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Distribution of small mammals and human induced factors in Gulme forest patches (Birsheleko), West Gojjam, Ethiopia

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This study dealt with distribution of small mammals and the major human induced factors in Gulme forest patches (Birsheleko). Live-trapping in the study area revealed the presence of *Stenocephalemys albipes, Lophuromys flavopunctatus*, *Crocidura flavescens*, *Arvicanthis dembeensis, Tatera robusta, Pelomys harringtoni* and *Mus mahomet. Tachyoryctes splendens* and *Hystrix cristata* were also observed in the study area. Intensive agricultural practice, livestock grazing and military training activity proved to be major factors that cause less species diversity of small mammals in the study area. Diversity of rodents was higher in the bushland as a result of more cover. This study also indicated that samples from the forest with military training carried out shows the least species diversity.

Key words: Distribution, human induced factors, relative abundance, small mammals.

INTRODUCTION

Ethiopia is one of the most physically and biologically diverse countries in the world (Glass, 1965; Yalden and Largen, 1992; Corti *et al*., 1999; Dessie, 2003). The country is characterized by physiographic, climatic and edaphic diversity resulting in variable vegetation and fauna (Wolde Selassie, 1998). The topographical variation ranges from 135 m below sea level in the Dallol depression to a peak of 4620 m above sea level at Ras Dejen in the Simien Mountains (Gebreegziabher, 1988; Tedla, 1995; Hundessa, 1996; Bekele and Corti, 1997; Zeleke, 2003; Adgo, 2003). Geographically, the country is located in the horn of Africa between latitude 3^0-15^0 N and longitude 33^0-48^0 E (Hundessa, 1996; Wolde Selassie, 1998).

Mammals are successful group of vertebrates (Hickman *et al*., 1988). Globally, small mammals form a major proportion of the mammalian fauna and are also a common feature of agricultural landscapes (Jacob *et al*., 2003; Gebresilassie *et al.,* 2005). The small mammals of East Africa include a diverse group of rodents, insectivores and bats, and they represent a heterogeneous group (Corominas, 2004; Keesing, 2000). Globally, small mammals form a major proportion of the mammalian fauna (Jacob et al., 2003) and used to indicate the level of disturbance of a given community.

Among the mammals of Africa, rodents are the most ubiquitous and numerous (Macdonald, 1984; Delany, 1986; Bekele, 1996). They comprise 29 living families, 443 genera, and more than 2000 species (Cole *et al*., 1994, Vaughan *et al*., 2000; Danell and Aave-Olsson, 2002; Amori and Gippoliti, 2003). Although rodents show considerable diversity in morphology, habitat utilization, behaviour, life history strategies and distribution (Mengistu and Bekele, 2003), they show less overall variation in body plan than do other mammalian orders (Macdonald, 1984).

Of the 284 mammalian species of Ethiopia, 84 species are rodents (Bekele and Leirs, 1997; Shenkut *et al*., 2006) and 21% are endemic (Bekele, 1996) constituting 50% of the Ethiopian endemic mammals (Bekele and Corti, 1997). For instance, *Tachoryctes macrocephalus* is an endemic rodent to Ethiopia and is restricted to high altitude grassland and moorland habitats (Yalden, 1985; 1988). *Arvicanthis dembeensis* and *Stenocephalemys albipes* are also endemic rodents to Ethiopia (Rabiu and Fisher, 1989; Bekele, 1995; Corti *et al*., 2005).

Few ecological studies on small mammals were carried out in the country. For instance, Alatish National Park (Habtamu and Bekele, 2008), Nechisar National Park (Datiko et al., 2007), Bale Mountains National Park (Yalden, 1988) and Simen Mountains National Park (Yalden et al., 1976) and in central Ethiopia by Bekele and Leirs (1997). Although few ecological studies on small mammals have been carried out in different parts of Ethiopia, the ecology of small mammals in the country is poorly known due to inaccessibility and unsuitable conditions of areas (Bekele, 1996). Information regarding distribution and associated human induced factors in Gulme forest patches has not been published up to this time. Therefore, an ecological survey was carried out in Gulme forest patches to determine the human induced factors and distribution of small mammals in the region.

MATERIALS AND METHODS

The study area

The investigation was carried out in Gulme forest patches. The area is located approximately 400 km northwest of Addis Ababa. It is situated between 10°27'-10°42' N latitude and 37°6' -37°13' E longitude at an altitude ranging from 1400-2000 m asl. The climate of the area is tropical with wet and dry seasons. The

