***Original Research Article***

**Inventory of entomofauna providing non-timber forest products in the southern part of Chad**

**Abstract**

Non-timber forest products exploitation such as insects, constitute increasingly an attractive activity for many persons and provide a wide variety of nutritional and economic value products in African countries and particularly in Chad. However, some edible insect species are increasingly at risk because of anthropic pressures, over-exploitation of plant species, environmental pollution, bush fires, etc. These adverse factors, therefore, contribute to the decline of the species. These detrimental factors are contributing to the rarefaction of numerous edible insect species, which depend on different biotopes. The present study aimed to contribute to food security through the inventory of edible insect species in four provinces of southern Chad including Logone Occidental, Logone Oriental, Mandoul and Moyen-Chari. To achieve this, entomological survey and field insect collection was carried out from April 2024 to February 2025 in sixteen (16) randomly selected sub-divisions of these four provinces. Edible insect species were collected using the manual insect observation and collection method. A total of thirty-five (35) insect species belonging to five orders, namely Orthoptera (locusts, grasshoppers, crickets 54.28%), Lepidoptera (caterpillars 20%), Hymenoptera (bees 5.71%), Isoptera (termites 8.58%) and Coleoptera (Buprestes 11.43%) were inventoried in the study area. These species are consumed by the local population. Their seasonal presence reflects an undeniable availability of protein to cover or supplement the dietary needs of the populations of the southern of Chad.

Key words: Edible insects; animal proteins; food security; non-timber forest products; Chad.

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## 1. Introduction

Exploitation, processing and marketing of the non-timber forest products (NTFPs) have provided significant income and served as food supplements, particularly for the most vulnerable rural and urban populations during lean periods, as well as achieving environmental objectives such as the conservation of plant biodiversity [1, 2]. In Chad, these forest products are used in diverse ways and provide substantial income for a majority of households living with less than one (1) US dollar per day [3]. According to FAO, IFAD, UNICEF, WFP and WHO. [4] report, world hunger measured as the undernourishment prevalence, remained relatively unchanged between 2021 and 2022, but increased during post-pandemic COVID-19 levels, affecting around 9.2% of the world's population in 2022, compared with 7.9% in 2019. Perspectives of the world population towards 2050 "revised in 2017", according to which the world population is expected to reach 8.6 billion in 2030 and 9.8 billion in 2050, force an

increase in human and animal food production; resulting in severe pressure on the environment, including shortages of agricultural lands, water, forests, fisheries, biodiversity resources, nutrients and non-renewable energies [5]. Over 25% of the world's population (around 1.6 billion people), depend on forest resources for their livelihoods; 75% of the world's poor people live in rural areas and depend on NTFPs for their subsistence and well-being, 80% of developing countries use NTFPs everyday [6, 7]. Two billion people are suffering from minerals or vitamins deficient and almost 30% of children in developing countries are victims of malnutrition [8]. In West and Central Africa for example, 11% of children under five suffer from acute malnutrition [9]. This situation is likely to worsen in Africa, where many countries are already facing economic slowdowns, political instability and episodes of internal conflict that are not conducive to governance for intensive agricultural production and medium to long-term agricultural investment [10, 11]. Regarding these various challenges, sustainable food and nutrient-rich solutions should be considered to alleviate food insecurity in Africa. Among the possibilities, nutrient-rich edible insects, already consumed for numerous decades in many African countries [12] and particularly in Chad, deserve a particular attention. The needs of a sustainable, nutrient-rich food system have been the subject of much research and study highlighting that, edible insects are healthy, valuable and nourishing food resources, rich in fats, essential proteins, amino acids, fatty acids, vitamins, carbohydrates, fiber, minerals and other bio-functional compounds; their nutritional value is highly variable due to the large number of insect species [13, 14, 15]. According to our knowledge of NTFPs in Chad, data on the entomofauna that provide non-timber forest products are not known in any detailed and precision in the southern Chad. Only data published by FAO [3] mentioned honey produced by bees (*Apis mellifera*) collected in Koumra as part of the project entitled "Strengthening the contribution of non-timber forest products to food security in Central Africa". This present study aimed to produce a database on entomofauna of the non-timber forest products in the southern part of Chad including of Logone Occidental, Logone Oriental, Mandoul and Moyen-Chari provinces.



