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# Data on Species Composition of Termites (Insecta: Isoptera) in Bac Huong Hoa Nature Reserve, Quang Tri Province

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**Abstract:** For the first time, species composition of termites in Bac Huong Hoa nature reserve has been recorded. We have identified 38 species belonging to 14 genera, 7 subfamilies and two families from this area. Among 14 genera recorded, the genus *Odontotermes* had the highest number of species and collected sample rate (9 species, accounted for 23.68% of total species number of the studied area collected samples), followed by *Schedorhinotermes* with six species (15.79%), *Reticulitermes* and *Nasutitermes*, with four species each (10.53%). The remaining genera had from one to three species (2.63-7.89%). In comparison with two nearby areas (Dakrong and Bach Ma), species composition of termites in Bac Huong Hoa Nature Reserve was lower than the areas. The result on distribution in different altitudinal bands showed that species number of termites in the altitudinal band 700-1000 m was the highest (26 species, accounting for 68.42%), followed by that in the altitudinal band >1000 m (16 species, 42.10%) and that in the altitudinal band <700 m (10 species, 26.32%).

*Keywords:* Termites, species composition, altitudinal distribution.

## 1. Introduction

Termites are often perceived as harmful insects. They may cause great losses especially for the agriculture, forestry, architecture, irrigation, transport, trade, because they use wood as food and nesting in the building, dams and plants. However, in the ecosystem they play an important role, contributing to the decomposition of organic matter derived from cellulose to increase the soil humus and minerals, being links in the food web of the ecosystem. Bac Huong Hoa Nature reserve has an area of 25.000 ha, located in five communes of Huong Hoa district. Bac Huong Hoa Nature reserve, for a long time, has been known for its high biological diversity. Many studies on biodiversity of the area have been conducted. There were records of 920 species of vascular plant belonging to 518 genera and 130 families, among which 17 species were listed in several Vietnam Red Data Books. Besides, there were records of 42 species of mammals, 11 species of which listed in the IUCN Red List, and records of 171 species of birds, including two species endemic to Vietnam. However, the knowledge on biodiversity of insects in the area is still very little, especially termites. In 2015, we conducted the field survey on

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termites in this area. This paper is the data on species composition of termites (Insecta: Isoptera) in Bac Huong Hoa Nature Reserve, Quang Tri province".

## 2. Materials and methods

The specimens of termite were collected following the method by Nguyen Duc Kham (1976) [1]. Sampling termites was carried out randomly along a line transect with the length from 1000 m to 3000 m, which was conducted in different habitats: primary forest, secondary forest and plantation. Sampling was also conducted across the range of different heights, including: < 700 m; 700-1000 m and > 1000 m. We tried collecting all castes of termites including soldiers, workers, alates, etc. In each sampling site, we used plastic boxes to hold temporarily some branches of trees or termites. Then, a soft forceps was used to collect termites and inserted them into plastic tubes with 75% alcohol and labels. The specimens were stored in the lab of the Institute of Ecology and Works Protection for further preservation and examination. All termite specimens were examined and measured under the binocular microscope using their external morphology, for instance, head, mandible, maxilla, labium, labrum, pronotum, etc. The measurement of the size of body or body parts were followed the guideline by Roonwal (1969) [2]. Identification of termite species were mainly based on the keys in some respective references, such as "Fauna of Vietnam," a monograph on termites by Nguyen Duc Kham et al. (2007) [3], "Termites of Thailand" by Ahmad (1965) [4], "Termites of Malaysia" by Thapa (1981) [5], "Fauna Sinica - Insecta - Isoptera in China" by Huang et al. (2000) [6].

The similarity in species composition between the studied areas was determined by the Bray - Curtis similarity index. All biodiversity indices, graphs, and tables were calculated by using the Primer V6 software and Microsoft Excel 2007.

