

# Identification, Geographical Distribution and Hosts of Subterranean Termites in the United Arab Emirates Arid Ecosystem

W. Kaakeh

Department of Arid Land Agriculture, College of Food Systems,  
P. O. Box 17555, United Arab Emirates University,  
Al-Ain, United Arab Emirates

وليد كعك

الخلاصة: تم تعريف ستة أنواع من النمل الأبيض (الأرضة) تابعة إلى خمسة أجناس وثلاث فصائل (هودوزرميتيدي Hodotermitidae، رابنوترميتيدي Rhinotermitidae، وترميتيدي Termitidae) في الإمارات العربية المتحدة. وأنواع الأرضة التي تم تسجيلها هي الأرضة الحاصدة أو الأرضة اللاشوكية (Burmeister) *Anacanthotermes ochraceus* (Navas و *Anacanthotermes ubachi* (Navas)، وأرضة الرمل الثغرية (*Psammotermes hypostoma* (Desneux)، والأرضة النجدية الدقيقة (*Microtermes najdensis* (Harris)، والأرضة *Heterotermes aethiopicus* (Sjostedt)، و*Silvestri*). وباستثناء النوع *H. aethiopicus*، فإنه تم تسجيل الأنواع الخمسة الأخرى للمرة الأولى في الإمارات العربية المتحدة. وتعيش كل الأنواع تحت الأرض وتصل إلى مصادر الغذاء الخشبية من خلال أنظمة الأنفاق الطينية. وقد وجدت الأرضة في مناطق مختلفة من الدولة والتي تتميز باختلاف ظروفها المناخية وغطائها النباتي ونوع تربتها. ويفضل الأرضة التغذية على العوائل الحية أو الميتة أو المتعفنة، بالإضافة إلى المواد غير السيليلوزية. ومن أكثر أنواع الأرضة توزيعاً في الإمارات العربية المتحدة هي *A. ochraceus* وتتبعها كل من *P. hypostoma* و *M. diversus*. وقد اختلف توزيع الأنواع الستة ضمن كل إمارة، ولكن وجدت كل الأنواع في أكبر إمارتين وهما أبوظبي ودبي.

ABSTRACT: Six termite species, belonging to five genera and three families (Hodotermitidae, Rhinotermitidae and Termitidae) were identified in the United Arab Emirates (UAE). Termite species recorded were the harvester termites *Anacanthotermes ochraceus* (Burmeister) and *Anacanthotermes ubachi* (Navas), the sand termite *Psammotermes hypostoma* (Desneux) and the small waxy termites *Microcerotermes diversus* (Silvestri), *Heterotermes aethiopicus* (Sjostedt), and *Microtermes najdensis* (Harris). Except for a previous record of *H. aethiopicus*, the other five species were recorded for the first time in the UAE. All species were subterranean in habitat and reach wood sources through earthen gallery systems. Termites were available in areas with varied conditions of climate, vegetation and soil types. Termites showed host preference for dead, living, or decaying plant materials and non-cellulose materials. The dominant termite species recorded was *A. ochraceus*, followed by *P. hypostoma* and *M. diversus*. The distributions of the six termite species varied in each of the seven Emirates. All species were present in the two largest Emirates of Abu Dhabi and Dubai.

Keywords: *Anacanthotermes ochraceus*, *Psammotermes hypostoma*, Arabian region, termite distribution, Isoptera, Rhinotermitidae, Hodotermitidae.

## Introduction

Termites have become increasingly important pests of crops and buildings in the United Arab Emirates (UAE), where desert and marginal lands are irrigated for agriculture. UAE also imports many kinds of woods and wood products to meet the needs of industry, new buildings, construction and furniture.

Two termite foraging strategies are adopted in the UAE ecosystem: species are either nocturnal or they construct protective soil tunnels within which they are shielded from heat and desiccating effects

of the sun. Termites feed on living, dead or decaying plant material. Some species are capable of reducing wooden structures to dust and may cause serious damage to buildings.