## 2. Material and Methods

### *2.1. Presentation of the study site*

The study was conducted from April 2024 to February 2025 in four provinces of southern Chad, including Moyen-Chari (09°08′39.53″ N and 18°22′32.32″ E), Mandoul (8°54′64.36″ N and 17°33′46.00″ E), Logone Oriental (08°39′33.12″ N and 16°51′13.92″ E) and Logone Occidental (8°42'89.00" N and 15°52'27.60" E) (Figure 1). These provinces belong to a Sudanese zone

covered with forest, which is disappearing near villages due to excessive logging. Due to its geographical position, southern Chad receives between 600 and 1,000 mm of rainfall per year and more than 1,200 mm of rainfalls between April and October are recorded in the extreme south (Sarh), [16]. The natural vegetation is wooded savannah based on perennial grasses growing on red ferralitic soils [17]. Two distinct seasons (dry and rainy seasons) with uneven distribution are observed in the zone. The average annual temperature ranges between 25°C and 27°C. The climate is determined by the monsoon. Agriculture, livestock farming, and trade are the main economic activities of the local population [16]. These provinces were chosen based on the exploitation of non-timber forest products, which is an increasingly attractive activity for many people in these areas.

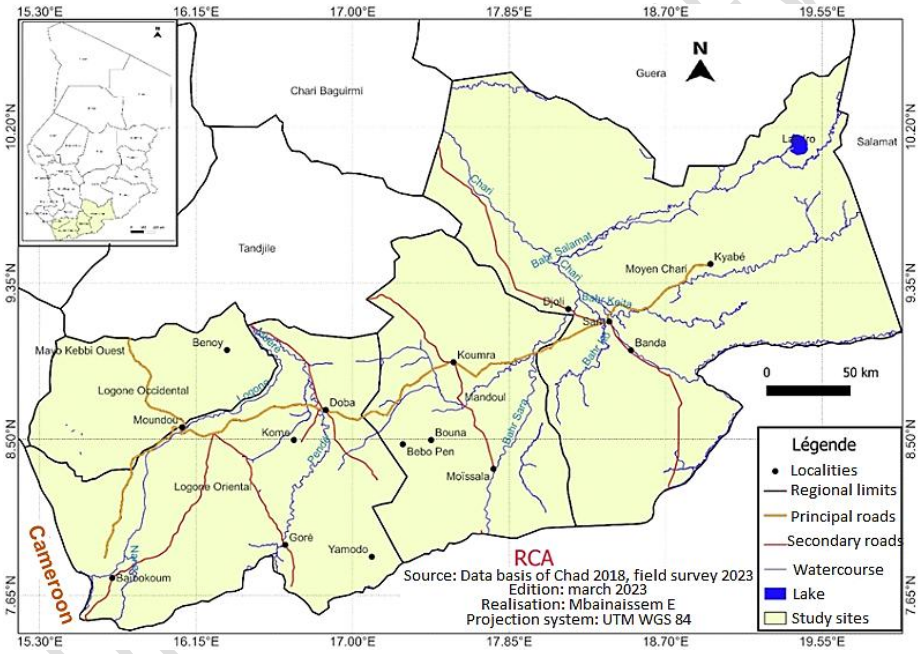


**Figure 1**. Geographical localisation of the study site

*2.2. Sampling methods*

*2.2.1. Ethno-entomological surveys in the sampled localities*

An ethno-entomological field surveys was conducted to collect data on insects consumed in the provinces of Logone Occidental, Logone Oriental, Mandoul, and Moyen-Chari. Sixteen (16) sub-divisions were randomly sampled. The surveys focused on the different insect species consumed; their vernacular name, part of the insect used; stage of insect consumed, collection

method, and period of appearance (seasonality). A total of 443 people (men and women) were interviewed. Survey data were collected using pre-established questionnaire with the Kobbo Collect and Google Form softwares.

*2.2.2. Collection of the edible insects*

Sampling of edible insects was carried out in the field based on the results of the ethno-entomological survey. It was conducted from April 2024 to February 2025 with one field sampling per month. Edible insects were captured either manually or using a sweep net in herbaceous vegetation. Other species were collected in fields by digging up tunnels at night with a hoe to capture them. Caterpillars were collected manually. During each sampling period, the collected insects were stored in 30 mL tubes with lids containing 70% alcohol. Each tube was labelled indicating the location name and the collection date. Insect samples were transported to the Laboratory of Agricultural Entomology of the Faculty of Agricultural Sciences (FSA) at the University of Abomey-Calavi for identification.