## 3. Results and discussion

### *3.1. Species composition of termites in Bac Huong Hoa nature reserve*

Total of 154 termite samples were collected in Bac Huong Hoa nature reserve, Quang Tri province. Based on the samples, we have identified 38 termite species belonging 14 genera, seven subfamilies and two families (Table 1). This resulted in the first data on species composition of termites in Bac Huong Hoa nature reserve, Quang Tri province. Among 14 genera are recorded, the genus *Odontotermes* was most speciose, with nine species (equivalent to 23.68% of total species in the studied area), next was the genus *Schedorhinotermes,* with six species (accounted for 15.79%), *Reticulitermes* and *Nasutitermes*, each with four species, equal to 10.53%. Two genera, *Macrotermes* and *Pericapritermes,* each had three species (7.89%). Genus *Hypotermes* had two species (5.26%). The remaining seven genera had the lowest number of species in the studied area, with only one species each (2.63% each).

In terms of the number of genera and species, the result showed that the number of species in a genus ranged from one to nine species. The number of genera with only one or two species in the studied area was eight (accounting for 57.14% of total genera). Four genera (28.57%) had from three to four species. One genus (7.14%) had six species was found, and one other genus had nine species. The data showed that the majority of the termite genera in the studied area had relatively low number of species and there are the differences in number of species between genera.

At subfamily level, it could be seen clearly that subfamilies of termites in the studied area differed significantly not only in the number of genus/genera and species, but also in the morphological and physiological characteristics, nest structure. Among subfamilies found in the studied area, Macrotermitinae with three genera

(*Macrotermes, Odontotermes, Hypotermes*) had the highest species number, 14, accounted for 36.84% of total species number. An important characteristic of this termite group is that they grow garden of the symbiotic fungus *Termitomyces*, therefore this subfamily is called "Fungus growing termites"[7]. Fungus garden is the product of food processing and is also indispensable food for these termites. Because of their ability of building fungus garden, so the food spectrum of Macrotermitinae is pretty wide. This termite group has high adaptability with the environment and that may contribute to their largest proportion of species among the subfamilies found in Bac Huong Hoa nature reserve.

Table 1. Species composition of termites in Bac Huong Hoa Nature Reserve

| No. | Scientific name | Number of species | Percentage (%) |
|---|---|---|---|
| | **RHINOTERMITIDAE Wasmann** | 31 | 20.13 |
| | **Rhinotermitinae Froggatt** | 16 | 10.39 |
| | ***Schedorhinotermes*** Silvestri | 16 | 10.39 |
| 1 | *Schedorhinotermes medioobscurus* Holmgren | 4 | 2.60 |
| 2 | *Schedorhinotermes sarawakensis* Holmgren | 7 | 4.55 |
| 3 | *Schedorhinotermes tarakanensis* Oshima | 1 | 0.65 |
| 4 | *Schedorhinotermes malaccensis* Holmgren | 2 | 1.30 |
| 5 | *Schedorhinotermes javanicus* Kemner | 1 | 0.65 |
| 6 | *Schedorhinotermes magnus* Tsai et Chen | 1 | 0.65 |
| | **Heterotermitinae Froggat** | 14 | 9.09 |
| | ***Reticulitermes*** **Holmgren** | 14 | 9.09 |
| 7 | *Reticulitermes speratus* Kolbe | 10 | 6.49 |
| 8 | *Reticulitermes chinensis* Snyder | 1 | 0.65 |
| 9 | *Reticulitermes magdalenae* Silvestri | 1 | 0.65 |
| 10 | *Reticulitermes pingjiangensis* Tsai et Peng | 2 | 1.30 |
| | **Coptotermitinae Holmgren** | 1 | 0.65 |
| | ***Coptotermes*** **Wasmann** | 1 | 0.65 |
| 11 | *Coptotermes curvignathus* Holmgren | 1 | 0.65 |
| | **TERMITIDAE Wetwood** | 123 | 79.87 |
| | **Amitermitinae Kemner** | 5 | 3.25 |
| | ***Globitermes*** **Holmgren** | 5 | 3.25 |
| 12 | *Globitermes sulphureus* Haviland | 5 | 3.25 |
| | **Termitinae Sjostedti** | 20 | 12.99 |
| | ***Pericapritermes*** **Silvestri** | 12 | 7.79 |
| 13 | *Pericapritermes tetraphilus* Silvestri | 9 | 5.84 |
| 14 | *Pericapritermes nitobei* Shiraki | 1 | 0.65 |
| 15 | *Pericapritermes latignathus* Holmgren | 2 | 1.30 |