Several records pertaining to termites in the Arabian Gulf countries, especially in Saudi Arabia, have been made (Nasr *et al.*, 1978; Badawi *et al.*, 1982, 1986; Chhotani and Bose, 1982 and 1991). The termite fauna of the Arabian Peninsula comprise 22 species (Badawi *et al.*, 1986; Chhotani and Bose,

1991). No study of the termite fauna in the UAE has previously been made; the only record for UAE is a colony of *Heterotermes aethiopicus* (Sjostedt) infesting a house in Al-Ain City in Abu Dhabi Emirate (Boocock, 1979).

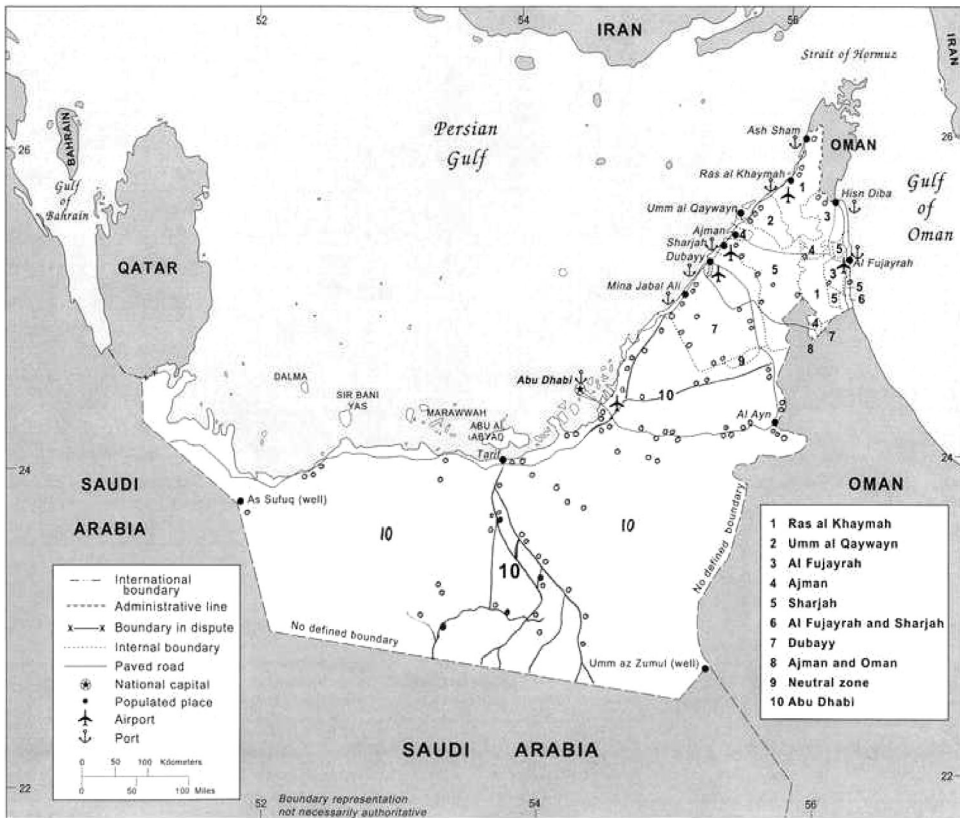
The objectives of this study were to conduct a general survey for identifying subterranean termites, to determine the geographical distribution of all termite species in all seven emirates, and to determine termite living- or dead-hosts.

**Materials and Methods**

Field sampling of termites from different regions of the UAE were conducted from March 2000-May 2002 (Figure 1). A total of 64 field trips were made in all Emirates (35 in Abu-Dhabi, 10 in Dubai, 8 in Sharjah, 4 in Ajman, 2 in Al Fujayrah, 3 in Umm al Qaywayn, 2 in Ras al Khaymah Emirate). A total of 224 sites (live or dead plant host or other infested

materials) were inspected for termite presence: 115 in Abu-Dhabi, 46 in Dubai, 25 in Sharjah, 12 in Ajman, 14 in Al Fujayrah, 6 in Umm al Qaywayn, 12 in Ras al Khaymah Emirate. The number of field trips was consistent with the size of the each emirate. Direct collection of termites was made from all infested plants and materials. Termite specimens were mostly workers or nymphs, and to a lesser extend winged termites. Winged adults of most species were collected after their swarming periods (during a humid day or at night at the beginning of the spring). Soldiers and winged castes were only collected during the spring season at the time of termite swarming. Specimens were kept in 70 % alcohol, each in a separate glass vial for each site in each emirate.