*2.2.3. Identification of edible insect species*

The insect identification was carried out in many steps. The insect specimens collected were firstly grouped based on morphological resemblance, then examined under a binocular magnifying glass to refine the morphological characteristics. The insect material was then carefully prepared, mounted, and identified. The specimens belonging to each identified insect Order were grouped in 60 mL boxes with lids and labelled indicating the coordinates and scientific name of the corresponding Order. This step was followed by a detailed re-examination of the specimens under a binocular magnifying glass, based on the morphological characteristics of all parts of the insect using standard identification keys [18, 19, 20, 21, 22, 23, 24].

**2.3. Statistical analysis**

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Data were treated using Microsoft Excel software and analysed using SPSS 20.0 software. Descriptive analysis was conducted to the frequencies and proportion of the respondents surveyed in the 4 provinces of Chad.

## 3. Results

*3.1. Ethno-entomological surveys*

The results of surveys carried out in four provinces of southern Chad as presented in **figure 2** showed that the number of respondents varied according to the provinces studied. A total of 39.29%, 23.83%, 22.94% and 20.71% participants were interviewed in Logone Occidental,

Logone Oriental, Mandoul and Moyen-Chari, respectively. Thus, people surveyed in Logone Oriental were more available to participate to the survey compared to the people of the other regions.

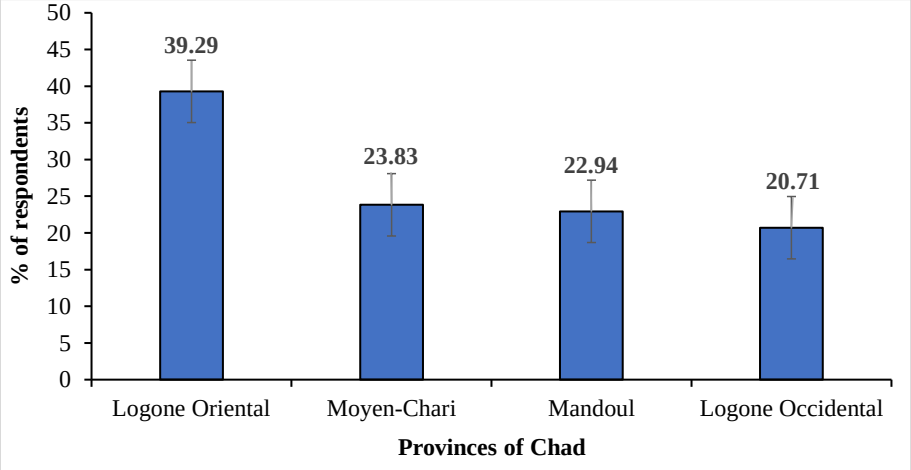


**Figure 2:** Proportion of respondents by province interviewed in the study

*3.1.1. Social status of the surveyed*

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Male persons participated more in the survey with a percentage of 51.89% compared to female participants (48.11%) **(Table 1)**.

Nine (09) socio-professional categories were recorded during the survey. According to the socio-professional category of the respondents, the majority were farmers (45.43%), followed by traders (25.84%). Students, teachers and craftsmen are relatively well represented, with participation rates of 12.03%, 8.24% and 5.35% respectively. Respondents with a low participation rate are manual workers, intermediate professions, qualified employees and senior executives, with participation rates of 1.78%, 0.67%, 0.45% and 0.21% respectively.

**Table 1.** Socio-professional status of the respondents

| Valeur | Statut social | Number | Percentage |
|---|---|---|---|
| **Gender** | Men | 233 | 51.89 |
| | Women | 216 | 48.11 |
| **Total** | | **449** | **100** |
| **Socio-professional category** | Farmers | 204 | 45.43 |
| | Traders | 116 | 25.84 |
| | Students | 54 | 12.03 |
| | Lecturers | 37 | 8.24 |
| | Craftsmen | 24 | 5.35 |

| | | | |
|---|---|---|---|
| | Manual workers | 8 | 1.78 |
| | Intermediate professions | 3 | 0.67 |
| | Qualified employees | 2 | 0.45 |
| | Senior executives | 1 | 0.21 |
| **Total** | | **449** | **100** |

*3.1.2. Knowledge on insect consumption by the populations studied*

The majority of respondents eat insects in their locality. Of the 449 people surveyed, 387 (86.19%) consume insects. The rate of people who did not eat insects in their locality was very low (13.81%) **(Table 2)**.

