They may appear after good, soaking rains, 12 mm or more, in spring, but the main crop develops during January to March during the main rainy season (E.L. Stephens Papers; W.O.A. Brons, pers. comm.). Sporocarps may form on the same termite mound for many years provided that part of the pseudorhiza is left in the mound when the cap is harvested for eating (W.O.A. Brons, pers. comm.). The velar remains on the stipe are consumed by the termites (E.L. Stephens Papers).

Termite association

Not all termite mounds produce these mushrooms. The ‘Termitenpilz’ or ‘Omajowa’ occurs only on the tall termite mounds which are seen throughout the central and north-central parts of Namibia where the average rainfall is 350 mm or more (W.O.A. Brons, pers. comm.).

These mounds frequently reach 3–4 m, and more, in height, and the apex is always inclined towards the north (P.C.H. Böhmcker; W.O.A. Brons, pers. comm.). In a letter to Miss Stephens dated 1957-11-07, Mr W. Giess, formerly

of the Windhoek Herbarium quotes from Dinter’s Index of South West African Plants that ‘an unknown agaric grows at the bases of the mounds of the termite *Termes bellicosus* which suggests that the fungus may live in a symbiotic relationship with the termites’. He added that only one species of mushroom grows on termite mounds in Namibia (Dr M.A.N. Muller, pers. comm.). Specimens of termites collected from one of these mushroom-bearing mounds, were identified as *Termes bellicosus* according to the secretary of the South West Africa Scientific Society (E.L. Stephens Collection, National Collection of Fungi).

Coaton & Sheasby (1972) reported that the termite *Macrotermes mossambicus* (Hagen) constructs massive mounds mostly 1.5–6.0 m in height with the apex inclined in a northerly direction. They found this species to be the dominant termite in the districts of Karibib, Okahandja, Omaruru, Outjo, Otjiwarongo, Tsumeb, Ovamboland and Okavango. Another termite *Macrotermes natalensis* Haviland also occurs in this area and builds mounds that are mostly less than 1.5 m in height, sub-conical in shape and not inclined northwards (Coaton & Sheasby 1972).

The termite name *Termes bellicosus* Smeathman is a synonym of *Macrotermes michaelsoni* (Sjöstedt) (Mrs M. Uys, pers. comm.). This latter name is listed as a synonym of *Macrotermes mossambicus* (Hagen) by Coaton & Sheasby (1972). Later Ruelle (1977) showed that *Macrotermes michaelsoni* (Sjöstedt) is the correct name for this termite.

Distribution

Apart from the localities recorded for the specimens examined, the ‘Omajowa’ is also known to occur at Otjiwarongo and Okahandja (W.O.A. Brons & P.C.H. Böhmcker, pers. comm.). A colour photograph (Figure 3) taken in the Etosha National Park between Halali and Olifantsbad of a mushroom on a termite mound close to the road, together with relevant information (Dr C.J. Rabie, pers. comm.), confirms the occurrence of the ‘Omajowa’ in this area.

The name ‘Omajowa’ is used by both the Herero and Ovambo peoples of Namibia for this termitophilic fungus, (E.L. Stephens Papers; W.O.A. Brons, pers. comm.). The German-speaking people know it as ‘Termitenpilz’. All agree, however, that it is a much-appreciated delicacy with very good flavour. The sporocarps are also eaten by duiker, steenbuck, warthog, porcupine and probably other small animals (E.L. Stephens Papers; W.O.A. Brons, pers. comm.).

Discussion

The specimens examined in this study agreed in all morphological characters, thus confirming their conspecificity. The presence of a long pseudorhiza which is connected to a termite nest is characteristic of species of *Termitomyces* Heim. The presence of thick, alveolately cracked scales composed of sphaerocysts on the pileal surface and lower stipe, and the large cylindrical to fusiform, often septate, hymenial cystidia, correspond with those of *Termitomyces schimperii* (Pat.) Heim as described by Heim (1977), Pegler (1977) and van der Westhuizen & Eicker (1990). There is

no doubt that the 'Omajowa' is *T. schimperi* and that the name, *T. albus*, used by Miss Stephens, would have had to be reduced to synonymy had it been validly published.

