Indian Journal of Agricultural Sciences **83** (4): 459–62, April 2013/Short Communication

First report of a commonly prevalent termite *Heterotermes indicola* from Delhi region

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Received: 24 May 2012; Revised accepted: 5 February 2013

Key words: Delhi, *Heterotermes indicola*, *Microtermes, Odontotermes,* Termites

Termite fauna of Delhi is poorly known. Pruthi (1939) is the pioneer to work on Delhi termites and recorded three species of termites. Later on Vishnoi (1957; 1962) reported seven species from various parts of Delhi. According to Thakur (2007) fourteen species of termites are known from Delhi. He listed 12 species under family Termitidae, one each from Kalotermitidae and Rhinotermitidae. *Coptotermes heimi* is the important structural termite reported under the last family. Another structural pest *Heterotermes indicola* was not reported by anyone in Delhi till-date. Under the National Fellow project, termite species were collected and efforts were directed to identify them. In earlier year (2009) we reported *Odontotermes bellahunisensis* Holmgren & Holmgren damaging seriously the rose plants in the poly-house of IARI farm. This paper deals with three more identified termite species reported first time from Delhi region. *H. indicola* (Isoptera: Rhinotermitidae) is the significant report in this paper.

Heterotermes is a semi-relict genus and one of the cost-effectively most important group of subterranean termites and cosmo-tropical in distribution, reported from all the zoogeographical regions except the Palaeartic region (Emerson 1955). It is found both in humid tropics and arid areas (Roonwal and Chhotani 1989). The obscure origin and dispersal of this genus presents a puzzling problem. Emerson (1955) believed that this genus might have originated in the tropical Indo-Malayan region during the late Jurassic or early Cretaceous period before the separation of Australian and Indo-Malayan regions. Twenty six species of this genus are known from the world out of which only four occur in India (Roonwal and Chhotani 1989). It is a semi-relict genus that indicates competitive reduction in numbers but still has numerous species. They typically inhabit several major regions, including Australia. Usually the numbers of species do not indicate the region of origin, possibly because of proportionately greater extinction of species in ancient areas of abundance. Globally, though literature on taxonomic aspects on termites is ample, in Indian situations the records in urban areas are limited. Glaring example is the absence of termite faunistic survey fact sheets in the IARI campus itself. Though taxonomy is viewed by the industry as a theoretical science with little applied value, the example of the Asian subterranean termite (*Coptotermes gestroi*) provides one of many clear-cut case of taxonomy's impact on industry. More examples can be seen by BioNet International (BioNET International 2004) (Kirton 2005). Reporting *H. indicola* first time from Delhi region, is a significant finding relevant to the urban-pest-management sector.

The Indian Agricultural Research Institute (IARI) is the study site. The location stands at 28.08°N and 77.12°E, above mean sea level being 229 metres. The climate is sub-temperate and semi-arid. The mean maximum daily temperature during the hot weather (May-October) ranges from 32.2°C to 40°C and the mean minimum temperature from 12.2°C to 27.5°C. June to September is rainy months during which about 500 mm of rainfall is received. The mean maximum temperature during winter (November-March) ranges from 20.1°C to 29.1°C and the mean minimum temperature from 5.6°C to 12.7°C. During winter, a small amount of rainfall (about 63 mm) is received. The campus of IARI is a self-contained aesthetically laid out complex spread over an area of about 500 ha. The beautiful clock-towered building of the Central Library of the Institute constitutes the focal point of the campus around which stand the laboratory buildings of various Divisions, staff quarters, students' hostels, guest houses, a medical dispensary and schools for boys and girls. The experimental fields, which form an integral part of the IARI campus, cover an area of about 340 ha, of which about 300 ha is irrigated by an interlinked chain of tubewells and water storage tanks, while the remainder is used for dryland farming research experiments. As the institute is on the lap of Aravali Hill Range, a termite-prone zone, IARI

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confronts with this tough task of termites both in the indoors and outdoors.

Termite samples were collected from various localities in IARI and some other places of Delhi. Specimens were preserved in 80% ethyl-alcohol and studied under stereoscopic binocular microscope. Termites were identified using external morphology of the soldier caste (Roonwal 1970a).The important characteristics used for identification were - shape and size of the head, labrum, mandibles, pronotum, postmentum and position of the tooth and antennal segments etc. Determination of species was based on the keys (Roonwal and Chhotani 1989, Chhotani 1997 and Thakur 1981). Biometric data and images of the specimens were taken with the help of MV 600UA Digital USB microscope.