**Table 2.** Insect consumption rates in surveyed localities

| Question | Answer | number | Percentage % |
|---|---|---|---|
| Do you eat insects in your locality? | Yes | 387 | 86.19 |
| | No | 62 | 13.81 |
| | Total | 449 | 100 |

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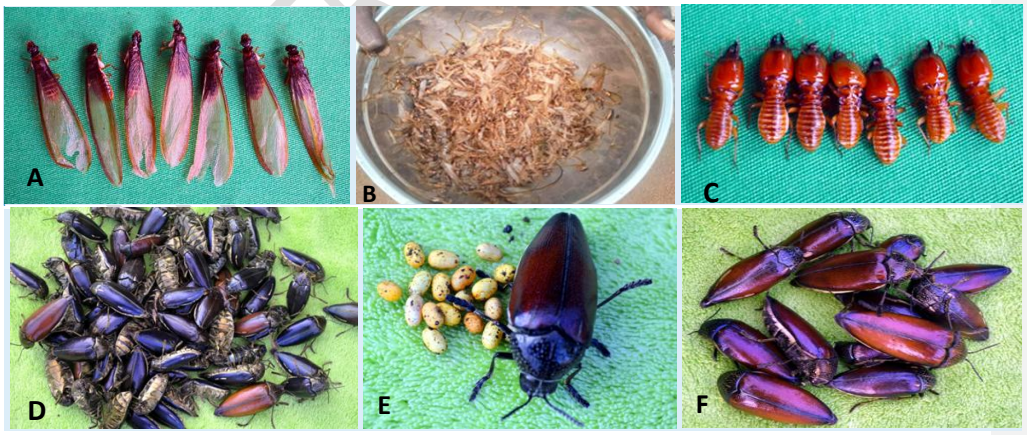
**3.1.3. Insect groups consumed by the communities of southern Chad**

Figure 3 presents the morphological aspects of some insect species consumed in the southern part Chad. In the provinces of Logone Occidental, Logone Oriental, Mandoul and Moyen-Chari, people consume at adult stages, winged termites (Figures 3A & B), non-winged soldier termites (Figure 3C), Coleoptera (*Sternocera* spp.) (Figures 3D, E & F) and Orthoptera (Figures 3G, H and I for crickets; Figures 3J, K and L for locusts). Lepidoptera including *Imbrasia* sp (Figure 3M) and *Agrius* sp (Figures 3N&O) are consumed at larval stage.



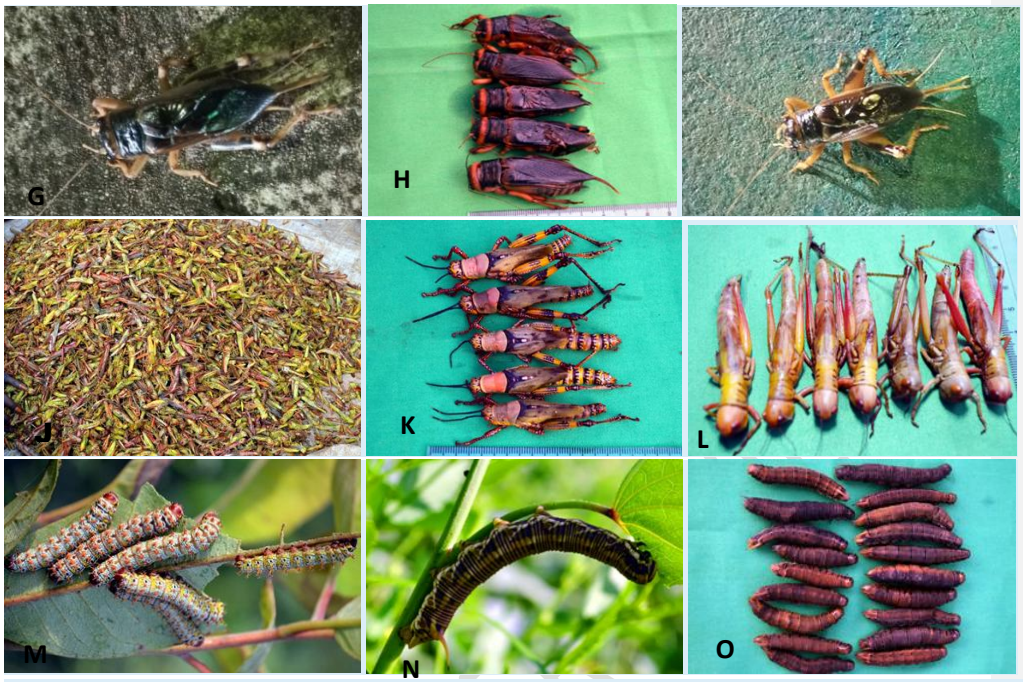



**Figure 3.** Morphological aspects of some insect species consumed in the southern part Chad A, B: winged termites; C: non-winged termites (soldier); D, E and F: Coleoptera (*Sternocera* spp.); G to L: Orthoptera (G, H and I.: crickets; J, K and L: locusts); M, N and O: Lepidoptera caterpillars (M: *Imbrasia* sp; N and O: *Agrius* sp).