Preliminary identification of the collected termites was made using the available termite keys (Snyder, 1949; Harris, 1967; Fontes, 1985; Sands, 1998). The confirmation of termite identification was made by sending specimens to the British Museum of Natural



**Figure 1.** Map of the United Arab Emirates. Each circle symbol, in each Emirate, represents 1-3 inspected sites in each location.

Table 1. Geographical distribution of identified termite species from the seven emirates of the United Arab Emirates. Number of sites with termites; figures in brackets indicate the percentage of all sites visited.

Family	Termite Species	Emirate (number of sites)							Ras al Khaymah (12)
		Abu Dhabi (115)	Dubai (46)	Sharjah (25)	Ajman (12)	Al Fujayrah (14)	Umm al Qaywayn (6)		
Hodotermitidae	<i>Anacanthotermes ochraceus</i> (Burmeister)	45 (39.1)*	13 (28.3)	14 (56.0)	x	8 (57.1)	5 (83.3)	3 (25.0)	
	<i>Anacanthotermes ubachi</i> (Navas)	6 (5.2)	3 (6.5)	x	x	6 (42.9)	1 (16.7)	x	
Rhinotermitidae	<i>Psammotermes hypostoma</i> (Desneux)	35 (30.4)	20 (43.5)	6 (24.0)	7 (58.3)	x	x	5 (41.7)	
	<i>Heterotermes aethiopicus</i> (Sjostedt)	4 (3.5)	2 (4.3)	x	x	x	x	1 (8.3)	
Termitidae	<i>Microcertotermes diversus</i> (Silvestri)	19 (16.5)	6 (13.1)	4 (16.0)	x	x	x	3 (25.0)	
	<i>Microtermes najdensis</i> (Harris)	6 (5.3)	2 (4.3)	1 (4.0)	5 (41.7)	x	x	x	

\*Number of inspected sites (percentage in parenthesis) in which each termite species was found in each Emirate.

History (UK). Data on the geographical distribution and hosts (plants and other materials) attacked by various termite species, was collected.

## Results and Discussion

### Termite species

Table 1 shows all identified termite species in each Emirate. A total of six termite species, belonging to 5 genera and 3 families, were identified. Termite species were the harvester termites: *Anacanthotermes ochraceus* (Burmeister) and *Anacanthotermes ubachi* (Navas), the sand termite *Psammodermes hypostoma* (Desneux), the small waxy termites *Microcerotermes diversus* (Silvestri), *Heterotermes aethiopicus* (Sjostedt), and *Microtermes najdensis* (Harris). Except for the only record of *H. aethiopicus* in the UAE (Boocock, 1979), the other five species had not previously been reported in the UAE. All species were subterranean in habitat and reach wood sources through earthen gallery systems. Workers of most species forage in the open from late afternoon to early morning. Soldiers appeared to form a small proportion of the termite colonies.

### Identification and geographical distribution

The dominant termite species found in the UAE were *A. ochraceus*, followed by *P. hypostoma* and *M. diversus*. The distributions of the six termite species in each emirate were as follows: *A. ochraceus* was found in all emirates, except in Ajman; *A. ubachi* was found in Abu Dhabi, Dubai, Al Fujayrah and Umm al Qaywayn; *P. hypostoma* was found in all emirates except in Al Fujayrah; *H. aethiopicus* was found in Abu Dhabi, and Ras Al Khaymah; *M. diversus* was found in four emirates of Abu Dhabi, Dubai, Sharjah, and Ras al Khaymah; and *M. najdensis* was found in Abu Dhabi, Dubai, Sharjah and Ajman.

All identified species were present in Abu Dhabi and Dubai Emirates. *A. ochraceus*, *P. hypostoma*, and *M. diversus* were found in 39.1, 30.4, and 16.5% of the inspected sites in Abu Dhabi and 28.3, 43.5 and 13.5 % of the inspected sites in Dubai. In Sharjah, *A. ochraceus*, *P. hypostoma*, *M. diversus*, and *M. najdensis* were found. In Ajman, only *P. hypostoma* and *M. diversus* were found. *A. ochraceus* and *A. ubachi* were found only in Al Fujayrah and Umm al Qaywayn Emirates. In Ras al Khaymah, *A. ochraceus*,

*P. hypostoma*, *H. aethiopicus*, and *M. diversus* were found.