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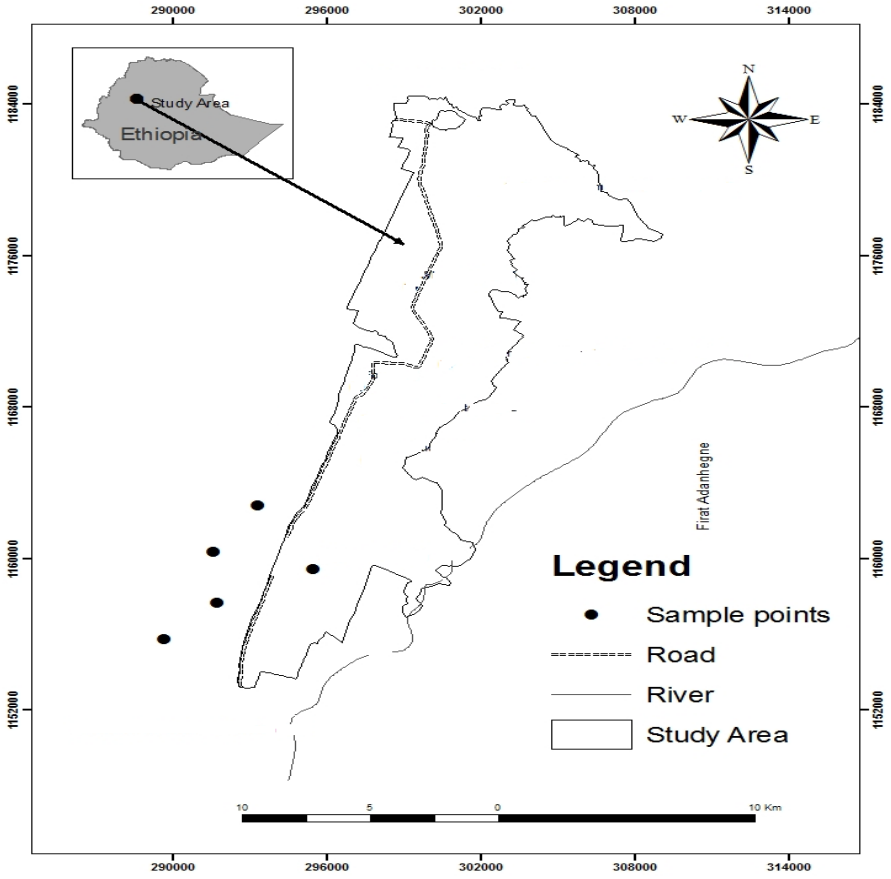

Figure 1. Map of the study area.

annual rainfall follows unimodal regime. Most of the area falls into 'Weina Dega' or "warm to cool semiarid" agro-climatic zone with the temperature range of 12-33.8°C. The hottest month of the year is March (33.8°C) and April and the coldest is July (8.2°C). The total study area was identified as military training forest, human encroached forest, riverine forest, bushland vegetation and grassland habitats (Figure 1).

METHODS

Global positioning system (GPS), meter, digital camera, polythene bag, protective gloves, Sherman live-traps, bait (peanut butter) and 70% ethyl alcohol were materials used in the data collection. During preliminary survey, all the available and relevant information about the area (climatic condition and approximate size of the different vegetation types) was gathered. Based on the habitat type, the total area was identified as military training forest (MTF), Human encroached forest (HEF), Riverine forest (RF), bushland (BL) and grassland (GL). The number of sampling grids chosen for different habitats was based on the total size of the area that the vegetation type covers. Representative sample grids were set in the different habitat types.

Based on the data collected during the preliminary survey, an ecological survey of small mammals was conducted during wet (August 2007 to October 2007) and dry seasons (December 2007 to February 2008). The capture-mark-recapture (CMR) technique was used in sampling small mammal populations, to estimate the population size and structure of the populations. The duration between two successive trap sessions was 30 days. Trapping was made in four sessions covering different seasons. Trapping session one (August, 2007) coincided with the main rainy season. The second trapping session was during mid-September to mid-October (2007). The third (December, 2007) and fourth trapping session (February, 2008) were also times where data collected. In all these trapping sessions, trappings carried out in military training forest, human encroached forest, riverine forest, bushland vegetation and grassland habitats.

Sherman live trap was used to trap rodents. Traps were covered with grass to reduce mortality from heat and cold. A permanent 4900 m^2 live trapping grid was established in all the different natural habitat area. Seven rows by seven columns were set at 10 m intervals between trap stations. Live traps were baited with peanut butter checked twice a day, late afternoon (between 05:00 and 06:00 p.m.) and early the next morning (between 07:00 and 08:00 a.m.). The Shannon-Weaver diversity index (H′) and SPSS software version 16.0 (using ANOVA) were used to analyze the data (Figure 2).

RESULTS

There were seven small mammals trapped in the area. The six species of rodents identified and recorded were *S. albipes, L. flavopunctatus, C. flavescens, A. dembeensis,*

Table 1. Species composition, relative abundance and distribution of live-trapped rodents in different habitat types (Dash indicates absence of capture).

Species	Habitat types					Total	Relative
	MTF	HEF	RF	BL	GL	catch	Abundance (%)
S. albipes	8	44	-	72	4	128	27.8
L. flavopunctatus	6	36	-	44	4	90	19.6
C. flavescens	-	-	4	44	22	70	15.2
A. dembeensis	-	-	-	28	32	60	13
T. robusta	-	-	8	24	14	46	10
P. harringtoni	-	12	4	22	4	42	9.2
M. mahomet	-	-	-	8	16	24	5.2
Tachyoryctes splendens	-	-	-	-	-	-	-
Hystrix cristata	-	-	-	-	-	-	-
Total	14	92	16	242	96	460	

T. robusta, P. harringtoni, and *M. mahomet*. The relative abundance of live-trapped species was: *S. albipes* (27.8%), *L. flavopunctatus* (19.6%), *C. flavescens* (15.2%), *A. dembeensis* (13 %), *T. robusta* (10%), *P. harringtoni* (9.2%), and *M. mahomet* (5.2%) (Table 1).