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***3.1.4 Edible insects or insect by-products most consumed in the southern part of Chad***

The main edible insect groups recorded in this ethno-entomological survey were locusts (29.74%), followed by termites (21.27%) **(Table 3)**. 14.92% of respondents use honey and wax for food, medicine and cosmetics. Caterpillars, crickets and beetles (*Sternocera* sp.) are moderately consumed, with consumption rates of 12.53%, 11.74% and 7.86% respectively. Grasshopper consumption was very low (at 1.94%) in all four study provinces.

**Table 3.** Frequency of the common insect groups most consumed in the zone studied

| Insect groups/products | Number | Frequence (%) |
|---|---|---|
| Locusts | 337 | 29.74 |
| Termites | 241 | 21.27 |
| Bee products "honey, wax" | 169 | 14.92 |
| Caterpillars | 142 | 12.53 |
| Crickets | 133 | 11.74 |
| Beetles (*Sternocera* sp.) | 89 | 7.86 |
| Grasshoppers | 22 | 1.94 |

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*3.1.5. Harvest periods of edible insects or insect by-products in the southern part of Chad*

The study area is characterized by a forest plant physiognomy periodically influenced by climatic factors, like rainfall. From the information gathered from the stakeholders surveyed, it emerges that the greatest number of insect species consumed appear during the rainy season from May to October. They are rarely observed between November and December, which represents the dry period of the year **(figure 4)**. Analysis of this figure shows that 96.66% of respondents agree that locusts appear between July and November, with a peak in September. For 97.77% of respondents, the period of abundant termite harvesting is from May to August. However, their peak harvesting period extends from June to September. As for the other insect groups, the abundant harvesting periods of crickets, caterpillars, beetles and grasshoppers extend from July to November period. However, insect-derived products such as honey and wax are abundant, and are abundantly harvested between February and May.

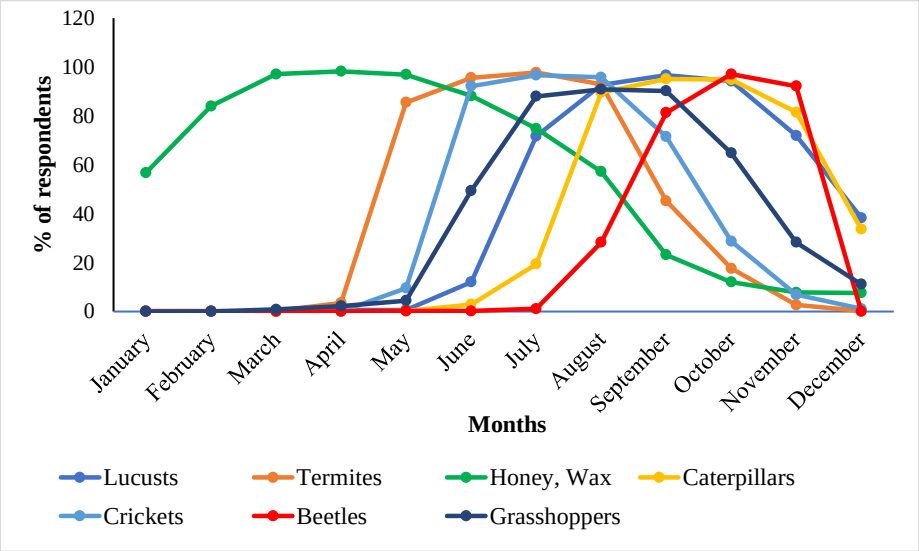


**Figure 4.** Harvesting period for insects and insect by-products (insects, honey, wax) consumed in the study area.

*3.2 Diversity of edible insects/by-product insect producers in the southern part of Chad*