| | | | |
|---|---|---|---|
| | ***Dicuspiditermes* Krishma** | 1 | 0.65 |
| 16 | *Dicuspiditermes makhamensis* Ahmad | 1 | 0.65 |
| | ***Pseudocapritermes* Kemner** | 2 | 1.30 |
| 17 | *Pseudocapritermes parasilvaticus* Ahmad | 2 | 1.30 |
| | **Macrotermitinae Kemmer** | 86 | 55.84 |
| | ***Macrotermes Holmgren*** | 17 | 11.04 |
| 18 | *Macrotermes latignathus* Thapa | 7 | 4.55 |
| 19 | *Macrotermes malaccensis* Haviland | 4 | 2.60 |
| 20 | *Macrotermes annandalei* Silvestri | 6 | 3.90 |
| | ***Odontotermes* Holmgren** | 61 | 29.61 |
| 21 | *Odontotermes formosanus* Shiraki | 19 | 12.34 |
| 22 | *Odontotermes angustignathus* Tsai et Chen | 3 | 1.95 |
| 23 | *Odontotermes pahamensis* Nguyen | 2 | 1.30 |
| 24 | *Odontotermes longignathus* Holmgren | 6 | 3.90 |
| 25 | *Odontotermes hainanensis* Light | 20 | 12.99 |
| 26 | *Odontotermes proformosanus* Ahmad | 2 | 1.30 |
| 27 | *Odontotermes feae* Wasmann | 1 | 0.65 |
| 28 | *Odontotermes ceylonicus* Wasmann | 3 | 1.95 |
| 29 | *Odontotermes brunneus* Hagen | 5 | 3.25 |
| | ***Hypotermes* Holmgren** | 8 | 5.19 |
| 30 | *Hypotermes makhamensis* Ahmad | 7 | 4.55 |
| 31 | *Hypotermes sumatrensis* Holmgren | 1 | 0.65 |
| | **Nasutitermitinae Hare** | 17 | 11.04 |
| | ***Nasutitermes* Dudley** | 9 | 5.84 |
| 32 | *Nasutitermes ovatus* Fan | 3 | 1.95 |
| 33 | *Nasutitermes matangensiformis* Holmgren | 4 | 2.60 |
| 34 | *Nasutitermes tiantongensis* Zhou et Xu | 1 | 0.65 |
| 35 | *Nasutitermes sinensis* Gao et Tian | 1 | 0.65 |
| | ***Hospitalitermes* Holmgren** | 3 | 1.95 |
| 36 | *Hospitalitermes medioflavus* Holmgren | 3 | 1.95 |
| | ***Ahmaditermes* Akhtar** | 1 | 0.65 |
| 37 | *Ahmaditermes tianmuensis* Gao | 1 | 0.65 |
| | ***Pilotermes* He** | 4 | 2.60 |
| 38 | *Pilotermes jiangxiensis* He | 4 | 2.60 |
| | **Total** | 154 | 100 |

The second richest subfamily was Nasutitermitinae, with four genera and seven species, equivalent to 18.42% and 28.57% of total genera and species number respectively. The soldiers of this subfamily are characterized by the front overhang of forehead, therefore Nasutitermitinae is known as "group of nose termites". They have the ability to build their nest under the ground or hanging on the trees, so the number of genera and species of Nasutitermitinae is relative high. Although the remaining subfamilies had only one genus each (7.14%), the number of species in each subfamily was different, as follows: Rhinoternitinae (six species, 15.79%), Termitinae (five species, 13.16%) Heterotermitinae (four species, 10.53%),

Coptotermitinae and Amitermitinae (each with one species, 2.63%).