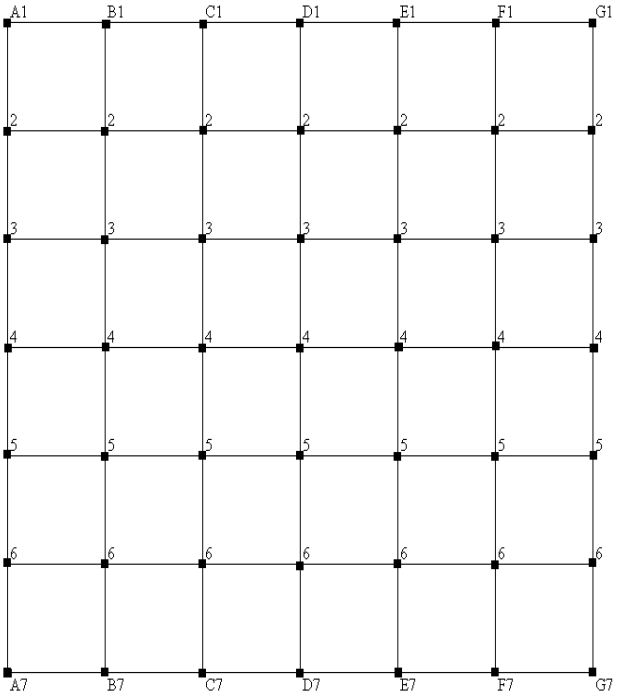

Figure 2. Diagrammatic representation of live-trapping grid with trap locations.

S. albipes and *L. flavopunctatus* occurred in military training forest, human encroached forest, bushland and grassland except riverine forest sample sites. *C. flavescens* and *T. robusta* distributed in riverine forest, bushland and grassland habitats. *P. harringtoni* occurred in all sampling sites except military training forest. Among the rodents trapped, *A. dembeensis* and *M. mahomet* had less distribution in the area captured only from bushland and grassland habitats.

Statistically significant variation was observed between bushland vegetation and military training forest, human encroached forest and riverine forest (Tukey HSD test: $p < 0.05$). The captured population from the different habitat types do not showed statistically significant variation ($p > 0.05$).

DISCUSSION

A total of seven species (six rodent and one insectivore species) was captured during the present investigation. *S. albipes*, common and widespread endemic species of the Ethiopian plateaux of altitudes from 1500 to 3300 m, captured from military training forest, human encroached forest, bushland vegetation and grassland except the riverine forest. Yalden *et al.* (1976) described the species associated with more of natural vegetation. Bekele (1995) and (1996) also explained the species as widespread in forests (Menagesha State Forest) and bushy vegetation. Wube (2005) also described the species as more abundant in bushland areas than in crop fields.

L. flavopunctatus was more recorded in bushland areas because it prefers places with better ground cover, abundant and diversified grasses and herbs. (Happold and Happold, 1987) have stated that the species avoid exposed areas. *C. flavescens* was the only insectivore captured during the present study. It is one of the common and widespread shrews in Ethiopia in altitude ranges of 1000-3000 m (Yalden *et al*., 1976). Delany (1964) described this as a typical forest species. However, in the present study, this species also occurred in the bushland and grassland habitat types. Probably these habitat types provided enough cover for them. *A. dembeensis* was the most dominant and abundant in bushland and grassland areas. The absence of capture in the military training forest, human encroached forest and riverine forest may reflect the agricultural pest of the species. *T. robusta* was widely distributed in the bushland and grassland. Bekele, Leirs and Verhagen (2003) also described the species as a minor pest in agricultural areas. This species was captured from maize fields and grasslands

from central Ethiopia (Bekele and Leirs, 1997) and from Arbaminch forests and farmlands (Datiko, Belay and Bekele, 2007). *P. harringtoni* is the least captured (2.0%) rodent species in the study area. Bekele (1996) also trapped the rodent in the Menagesha State Forest with less trap success. As the species has semi-arboreal habits (Yalden, Largen and Kock, 1976), it may be underestimated as the traps were set on the ground.

The military training center at Bir Sheleko causes high disturbance and limited underground vegetation. Military training forest had the lowest species diversity might be due to the high disturbance. Avenant and Cavallini (2007) and Fox and Fox (2000) also described that areas with high disturbance show lowest species diversity. At the same time, extensive human activities in different areas of the Farm Development as the result of disturbances leading to the shift in habitat types (Happold, 1975). Generally, disturbance decreases density of small mammals as discussed by Wijesinghe and Brooke (2005).

Live stock grazing is also another human induced factor that affects small mammal diversity of the study area. This practice may also result in change in vegetation type. Makundi, Massawe and Mulungu (2005) described that human activity, change in vegetation type and clearing of natural forests for agricultural development affect the distribution of small mammals.

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