RESULTS AND DISCUSSION

In toto, 76 termite samples were collected from various parts of IARI campus by extensive field and structural inspections. Termite workers and soldiers of *H. indicola* were observed and collected during a structural inspection at store room of Division of Entomology, IARI, New Delhi in May 2012 (Fig. 1). The morphometric measures for *H. indicola* soldier caste was presented (Table 1).

We identified following species: *Odontotermes bellahunisensis* Holmgren & Holmgren, *O. obesus* (Rambur), *O. redemanni* (Wasmann), *Microtermes obesi* Holmgren, *M. mycophagus* Desneux, *Heterotermes indicola* (Wasmann).

We surveyed IARI (Delhi) campus extensively, and recorded first time *Heterotermes indicola*. Wasmann (1902) recorded this species first time from Bombay (India) and named *Leucotermes indicola*. Later Snyder (1949) termed it *Heterotermes indicola*. This species also recorded earlier by various workers from various parts of the country apart from Delhi (Roonwal 1955, 1970b, Roonwal and Chhotani 1967, Sen-Sarma *et al.* 1975, Roonwal and Rathore 1977, Roonwal and Verma 1977, Chhotani and Bose 1979, Sen-Sarma and Thakur 1980, Chhotani 1985, Thakur 2009). Recently, junior author of this paper has collected this species from various localities of Haryana, ie Loharu and Sagbankheri village, Bhiwani; Rajeev chock near bus stand, Gurgaon; CCS Agricultural University Campus, Hisar; Ateli Railway Station, Mahendragarh; Israna, Panipat; Tikaram College Campus and Kundli village, Sonipat; and identified under the able guidance of Dr R K Thakur, Termite Expert, Forest Research Institute, Dehradun (Kumar 2010).

Table 1 Biometric measurement of *Heterotermes indicola* soldiers

Body-Parts	Range	Mean±SD
I. General		
Total body length	4.05-4.89	4.46±0.58
II. Head		
Head-length with mandibles	2.21-2.51	2.39±0.11
Head-length to lateral base of mandibles	1.42-1.79	1.63±0.14
Maximum width of head	0.91-1.00	0.95±0.03
Length of mandibles		
(a) Left mandible	0.80-0.93	0.86±0.05
(b) Right mandible	0.79-0.90	0.84±0.05
III Thorax		
Length of Pronotum	0.49-0.52	0.50±0.01
Width of Pronotum	0.75-0.85	0.79±0.03
Length of Postmentum	1.16-1.44	1.33±0.10
Width of Postmentum	0.38-0.47	0.42±0.03

Figures are mean of 10 termite specimens

Nature of damage: This species causes extensive damage to wooden structures in house in northern India and is also reported to destroy papers, clothes and stored products of cellulosic nature. The infestation in house can be made out from the galleries running on walls and ceiling to reach wooden structures (Roonwal and Chhotani 1989). Damage by the *H. indicola* generally runs along the wood

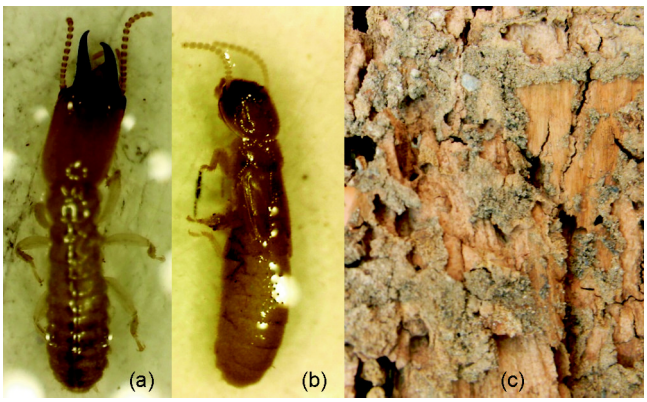

Fig. 1 *Heterotermes indicola* (Wasmann) a) Soldier b) Worker caste c) damaged wood-surface

Fig. 2 Termite infested wooden box (characteristic hanging mud tubes)

grains. The termite eats up the softer wood, leaving the harder parts as thin partition walls which are plastered with excrement. The wood is hollowed out only leaving outer cover. Though it is attacking wood, always has connection with the ground soil where it breeds. Latest, Biswas and Mukhopadhyay (2010) reported aberrant behavior of *H. indicola* in constructing hanging food tunnels in West Bengal region. We recorded this aberrant hanging food mud tubes in wooden box severely infested in the store house of Entomology Division. The wood is hollowed out only leaving outer cover (Fig 2). A serious infestation of a three-storeyed residential building in Paschim Vihar is also recorded (Dr B Paul, pers. comm.).

