

Distribution, bioecology, and threats of *Macroscirtus kekeunoui* (Orthoptera: Tettigoniidae) in Mpem and Djim National Park of Cameroon

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Abstract

Macroscirtus kekeunoui is a forest-dwelling katydid with minimal dispersal abilities, distributed in Mpem & Djim National Park. This species is vulnerable to habitat changes and may face a rapid decline as a result of pressure from anthropogenic activities. Our goal is to provide a preliminary assessment of the conservation status of this species to help in the planning of conservation strategies. The sampling was conducted each month from July 2023 to June 2024, employing a sweep net in the Mpem & Djim National Park. The results show that twenty-seven individuals of *Macroscirtus kekeunoui* were collected during 12 months and were mostly distributed in the southern zone of Mpem & Djim National Park. They are most abundant during the rainy season, especially in September. *Macroscirtus kekeunoui* preference habitat is forest, especially undergrowth marantaceae forest. The main threats facing *Macroscirtus kekeunou* are bush fires set by herdsmen around and within the park, deforestation by stakeholders for installing industrial plantations (Cocoa), and also food crops, including corn for their subsistence. This project reveals that *Macroscirtus kekeunoui* is only present within forest vegetation and absent in savana vegetation.

Introduction

In order to safeguard and enhance biodiversity, Cameroon ratified important international agreements concerning the creation of protected areas (Hiol *et al.*, 2015). More than 101 protected areas (PA), covering approximately 22% of the national territory are known. They comprised wildlife reserves (23%) and national parks (75%). Among the national parks, the Mpem and Djim National Park (MpDNP) is the second-largest PA in the forest-savannah ecotone zone in Cameroon and covers a vast natural area of 97,480 ha (Doumenge *et al.*, 2015). Since its creation in 2004, particular efforts has been paid to the conservation of large and medium- sized mammals in natural environments (Kack *et al.*, 2013), including the African golden cat, the heavily threatened pangolin species (Difouo *et al.*, 2020, 2021 ; Simo *et al.*, 2019, 2021, 2023a, 2023b) and bat fauna (Atagana *et al.*, 2018). However, the situation of invertebrate fauna, including insects, is also in peril yet generally overlooked, with challenges for deforestation, pesticide spraying of cocoa trees, and other crops within the catchment area (Lévêque *et al.*, 2006 ; Kitio *et al.*, 2022). The insect community is overwhelmingly diverse compared to other animal taxa and provides critical ecosystem services such as pollinating plants, enhancing soil formation and fertility, increasing plant productivity, and organic decomposition (Kremen *et al.*, 1993,



Andersen *et al.*, 2004, Ward and Larivière 2004). The importance of insects to the function of each ecosystem suggests that any biological or ecological process should be a conservation objective. Currently, knowledge on invertebrate in the Mpem and Djim national park is very poor; however, one Katydid species has been recently discovered, *Macroscirtus kekeunoui* and its ecology, distribution, and anthropogenic pressure are baseline data to monitor changes in the habitat and establish restoration goals in insect communities and other invertebrate (Simeu-Noutchom *et al.*, 2022). It is the case of *Macroscirtus kekeunoui* which is a forest-dwelling katydid invertebrate found only in Cameroon. This species, with minimal dispersion abilities, may be threatened by anthropogenic activities and global changes, which are presently causing mass species extinction. Species that live in microhabitats are particularly in danger of extinction, particularly in tropical areas (Lewis, 2006) and this could be the case of *Macroscirtus kekeunoui*. Like other katydids or insects, *Macroscirtus kekeunoui* is extremely vulnerable to habitat changes and may face a rapid decline as a result of deforestation and environmental deterioration (Massa, 2021; Simeu-Noutchom *et al.*, 2022). For the creation of successful conservation strategies for this target taxon, accurate information on its distribution, bioecology, and threats is required. There is currently no information on the conservation status of this significant taxonomic species that can authorize or encourage conservation action. As anthropogenic pressure is increasing at an alarming rate in Cameroon, and particularly in the study area, it is therefore very urgent to establish the conservation status of this target species.

Main objective : This study was intended to provide baseline data to establish the conservation status and habitat preference of *Macroscirtus kekeunoui*

Specific objectives :

- (1) Assess the distribution of *Macroscirtus kekeunoui* in the Mpem and Djim national park;
- (2) Assess bioecology by identifying habitat preference and estimating the size of the population of *Macroscirtus kekeunoui* in the Mpem and Djim national parks in Cameroon;
- (3) Identify all the threats associated with *Macroscirtus kekeunoui* in the study area.