Termitomyces schimperi was first described from Ethiopia by Patouillard in 1891 (Heim 1977) and is known to occur throughout tropical Africa (Heim 1977; Pegler 1977; Pearce 1987; Morris 1986). It has been collected only once previously in South Africa (van der Westhuizen & Eicker, 1990). In Namibia it is now known to occur at Omaruru, Okahandja, Otjiwarongo, Grootfontein, Tsumkwe, east of Windhoek and in the south-eastern part of the Etosha National Park.

The observations and descriptions of the termite mounds on which *T. schimperi* occurs, agree with the descriptions by Coaton & Sheasby (1972) of the mounds constructed by *Macrotermes michaelseni*. Termites from mounds bearing sporocarps have been identified as this species which occurs in the same area in which *T. schimperi* is now known to occur. This indicates that *M. michaelseni* is the termite species associated with *T. schimperi* in this part of Namibia. This association has not been recorded previously.

Termitomyces schimperi has been recorded in association with the termite *Odontotermes patruus* in Zambia (Pearce 1987); a species not known to occur in Namibia (Mrs V. Uys, pers. comm.). It has also been recorded in association with *Macrotermes natalensis* from other parts of Africa (Sands 1970), a species which is quite common in Namibia (Coaton & Sheasby 1972). The mounds built by *M. natalensis* (Coaton & Sheasby 1972) differ from the descriptions of the mounds on which *T. schimperi* are found. It therefore is unlikely that *T. schimperi* is associated with *M. natalensis* in this area.

From the available information, it can be concluded that only one agaricoid fungus, *Termitomyces schimperi*, is known as the 'Omajowa' or 'Termitenpilz' in Namibia and that this species is associated with the termite *Macrotermes michaelseni*.

Acknowledgements

The authors thank the following persons for their assistance: Mr H.W. Theiss of S.W. Photo, Windhoek and Mr W.O.A. Brons of Otjiwarongo for postcards, photographs and

permission to reproduce them here; Mr J. Staby and Dr Eberhard von Koenen, both of Omaruru, Mr P.C.H. Böhmcker, Okahandja and Dr M.A.N. Muller, South West Africa Herbarium, Windhoek, supplied information; Ms Leonie Twentyman-Jones, Manuscript and Archives Division, University of Cape Town Libraries supplied copies of material from the Edith L. Stephens Papers; Dr J.W.J. Jankowitz, Technicon of Namibia, Windhoek, supplied specimens; Dr C.J. Rabie, Microbiology Division, National Food Research Laboratory, Pretoria, supplied photographs and information; the Director, Plant Protection Research Institute, Pretoria, permitted examination of material in the Herbarium of the National Collection of Fungi; the Curator, Miss Alice P. Baxter assisted and Mrs Vivienne Uys of the National collection of Insects of the same Institute, advised on the nomenclature and distribution of termites; Dr Derek A. Reid, Royal Botanic Gardens, Kew, critically reviewed the manuscript.

References

- COATON, W.G.H. & SHEASBY, J.L. 1972. Preliminary report on a survey of the termites (Isoptera) of South West Africa. *Cimbebasia*, mem. no. 2: 1-129.
- GREEN, L.G. 1972. When the journey's over. Howard Timmins, Cape Town.
- HEIM, R. 1977. Termites et champignons. Les champignons termitophiles d'Afrique Noire et d'Asie Méridionale. Société Nouvelle des Editions Boubee, Paris.
- MORRIS, B. 1986. Notes on the genus *Termitomyces* Heim in Malawi. *Soc. Malawi J.* 39: 40-49.
- PEGLER, D.A. 1977. A preliminary agaric flora of East Africa. *Kew Bull. Add. Ser.* 6: 277-295.
- PIEARCE, G.D. 1987. The genus *Termitomyces* in Zambia. *The Mycologist, Bull. Brit. mycol. Soc.* 21: 111-116.
- RUELLE, J.E. 1977. *Macrotermes michaelseni* (Sjöstedt) a new name for *Macrotermes mossambicus* (Hagen) (Isoptera: Termitidae). *J. ent. Soc. sth. Afr.* 40: 119.
- SANDS, W.A. 1970. The association of termites and fungi. In: *Biology of Termites*, eds Krishna, K. & Weesner, F.M., Vol. 1, Ch. 16, Academic Press, New York.
- VAN DER WESTHUIZEN, G.C.A. & EICKER, A. 1990. Species of *Termitomyces* occurring in South Africa. *Mycol. Res.* (in press).