The termites found in the studied area belong to two families: Rhinotermitidae (damp wood termites) and Termitidae (soil termites). The results showed that the percentage of species number of Rhinotermitidae was rather low (11 species, equivalent to 29% of total species number), while this percentage of Termitidae was much higher (27 species, 71%). Termitidae was also dominant in terms of the number of genera (11 of the total 14 genera, equivalent to 78.6% of total genera) in comparison with Rhinotermitidae (three of 14 genera, accounted for 21.4%) in the studied area.

### *3.2. Comparison of species composition of termites with the ones from other studied areas*

In order to clarify the diversity of termites in the studied area, we compared the species composition of termites collected in Bac Huong Hoa nature reserve with that of other nearby areas, namely Dakrong nature reserve and Bach Ma national park. The results in Table 2 showed that, there were clear differences in the number of genera and species of termites between Bac Huong Hoa nature reserve and Dakrong nature reserve as well as Bach Ma National Park. The number of taxa found in Bac Huong Hoa were much lower (38 species, 14 genera) than those in Dakrong (69 species, 18 genera) and in Bach Ma (62 species, 21 genera).

Table 2. The taxon numbers of termites in studied areas

| **Taxonomic rank** | **Numbers of taxon in studied areas** | | |
|---|---|---|---|
| | Bac Huong Hoa | Dakrong[(1)] | Bach Ma[(2)] |
| Family | **2** | 3 | 3 |
| Genus | **14** | 18 | 21 |
| Species | **38** | 69 | 62 |

*Sources:* [(1)]Nguyen Van Quang et al. (2005) [7]; [(2)]Nguyen Thi My et al. (2007) [8]

The Bray-Curtis index in Table 3, calculated based on the similarities of species composition of termites between three areas, showed that the values of similarity were relatively low, ranging from 31.579 to 39.604. The species composition of termites in Bac Huong Hoa nature reserve was closer than that of Dakrong nature reserve (Table 3).

Table 3. The Bray-Curtis similarity index (%) of termite communities in different areas

| | Bac Huong Hoa | Bach Ma | Dakrong |
|---|---|---|---|
| Bac Huong Hoa | | | |
| Bach Ma | 31.579 | | |
| Dakrong | 39.604 | 36.923 | |

The results provided preliminary findings in the Bac Huong Hoa nature reserve. In order to have more comprehensive understandings of the termite fauna of the studied area, a subsequent investigation should be done in future.

*3.3. Distribution of termites along the altitudinal bands*

The areas with different elevations have different characteristics of climate, subsequently lead to differences in the species composition of plants as well as in soil structures. Those features affect food resources and capabilities of building nest of termites. Three altitudinal bands in Bac Huong Hoa nature reserve were divided for analyzing the distribution of the termites along different altitudes, namely "<700 m", "700-1000 m" and ">1000 m". The analysis results were shown in Table 4.