Material and Methods

The study was conducted in the Mpem & Djim National Park (PDNP) from July to December 2023. This park covers about 97,480 ha and is located in neighboring protected areas like the Dja Biosphere Reserve and Lobeke National Park in Cameroon. A total of twelve field trip sampling was conducted in the different park sectors, including North and South. Two transects of 4km each was defined per trip, for a total of 24 transects for 12 field trip. The fieldwork team comprised four people, namely the principal investigator, two assistants, and one ecoguard or ranger (Figure 1). The sampling was done each month in Mpem & Djim National Park using tools such as GPS to register coordinate, digital cameras to captures photographs in digital memory and sweep nets to collect species (Figure 1). The **distribution assessment** was based on geographical coordinates of *Macroscirtus kekeunoui* individuals collected using GPS. We plot all the coordinates and records on a map of the *Macroscirtus kekeunoui* distribution using the free software QGIS. **To assess the threats**, during the survey in the park, the presence of anthropogenic activity threats was recorded along the transect of 4 km each, and other activities. **Bioecological traits were evaluated** based on the abundance, occurrence, and habitat characteristics of the target species. The abundance is the total number of mature individuals collected in the park and enable us to predict with success the population size of the species in its habitat. The occurrence of the target species is determined by its presence during the survey according to the season, month, and site of sampling. The habitat characteristics is the description of vegetation and soil where the species was caught.



Figure 1. Field survey activities: (a) team members and (b) sampling activities using sweep net

Results

I- Distribution of *Macroscirtus kekeunoui*

Our active search through the various savanna and forest vegetation types found in the examined localities allows us to record *Macroscirtus kekeunoui* in different points and exclusively in the forest. We collected *Macroscirtus kekeunoui* mostly in the south and a few in the north of Mpem & Djim National Park (Figure 2). Compared to the north, which has more savanna, *M. kekeunoui* individuals were more widely dispersed in the south, which has the greatest amount of forest land. Moreover, every specimen collected was adult forest dwellers.

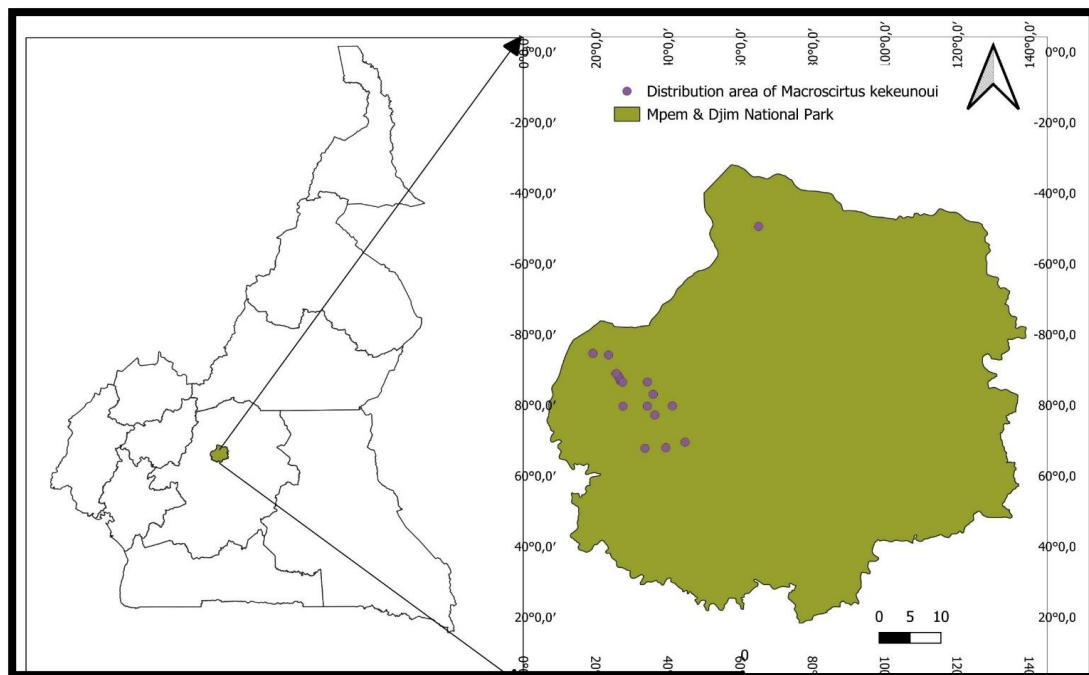


Figure 2. Distribution of *Macroscirtus kekeunoui* in the Mpem and Djim national park

II- Bioecology of *Macroscirtus kekeunoui*

II.1- Abundance and occurrence of *Macroscirtus kekeunoui*

Active search in different savanna and forest vegetation's present in the Mpem & Djim National Park permits us to record 27 specimens from July 2023 to June 2024. Indeed, Mpem & Djim National Park is under four climatic regimes: a long dry season (from mid-November to mid-March), a short rainy season (from mid-March to mid-June), a short dry season (from mid-June to mid-September), and a long raining season (from mid-September to mid-November). *Macroscirtus kekeunoui* was most frequent in the rainy season. The highest abundance of *Macroscirtus kekeunoui* was observed in September with 6 individuals, which corresponded to the highest rainy season, and the lowest abundance was observed in the dry season, where some specimens were collected. In fact, November is a month of transition between the rainy season and the dry season (Figure 3).