During the period from April 2024 to February 2025, 5338 insects were collected in the provinces of Logone Occidental, Logone Oriental, Mandoul and Moyen-Chari. After identification, insects collected were grouped in 5 Orders, 9 families, 14 sub-families and 35 insect species (Table 4). Order of Hymenoptera (Apidae) is represented by two species of honey bees *Apis mellifera adansonii* (Latreille, 1804) and *Apis mellifera scutellata* (Lepeletier, 1836)

representing respectively 1.06 and 1.16% of the total collection. Order of Coleoptera (Buprestidae) comprised 4 species consumed commonly at adult stage. These species included 4 species of *Sternocera* with high frequency of 11.58% of *Sternocera interrupta* (Olivier, 1790). Order of Blattodea (Termitidae) the most collected (31.83% of total collection) in the study are commonly consumed at adult stage and is represented by 3 species of *Macrotermes* genera including *Macrotermes bellicosus* (Smeathman, 1781), *M. gilvus* (Hagen, 1858) and *M. subhyalinus* (Rambur, 1842). Order of Lepidoptera comprise edible insects at larval stage. This Order grouped two families including Saturniidae family comprising 6 species: *Cirina butyrospermi (Vuillet, 1911), G. alopia* (Westwood, 1849), *G. belina* (Westwood, 1849), *G. hecate* (Rougeot, 1955), *G. melanops* (Bouvier, 1930) and *Imbrasia obscura* (Butler, 1878). The family of Sphingidae represent only one species *Agrius convolvuli* (Linnaeus, 1758). The species belonging to Lepidoptera order were fairly collected in the study zone. Orhtoptera was the largest Order of edible insects collected in the southern part of Chad. This Order is grouped in 4 families. Among them, the family of Acrididae was largest grouping 6 sub-families and 12 species (Acridinae: *Acrida bicolor* (Thunberg, 1815); Cyrtacanthacridinae with 6 species: *Acanthacris ruficornis* (Fabricius, 1787), *Anacridium melanorhodon* (Walker, 1870), *Cyrtacanthacris tatarica* (Linnaeus, 1758), *Kraussaria angulifera* (Krauss, 1877), *Nomadacris septemfasciata* (Serville, 1838) and *Ornithacris turbida cavroisi* (Finot, 1907); Eyprepocnemidinae: *Cataloipus oberthuri* (Bolívar, 1890); Hemiacridinae: *Hieroglyphus daganensis* (Krauss, 1877); Oedipodinae with 2 species: *Locusta migratoria* (Linnaeus, 1758) and *Oedaleus senegalensis* (Krauss, 1877) and Tropidopolinae : *Afroxyrrhepes procera* (Burmeister, 1838)). The family of Gryllidae is moderately represented with 5 species recorded including *Acheta domesticus* (Linnaeus, 1758), *Brachytrupes colosseus* (Saussure, 1899), *Brachytrupes grandidieri* (Saussure, 1877), *Brachytrupes membranaceus* (Drury,1773) and *Tarbinskiellus portentosus* (Lichtenstein, 1796). Families of Pyrgomorphidae and Tettigoniidae recorded each one specie with *Zonocerus variegatus* (Linné, 1758) and *Amblycorypha sp.* as species, respectively. All these Orthoptera are harvested to consume at adult stage. Apart honey harvested in the beehives and holes in the trees, the edible insect larvae and adults are collected on the leaves, branches, grasses of the plants in the crops and bushes. However, some cricket species are dug in the holes and basements.