### Hosts

Subterranean termites in the UAE are considered pests because of the extent of damage they cause to various sorts of living hosts structural materials. Termites showed host preference as follows:

*Termites and residences and historical buildings:* Damage to wood in residences and historical buildings was inflicted by all identified species in all emirates, except in the case of *M. najdensis* where there was no record of infestation in buildings. *A. ochraceus* and *P. hypostoma* were found attacking and destroying roofs of historical buildings and causing damage to constructional timbers and furniture. In many cases these species had removed the straw from mud bricks used in the construction of rural residences, especially in Dubai and Abu Dhabi Emirates. Kassab *et al.* (1960) reported that a severe infestation by *A. ochraceus* resulted in the abandoning of a village in Egypt.

The damage caused to wood in residences and historical buildings in Abu Dhabi and Dubai Emirates, mainly by *A. ochraceus* and *P. hypostoma*, justify the application of chemical preservatives and other chemical control strategies such as pressure injection treatments, barrier treatments, and the use of baits.

*Termites and fruit trees:* Termites in UAE are considered to be pests of fruit trees. Live citrus trees, *Citrus* sp., were infested by *A. ochraceus* and *P. hypostoma* in Ras al Khaymah, and *M. najdensis* in Ajman. Date palm trees, *Phoenix dactylifera*, were affected by all identified species at various levels of infestation. Live date palm trees were affected by four species: *A. ochraceus* in Abu Dhabi, Dubai and Al Fujayrah; *P. hypostoma* in Abu Dhabi; *M. diversus* in Abu Dhabi and Sharjah; and *M. najdensis* in Abu Dhabi, Dubai and Ajman. Roots and trunks of dead palm trees in all emirates (except Ajman) were infested by all identified species except *M. najdensis*. The most common form of attack by termites was the hollowing-out of the palm roots, which may be followed by yellowing and death of palm trees, especially young trees and offshoots.

*Termites in woodland:* Several forest trees were affected by termite damage: Sidr or Nabak (*Zizyphus spina-christi*), Samur (*Acacia tortilis*), Ghaf (*Prosopis*

**Table 2.** Primary hosts of termite species identified from each of the seven emirates of the United Arab Emirates.

Emirate	Termite species*					
	<i>Anacantho- termes ochraceus</i> (Burmeister)	<i>Anacantho- termes ubachi</i> (Navas)	<i>Psammo- termes hypostoma</i> (Desneux)	<i>Hetero- termes aethiopicus</i> (Sjostedt)	<i>Microcero- termes diversus</i> (Silvestri)	<i>Micro- termes najdensis</i> (Harris)
Abu Dhabi	Aw, DP, Fs, LP, Nc, Pp, Rs, Wd, Vg	DP, Nc, Pp, Rs, Wd	Aw, DP, Fs, LP, Nc, Pp, Rs, Wd, Vg	DP, Fs, Nc, Pp, Rs, Wd	DP, Fs, LP, Nc, Pp, Rs, Wd, Vg	Fs, LP, Nc, Wd, Vg
Dubai	DP, Nc, Pp, Rs, Wd	Rs, Wd	DP, Nc, Pp, Rs, Wd, Vg	Rs, Wd	DP, Pp, Rs, Wd	LP, Wd
Sharjah	DP, Nc, Pp, Rs	x	DP, Nc, Rs, Wd	x	LP, Nc, Rs, Wd	Wd
Ajman	x	x	Pp, Rs, Wd	x	x	Ct, LP, Wd
Al Fujayrah	DP, LP, Pp, Rs	DP, Pp, Wd	x	x	x	x
Umm al Qaywayn	DP, Pp, Rs	Wd	x	x	x	x
Ras al Khaymah	,Ct, DP Pp, Rs	x	,Ct, DP, Rs Wd, Vg	Rs, Wd	DP, Rs, Wd	x

\*Abbreviations of termite hosts: Aw = Agricultural weeds; Ct = Citrus; DP = Dead date palm, Fs = Forest trees; LP = Live date palm; Nc = Non-cellulose products; Pp = papers; Rs = Residences; Wd = Wood; Vg = Vegetable field crops; x = species not present.