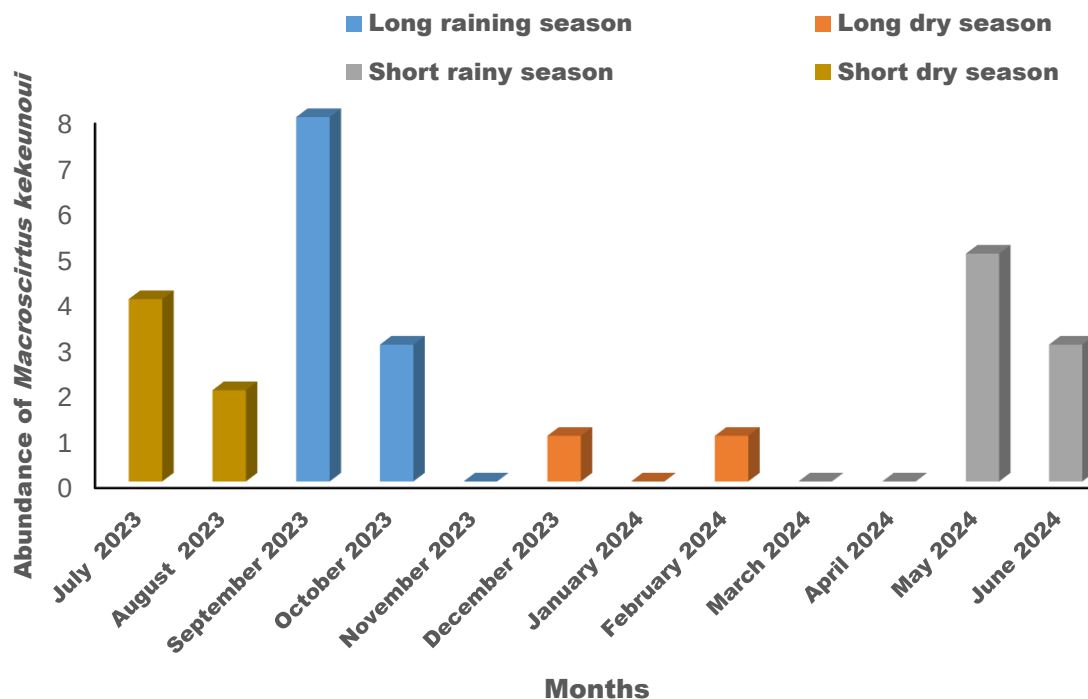


Figure 3. Abundance fluctuation of *Macroscirtus kekeunoui*, from July 2023 to June 2024 in the Mpem & Djim National Park

II.2- Habitat preference

Following year of observation from July 2023 to June 2024, in four types of vegetation, namely marantaceae forest, liana forest, savannahs, and some agroforests of Mpem & Djim National Park, *Macroscirtus kekeunoui*, it appears mostly inhabit forest types, with high frequency in marantaceae forest and absence in savannah (Figure 3). They were all gathering in the undergrowth of the forest, mostly in the form of dead leaves and branches. This insect may contribute to the breakdown of forest trash (Figure 4). Additionally, no *Macroscirtus kekeunoui* specimen was captured only in forests, which were very little disturbed by anthropogenic activities. *Macroscirtus kekeunoui* may serve as a



bioindicator of the stability or undisturbed ecosystems of the park's forests and need further investigation. A savannah environment did not yield any individuals, indicating that the conditions there are not favorable to the growth of *Macroscirtus kekeunoui*. Therefore, a number of human actions, including over-logging, slash-and-burn farming, and other activities, may significantly diminish its population sizes.