**Table 4.** Diversity of edible insects collected in the southern Chad from April 2024 to February 2025

| Orders | Families | Sub-Families | Insect species | Total | % | Stage/product consumed | Place of harvest |
|---|---|---|---|---|---|---|---|
| **Hymenoptera** | Apidae | Apinae | *Apis mellifera adansonii (Latreille, 1804)* | 57 | 1.07 | Honey | Beehives, Holes in trees |
| | | | *Apis mellifera scutellata (Lepeletier, 1836)* | 62 | 1.16 | | |
| **Coleoptera** | Buprestidae | Julodinae | *Sternocera henteri (Thomson, 1859)* | 4 | 0.07 | Adults | Leaves and branches of grasses and crops |
| | | | *Sternocera interrupta (Olivier, 1790)* | 618 | **11.58** | | |
| | | | *Sternocera orissa luctifera (Klug, 1855)* | 128 | 2.40 | | |
| | | | *Sternocera orissa variabilis (Kerrmans,1886)* | 54 | 1.01 | | |
| **Blattodea (Isoptera)** | Termitidae | Macrotermitinae | *Macrotermes bellicosus (Smeathman, 1781)* | 490 | **9.18** | Adults | Termite mounds |
| | | | *Macrotermes gilvus (Hagen, 1858)* | 586 | **10.98** | | |
| | | | *Macrotermes subhyalinus (Rambur, 1842)* | 623 | **11.67** | | |
| **Lepidoptera:** | Saturniidae | Saturniinae | *Cirina butyrospermi (Vuillet, 1911)* | 83 | 1.55 | Larval (caterpillars) | Leaves and branches of grasses and crops and trees |
| | | | *Gonimbrasia alopia (Westwood, 1849)* | 44 | 0.82 | | |
| | | | *Gonimbrasia belina (Westwood, 1849)* | 73 | 1.37 | | |
| | | | *Gonimbrasia hecate (Rougeot, 1955)* | 112 | 2.10 | | |
| | | | *Gonimbrasia melanops (Bouvier, 1930)* | 71 | 1.33 | | |
| | | | *Imbrasia obscura (Butler, 1878)* | 68 | 1.27 | | |
| | Sphingidae | Sphinginae | *Agrius convolvuli (Linnaeus, 1758)* | 121 | 2.27 | | |
| **Orhtoptera** | Acrididae | Acridinae | *Acrida bicolor (Thunberg, 1815)* | 95 | 1.78 | Adult | Leaves and branches of grasses and crops and trees |
| | | Cyrtacanthacridinae | *Acanthacris ruficornis (Fabricius, 1787)* | 82 | 1.54 | | |
| | | | *Anacridium melanorhodon (Walker, 1870)* | 63 | 1.18 | | |
| | | | *Cyrtacanthacris tatarica (Linnaeus, 1758)* | 296 | 5.55 | | |
| | | | *Kraussaria angulifera (Krauss, 1877)* | 142 | 2.66 | | |
| | | | *Nomadacris septemfasciata (Serville, 1838)* | 83 | 1.55 | | |
| | | | *Ornithacris turbida cavroisi (Finot, 1907)* | 248 | 4.65 | | |
| | | Eyprepocnemidinae | *Cataloipus oberthuri (Bolívar, 1890)* | 89 | 1.67 | | |
| | | Hemiacridinae | *Hieroglyphus daganensis (Krauss, 1877)* | 182 | 3.41 | | |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Oedipodinae | *Locusta migratoria (Linnaeus, 1758)* | 44 | 0.82 | | |
| | | | *Oedaleus senegalensis (Krauss, 1877)* | 38 | 0.71 | | |
| | | Tropidopolinae | *Afroxyrrhepes procera (Burmeister, 1838)* | 259 | 4.85 | | |
| | Gryllidae | Gryllinae | *Acheta domesticus (Linnaeus, 1758)* | 32 | 0.60 | | Holes and |
| | | | *Brachytrupes colosseus (Saussure, 1899)* | 42 | 0.79 | | Basement |
| | | | *Brachytrupes grandidieri (Saussure, 1877)* | 97 | 1.82 | Adult | |
| | | | *Brachytrupes membranaceus (Drury,1773)* | 49 | 0.92 | | |
| | | | *Tarbinskiellus portentosus (Lichtenstein, 1796)* | 126 | 2.36 | | |
| | Pyrgomorphidae | Pyrgomorphinae | *Zonocerus variegatus (Linné, 1758)* | 169 | 3.17 | Adult | Leaves |
| | Tettigoniidae | Phaneropterinae | *Amblycorypha sp.* | 8 | 0.15 | Adult | Leaves |
| **5 Orders** | **9 families** | **14 sub-families** | **35 species** | **5338** | **100** | | |

## 4. Discussion

Carried out in the provinces of Logone Occidental, Logone Oriental, Mandoul and Moyen-Chari, a total of 449 people participated in the ethno-entomological survey with more participation rate of men compared to women. The respondents were majorly interviewed in Logone Occidental compared to Logone Oriental, Mandoul and Moyen-Chari provinces. The results of this study show a diversity of ethnolinguistic groups consuming insects. According to [25], socio-demographic factors play an important role in the choice of entomophagy practice.

The majority of respondents were farmers, followed by traders while qualified workers and senior executives had a very low participation rate. These results could be explained by the fact that on the one hand, farmers associate hunting activities with farming practices. On the other hand, the unemployed are more inclined to eat insects as reported by Meyer-Rochow [26]. Indeed, Elise [6], and IUCN [7] report that 75% of the world's poor people live in rural areas and depend on non-timber forest products, including insects, for their subsistence and well-being, while 80% of developing countries use non-timber forest products on a daily basis.