*cineraria*), Arabean gum (*Acacia arabica* [=nilotica]), Ethel or Tamarisk (*Tamarix* sp.), Arak or Arakh (*Salvadora persica*). Woodland trees grown in Abu Dhabi Emirate were infested by all identified species except *A. ubachi*. *A. ochraceus* was the only species infesting woodland trees in Dubai Emirate.

*Termites and vegetable crops:* Tomato (*Lycopersicon esculentum*), okra (*Abelinoschus esculentus*), pepper (*Capsicum annum*) and cauliflower (*Brassica oleracea botrytis*) were the vegetable plants most affected by *A. ochraceus* in Abu Dhabi; *P. hypostoma* in Abu Dhabi, Dubai and Ras al Khaymah; and *M. diversus* and *M. najdensis* in Abu Dhabi. *A. ochraceus* was collected from the soil surface of dry grass and vegetable debris in the field. This feeding habit gives the *Anacathotermes* group their alternative name of harvester termites (Harris, 1967).

*Termites and agricultural weeds:* The only termite species infesting agricultural weeds in date palm plantations, field crops, and dry lands were *A. ochraceus* and *P. hypostoma* in Abu Dhabi Emirate. The main weeds affected by termites were: *amaranthus viridis*, *Convolvulus arvensis*, *Cornulaca monacantha*, *Crotalaria aegyptiaca*, *Cucumis prophetarum*, *Cyperus rotundus*, *Halopyrum mucronatum*, *Halyoxylon persicum*, *Phragmites australis*, *Setaria verticellata*, and *Zilla spinosa*.

*Termites and non-cellulose products:* Non-cellulose items, such as carpets, leather and rubber were affected by all identified species in Abu Dhabi Emirate. *A. ochraceus* and *P. hypostoma* also fed on non-cellulose items in Dubai and Sharjah Emirates.

*Termites and paper:* Paper was infested by *A. ochraceus* in all emirates except Ajman; *A. ubachi*

was also found in Abu Dhabi and Al Fujayrah; *P. hypostoma* and *M. diversus* in Abu Dhabi and Dubai and *H. aethiopicus* in Abu Dhabi.

*Termites and wood:* Wood in storage and wood products, such as furniture, were affected by all identified species in all emirates.

The seven emirates of the UAE enclose a total area of about 83,000 km<sup>2</sup> lying at the southwestern tip of the Arabian Peninsula between 20 and 26 °N and 51 and 56 °E. Apart from the mountains, the landscape is dominated by geologically recent sands overlying limestone sediments plus marls, shale deposits and evaporates. Folded sediments occasionally protrude through the sands as isolated hills. The UAE has two coastlines, one to the west and one to the east. The climate is characterized by low rainfall and high temperatures, ideal for termite growth and development.

Rainfall, atmospheric temperature, humidity, vegetation and soil type are the major ecological factors influencing the abundance, distribution and dispersal of termites. The annual rainfall is highly variable. All recorded termite species occur in Abu Dhabi and Dubai, where less than 100 mm rainfall is usually recorded. Only in those areas where man has a direct influence, as in towns, villages, farms and beside roads, has there been any significant alteration to the desert environment in recent years (Western, 1989). There is a wide-scale attempt to create woodland in parts of the UAE which will increase the range of micro-habitats suitable for subterranean termites, especially *A. ochraceus*, *P. hypostoma*, and *Microcerotermes diversus*.

Nests of termite species recorded in all emirates were of subterranean termites found in arid conditions where there was at least a proportion of clay in the soil and groundwater was enough to support sparse vegetation. Nests of *A. ochraceus* and *P. hypostoma* consisted of complex systems with several interconnecting galleries. Nests of other termite species consisted of diffuse systems of small cells at various depths with interconnecting galleries. *A. ochraceus* and *P. hypostoma* comprised over 70 % of the termites recorded in the largest two emirates, Abu Dhabi and Dubai (Table 2). *A. ochraceus* fed largely on dry grass and other vegetable debris, but it has been reported to damage rural buildings, soft timers, palm thatch and mud bricks (Harris, 1967). *P. hypostoma* preferred non-cultivated areas with little vegetation