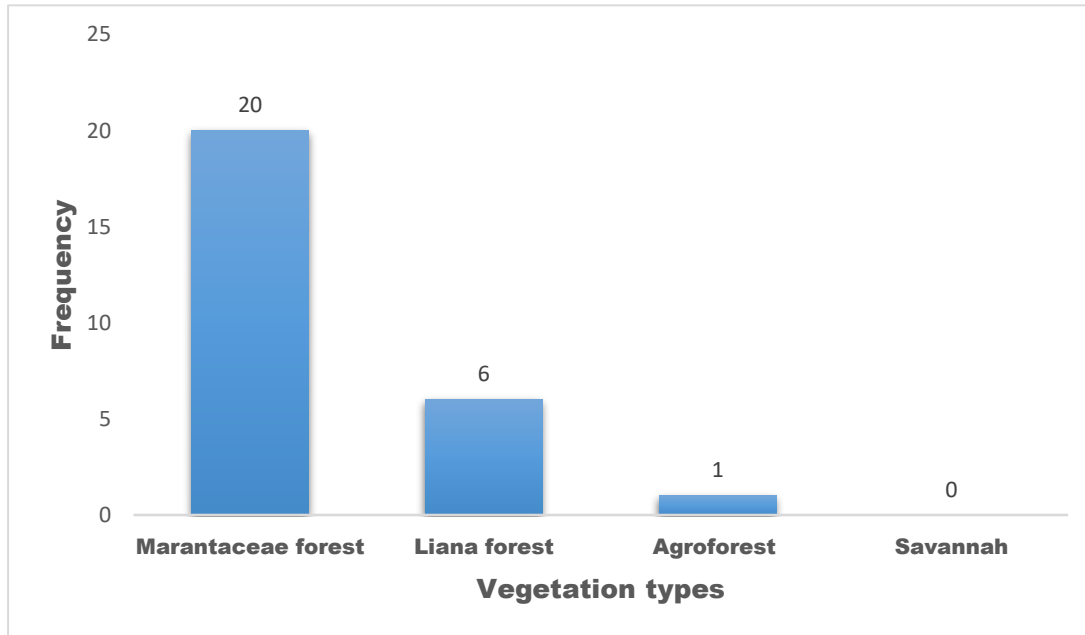


Figure 4. Frequency of *Macroscirtus kekeunoui* in different type of habitats in the Mpem & Djim National Park s



Figure 5. Habitat preference of *Macroscirtus kekeunoui*, following its occurrence in the forest of Mpem & Djim National Park

III- Threats of *Macroscirtus kekeunoui* in the Mpem and Djim park

Over the year, many threats have been found during sampling around and in the park. *Macroscirtus kekeunoui*'s existence in the Mpem and Djim parks, along with that of numerous other invertebrates, is threatened by multiple activities. The main human activities that pose a threat to *Macroscirtus kekeunoui* are bush fires set by shepherds to replenish young growth for grazing and burn agricultural practices. The reason for this practice by shepherds is that the grass gets very dry, especially during the dry season. On the other hand, fire set by stakeholder is for agricultural practices, for installing industrial plantations (cocoa). Given that *Macroscirtus Kekeunoui*'s preferred habitat is primarily made up of leaves and decaying wood, the illegal activity in the park's surrounding region poses a serious threat to the species. The immediate effects of fire on *Macroscirtus kekeunoui* include death and injury. *Macroscirtus kekeunoui* that survive the fire itself may later starve or be exposed to predators as a result of a lack of food or cover. They must outcompete other creatures that have fled to unburned areas in order to survive in areas that have not been touched by the fire. Furthermore, the harvesting of tree products, the use of wood, the planting of maize farms, and the production of cocoa were among the other activities recorded that contributed to the degradation of the forest cover in our two prospective areas and had a detrimental impact on the population of *Macroscirtus kekeunoui* and other invertebrate. In addition, upon entering the forest for hunting, local people typically cut trees to create makeshift shelters and use the young



stems to make animal traps. These actions negatively impact the reserve's plant regeneration and, consequently, the limited dispersal ability of *Macroscirtus kekeunoui*.



Figure 6. Different anthropogenic practices threatening *Macroscirtus kekeunoui* in the park: (a) bush fires, (b) deforestation, (b)maize farms, (d) cocoa farms plantation

IV- Perspectives

- Carry out an awareness campaign in the Mpem & Djim National Park with a view to reducing the threats to the *Macroscirtus kekeunoui* population as well as other protected wildlife and their habitat.
- Intensify the monitoring of target and other species of katydid in Mpem & Djim National Park as well as in adjacent parks in order to identify all the existing populations.
- Publish our results in a peer-reviewed journal.

Conclusion

At the end of this study, it appears that *Macroscirtus kekeunoui* is mostly distributed in South Est Mpem and Djim Park. Ecologically, according to the deforestation gradient point of view, *Macroscirtus kekeunoui*, was most abundant and frequent in marantaceae forest, but was absent in savannah. Therefore, its preference habitat seems to be forest, especially marantaceae forest. However, *Macroscirtus kekeunoui* is under great anthropogenic pressure, such as bush fires, farming, deforestation, and clear-cut practices for installing industrial plantations (Cocoa). It is urgent to carry out an awareness campaign with a view to reducing the threats to the *Macroscirtus kekeunoui* population as well as other protected wildlife and their habitat in the Mpem & Djim National Park



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