Table 4. The species number of termite genera in different altitudinal bands

| No. | Scientific name | Nr. of species | Species number in different altitudinal bands | | |
|---|---|---|---|---|---|
| | | | <700m | 700-1000 | >1000m |
| | **RHINOTERMITIDAE** | | | | |
| 1 | *Schedorhinotermes* Silvestri | 6 | | 6 | 2 |
| 2 | *Reticulitermes* Holmgren | 4 | | 3 | 3 |
| 3 | *Coptotermes* Wasmann | 1 | 1 | | |
| | **TERMITIDAE** | | | | |
| 4 | *Macrotermes* Holmgren | 3 | 1 | 3 | 1 |
| 5 | *Odontotermes* Holmgren | 9 | 5 | 6 | 3 |
| 6 | *Pericapritermes* Silvestri | 3 | 1 | 1 | 3 |
| 7 | *Globitermes* Holmgren | 1 | | 1 | |
| 8 | *Dicuspiditermes* Krishma | 1 | | 1 | |
| 9 | *Pseudocapritermes Kemner* | 1 | | 1 | |
| 10 | *Hypotermes* Holmgren | 2 | 2 | | |
| 11 | *Pilotermes* He | 1 | | 1 | |
| 12 | *Nasutitermes* Dudley | 4 | | 2 | 3 |
| 13 | *Hospitalitermes* Holmgren | 1 | | 1 | |
| 14 | *Ahmaditermes* Akhtar | 1 | | | 1 |
| | **Total** | **38** | **10** | **26** | **16** |
| | **%** | **100** | **26.32** | **68.42** | **42.10** |

The results showed that the species number of termites found in the altitudinal band 700-1000m was the highgest (26 species, accounted for 68.42% of total species), followed that in the altitudinal band >1000 m (16 species, 42.10%) and that in the altitudinal band <700 m (10 species, 26.32%). In addition to these results, 24 species were found in only one altitudinal band, 10 species in two altitudinal bands and four species in all three altitudinal bands. The results suggest that the elevation had some influence on the distribution of termite species in the studied area.

## 4. Conclusions

From the results above, some conclusions were drawn as follows:

In Bac Huong Hoa nature reserve, we have identified 38 species of termites belonging to 14 genera, seven subfamilies and two families. The genus *Odontotermes* had the highest number of species (with nine species accounted for 23.68%), followed by the genus *Schedorhinotermes* with six species (15.79%), *Reticulitermes* and *Nasutitermes*, with four species each (10.53%). The remaining genera were found with one to three species (2.63-7.89%). These are the first reported data of the termite fauna in Bac Huong Hoa nature reserve.

In terms of distribution between different elevations, the species number of termites in the altitudinal band 700-1000 m was the highest (26 species, accounting for 68.42%), followed by that in the altitudinal band >1000 m (16 species, 42.10%), and that in the altitudinal band <700 m (10 species, 26.32%).

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# Dẫn liệu về thành phần loài mối (Insecta: Isoptera) tại khu bảo tồn thiên nhiên Bắc Hướng Hóa, tỉnh Quảng Trị

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**Tóm tắt:** Lần đầu tiên thành phần loài mối được ghi nhận ở khu Bảo tồn Bắc Hướng Hóa. Kết quả nghiên cứu đã xác định được 38 loài thuộc 14 giống, 7 phân họ và hai họ. Trong số 14 giống được ghi nhận, giống *Odontotermes* có số loài cũng như tỷ lệ mẫu thu được nhiều nhất (9 loài chiếm 23,68% tổng số lượng loài trong khu vực nghiên cứu), tiếp đến là giống *Schedorhinotermes* với 6 loài (15,79%), *Reticulitermes* và *Nasutitermes*, mỗi giống đều có 4 loài (10,53%). Các giống còn lại chỉ có từ 1 đến 3 loài (2,63-7,89%). So với hai vùng nghiên cứu lân cận là vườn Quốc gia Bạch Mã và Khu bảo tồn thiên nhiên Dakrong, thành phần loài mối ở khu vực này kém đa dạng hơn. Kết quả nghiên cứu về sự phân bố theo độ cao của mối cho thấy số lượng loài thu được nhiều nhất ở dải độ cao từ 700 đến 1000m (26 loài, 68,42% tổng số loài thu được), tiếp đến là ở độ cao trên 1000m (16 loài, chiếm 42,10% tổng số loài thu được) và sau cùng là dải độ cao nhỏ hơn 700m (10 loài, chiếm 26,32% tổng số loài thu được).

*Từ khóa:* Mối, thành phần loài, phân bố theo độ cao.