and sandy soil through which water rapidly percolates, and where it would be possible to construct tunnels to the water table which may be at a depth of 10 m. The presence of *P. hypostoma* at a depth of 30-40 m has been reported (Howse, 1970). The species tend to be less common in areas where the soil has a high clay fraction (Harris, 1970). The nest structure and microclimate of *P. hypostoma* has been described by Noirot (1970). The nest pattern of *P. hypostoma* differed greatly, particularly as to depth, in different localities (Abu Dhabi to Ras al Khaymah), presumably in relation to humidity and temperature. It is reported to replace *A. ochraceus* in areas of high temperature and with a sandy terrain (Harris 1970). *P. hypostoma* fed on wood, vegetable debris and on living plants. They are found attacking and destroying roofs of historical buildings and residences in Abu-Dhabi and Dubai Emirates.

The present survey was the first attempt to identify the termite fauna of the UAE. Future studies on subterranean termites in the UAE are needed, such as population dynamics of the identified termites on their hosts, correlation of termite distribution with the type of soil and temperature, the extent of damage inflicted on local and imported woods by the identified termites and development of new control strategies to combat termite problems.

### Acknowledgment

I appreciate the assistance of all field workers in the Department of Agriculture and Livestock in Al-Ain, the Municipalities (Al-Ain, Abu Dhabi and Dubai), and the Ministry of Agriculture and Fisheries for collecting termites in various emirates. This research project (No. 03-6-11/00) was funded by the Scientific Research Council of the United Arab Emirate University.

### References

- Badawi, A., A. Dabbour and A. Faragalla. 1982. A contribution to the termite fauna (Isoptera) of Saudi Arabia. *Sociobiology* 7:259-260.
- Badawi, A., H. Al-Kady and A. Faragalla. 1986. Termites (Isoptera) of Saudi Arabia, their hosts and geographical distribution. *Journal of Applied Entomology* 101:413-420.
- Boocock, D. 1979. Termites. *Emirates Natural History Group Bulletin* 8:27-28.
- Chhotani, O.B. and G. Bose. 1982. Insects of Saudi Arabia, Isoptera. *Fauna of Saudi Arabia* 4:73-83.

- Chhotani, O.B. and G. Bose. 1991. Isoptera from Saudi Arabia and Kuwait, with a key to Arabian species. *Fauna of Saudi Arabia* 12:256-265.
- Fontes, L.R. 1985. New genera and new species of Nasutitermitinae from the Neotropical region (Isoptera, Termitidae). *Review of Brazilian Zoology* 3:7-25.
- Harris, W.V. 1967. Termites of the genus *Anacanthotermes* in North Africa and the Near East (Isoptera: Hodotermitidae). *Proceedings of the Royal Entomological Society of London* (B) 36:79-86.
- Harris, W.V. 1970. Termites of the Palearctic region. In: *Biology of Termites*, K. Krishna and F. M. Weesner (Editors) 2:295-314. Academic Press, London.
- Howse, P.E. 1970. *Termites: A Study in Social Behaviour*. Hutchinson Univ. Library. London.
- Kassab, A., M.I. Hassan, A.M. Chaarawi and A.M. Shahwan. 1960. The termite problem in Egypt with special reference to control. Ministry of Agriculture. Cairo, Egypt.
- Myles, T.G. 2004. Proposed taxonomy of the order Isoptera. In: <http://www.utoronto.ca/forest/termite/taxon.htm>.
- Nasr, H., A. Halawani, F. Al-Hadidi and B. Yahia. 1978. Survey of termite species in the Western Region of Saudi Arabia. Technical Report, Agriculture Research Center, Western Region, Ministry of Agriculture and Water, Saudi Arabia, pp46-64.
- Noirot, C. 1970. The nests of termites. In: *Biology of Termites*, K. Krishna and F.M. Weesner (Editors), 2:73-125. Academic Press, London.
- Sands, W.A. 1998. *The Identification of Worker Castes of Termite Genera from Soil of Africa and the Middle East*. CAB International, Wallingford, UK.
- Snyder, T. 1949. Catalog of the Termites of the World. *Smithsonian Miscellaneous Collection* 112:1-490.
- Western, R.R. 1989. *The Flora of the United Arab Emirates: An Introduction*. UAE University Publication. Al-Ain, UAE.

---

Received: February 2005

Accepted: June 2005