Heterotermes indicola is well known as a pest in the household, nevertheless its pest status in agricultural crops was also recorded decades back. Roonwal (1982) reported it as a pest of bitter gourd *Momordica charantia* in the arid zone – Indian desert. Roonwal (1979) also reported it as a pest of *Mulberry* sp. and from several forest trees. He ranked it most destructive termite depending upon its damage propensity. Salihah *et al.* (1988) reported this termite as a pest of sugarcane in Pakistan.

Damage to human habitations by termites varies in its impact. When buildings are built of timber, their structure can sometimes be severely compromised. In what may be the most extreme example of damage by termites, an entire township in India was gradually destroyed by the termite, *H. indicola*, and eventually resembled a bombed-out ghost town (Roonwal, 1955, 1970b). The entire town of Sri Hargobindpur, Punjab was abandoned in 1940s, because of pervasive damage by this species.

The study site comes under the Aravali Range. This is a range of mountains in western India and eastern Pakistan running approximately 800 km from northeast to southwest across states of Rajasthan, Haryana, Gujarat and Pakistani provinces of Punjab and Sindh. The northern end of the range continues as isolated hills and rocky ridges into Haryana state, ending in Delhi. The famous Delhi Ridge is the last leg of the Aravalli Range, which traverses through South Delhi and terminates into Central Delhi where Raisina hill is its last extension. It is one of the world's oldest mountain ranges. It dates back to pre-Indian sub-continental collision with the mainland Asiatic Plate (http://en.wikipedia.org/wiki).

The place of origin of *Heterotermes* is obscure. All the genera of the Rhinotermitidae are clearly extensions from Indo-Malayan during the early Cretaceous. All except *Heterotermes* give numerical evidence of their Indo-Malayan origin. The Indo-Malayan region has a larger proportion of original dry and humid forest lands than any other tropical region, and this fact together with the modification by dense populations of humans has doubtless influenced its known termite fauna. *Heterotermes* genus is presumed to have arisen before the Cretaceous separation of Australia from Indo-Malaya. One might expect some records from central and southern Africa and possibly also from Madagascar. The exclusion of this genus from the major portion of the Ethiopian region seems difficult to explain, except by competition with an ecological equivalent. *Psammotermes* (sand termites) in is mutually exclusive but is restricted to dry areas, while *Heterotermes* may live in rain-forests.

Finally as on today, seventeen species of termite are known from Delhi region. The identification of *H. indicola* from Delhi region is of particular importance, especially because it is a major structural pest and control strategies may be taken with appropriate care. Reporting first time a commonly prevalent termite *Heterotermes indicola* is certainly a significant finding relevant to the urban-pest-management sector. It is probable that several more undescribed and new termite species remain to be discovered in Delhi region considering the centralized location, diversity of habitat, and the zoogeographical extent of the current survey.

SUMMARY

Termites are most common in Delhi region, but are known poorly species-wise. Pruthi (1939) is the pioneer to work on termites in Delhi and recorded 3-species. Later on Vishnoi (1957, 1962) reported 7-species from various parts of Delhi. According to Thakur (2007) fourteen species of termites are known from Delhi. In 2009, we identified *Odontotermes bellahunisensis* Holmgren & Holmgren from IARI Rose Poly-house, and this year we identified five more species, viz. *Odontotermes obesus* (Rambur), *O. redemanni* (Wasmann), *Microtermes obesi* Holmgren, *M. mycophagus* Desneux and *Heterotermes indicola* (Wasmann). Thus the termites in Delhi region list goes to seventeen after Thakur (2007). Three new additions to the list are *O. bellahunisensis, O. redemanni* and *H. indicola*. The last one, despite its significant history of devastating an entire village in Punjab in 1940-50s, lack of any record of this species in Delhi region till-date, clearly implies a glaring gap of relevant research activities on termites in our national capital region. Our investigation initiated the break in this gap, reported *H. indicola* with its morphometric studies of soldier caste. The species taxonomy and zoogeographical-distribution is discussed in this paper.

ACKNOWLEDGEMENTS

Authors are thankful to the funding agency ICAR for the sanctioned National Fellow Project, Environmentally Sustainable Termite Control: Integrative & Inclusive Approach of Frontier and Indigenous Technologies. Logistic supports provided by Director, IARI is gratefully acknowledged. Thanks are also due to Dr V V Ramamurthy (PS, Insect-Identification-Service) for identification of *Odontotermes bellahunisensis* Holmgren & Holmgren.

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