Of the 449 people surveyed, the majority consumed insects, compared to the remained respondents. These results illustrate that entomophagy is an existing practice in Chad, and is variably represented in all ethnic groups living in the four studied zones. These insects are generally consumed at the adult stage, with the exception of Lepidoptera, which are eaten at the larval stage (caterpillars) in fried or grilled form. According to Christensen et al. [27] and Hoare [28], entomophagy is practised in many parts of Africa as a traditional heritage.

According to data from the ethno-entomology survey, edible insects are generally harvested during the rainy season. In the areas surveyed, crickets and grasshoppers are mostly collected in August. These results confirm the findings of Seignobos [29], who reports that the rainy season is a particularly favourable period for the explosion of entomofauna. Crickets are collected by digging their galleries with a hoe or machete. Grasshoppers are collected on the leaves and branches of grasses and crops. Locusts and caterpillars are collected towards the end of the rainy season, with peaks observed in September. Seignobos [29] makes a similar observation on the consumption of locusts, grasshoppers and other insects in northern Cameroon. This similarity would be linked to the same type of climate shared the northern Cameroon with our study areas.

Termites are collected at the beginning of the rainy season in the vicinity of termite mounds, with a peak in collection observed in July. Indeed, Mabossy-Mobouna and Malaisse [30] reported that termite harvesting takes place during the rainy season, more precisely during the

period of the first rains after the long dry season in Congo. However, they point out that harvesting starts in September and can extend into December, which differs from the precise month of harvesting in Chad from May to August. This difference is due to the rainy season, which varies from one country to another.

Collection of beetles (Buprestes) generally takes place during the harvest on grass leaves and crops with a collection peak in October. The same result on the Buprestes collection period reported by Signobos [29] on insect consumption in northern Cameroon. The results also showed a period of low collection during the dry season. These results could be linked to abiotic factors (temperature, humidity, rainfall) that favour and/or disrupt insect development. According to Huffaker et al. [31], climate plays a decisive role in the geographical distribution, number of annual generations and abundance of arthropods present in ecosystems. As for honey, the main harvest runs from February to June, with peaks in April and May. These results are probably related to the type of season and climate. Indeed, Prost [32] reported that the cyclical evolution of bees follows the rhythm of the seasons, with the colony passing through phases of active life alternating with periods of slower life.

The inventory of edible insects indicates thirty-five (35) species of edible insects belonging to nine families identified in the provinces of Logone Occidental, Logone Oriental, Mandoul and Moyen-Chari in southern Chad. A great diversity of edible Orthoptera (crickets, crickets and grasshoppers) occupy a significant place with nineteen (19) species belonging to four families identified, representing a percentage of 54.28%. According to Malaisse [33], one hundred and ninety-five (195) species of edible orthopterans have been identified worldwide. Roulon-Doko [34], reports that orthopterans are the most consumed order (40%) in Central Africa. For similar latitudes, in Northern Cameroon, various aspects of their importance have been extensively detailed by Seignobos [29].

Seven species of edible Lepidoptera (caterpillars) belonging to two families were identified with a percentage of (36%) after Orthoptera. This result corroborates that of Roulon-Doko [34] obtained on insect consumption, with Lepidoptera occupying second position in terms of consumption after Orthoptera. This could be explained by the fact that southern Chad and the CAR are neighbours, and the populations of these countries have almost the same eating habits. However, in Burkina Faso, the most edible insect is the caterpillar [35].

Four species of edible Coleoptera (Buprestes) with a percentage of (11.4%) were identified. The inventory of edible beetles revealed a relatively low diversity. Our results differ from those of Bani [36], who reported the consumption of several beetle species in the Republic of Congo, the consumption of many coleoptera species.

## 5. Conclusion

The aim of this study was to contribute to food security through an inventory of edible insect species in four provinces of Chad including Logone Occidental, Logone Oriental, Mandoul and Moyen-Chari from April 2024 to February 2025. Direct observations, field missions, surveys and interviews carried out in the four provinces enabled us to collect useful data on the social status of the respondents, the different groups of edible insects, the stage of consumption and the collection sites. The insect samples collected enabled us to inventory the different species of insects consumed. The results revealed a total of thirty-five (35) insect species belonging to five orders: Orthoptera (crickets, grasshoppers, crickets 54.28%), Lepidoptera (caterpillars 20%), Hymenoptera (bees 5.71%), Isoptera (termites 8.58%) and Coleoptera (Buprestes 11.43%) were inventoried and consumed throughout the study area. Their seasonal presence reflects an undeniable availability of protein to cover or supplement the dietary needs of populations in the four study provinces.

## Data Availability

Data used to support the findings of this present study are included in the manuscript.

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