Tanzania Journal of Science 45(4): 543-558, 2019 ISSN 0856-1761, e-ISSN 2507-7961

Altitudinal Distribution and Monthly Occurrence of Butterflies in the Kihansi Gorge Forest, Tanzania, with a Checklist of Species

Devolent Mtui[1*], Colin Congdon[2], Ivan Bampton[2], Parson Kalenga[1], and Haule Leonard[1]
[1]*Tanzania Wildlife Research Institute, P. O. Box 661, Arusha, Tanzania.*
[2]*African Butterfly Research Institute, P. O. Box 14308 Nairobi, Kenya.*
Corresponding author e-mail address: deovolentem@gmail.com
Co-authors e-mail: colin.congdon@gmail.com, leonhaule22@gmail.com, parskale1978@gmail.com

Abstract

The goal of this project was to establish a checklist of butterflies occurring in Kihansi gorge to serve as baseline for monitoring of gorge ecosystem health. The key questions were *what* and *how many* species of butterflies occur in the gorge with respect to time and space. The study was conducted between October 2005 and February 2007. Butterflies were recorded twice a week, along a walking trail, using malaise traps and sweep net. The traps were located at upper (> 750 – 1100 m), mid (> 580 – 750 m) and lower (300 – 580 m) gorge. A total of 213 species were documented, of which 50.2% belong to the family Nymphalidae, 19.2% Lycanidae, 17.8% Hesperiidae, 7.5% Pieridae, 5.6% Papilionidae, and 0.5% Riodinidae. Of the 213 species, only 130 had complete information about time and space of occurrence in the gorge. The Nymphalids and Papilionids were present in the gorge throughout the year, while the Pierids, Hesperiids and Lycaenids occurred in the gorge between November and May. Of the 130 species, 51% were common throughout the gorge, while 26%, 3%, and 20% were unique to upper, mid and lower gorge, respectively. Among the documented species are 3 of conservation concern including a new species, *Charaxes mtuiae*, and two rare species *Etesiolaus pinheyi* and *Artitropa reducta* that are only known from the Eastern Arc Mountain Forests. Kihansi gorge therefore serves as their valuable range extension; hence conservation of this area is important.

Keywords: Butterfly, Kihansi, Kihansi gorge, Eastern Arc Mountain

Introduction

Butterflies are insects in the order Lepidoptera (Williams 2006). Worldwide, there are over 20,000 described species of butterflies grouped into six families, namely Papilionidae, Pieridae, Nymphalidae, Lycaenidae, Hesperiidae and Riodinidae (Larsen 2005). Butterflies are sensitive to environmental gradients (Larsen 1991), and because of that are considered as potential important indicators of ecosystem health. Environmental changes may cause changes in the numbers and distribution of butterfly species (Luoto et al. 2006). Documentation of species that may be sensitive or tolerant to environmental changes would provide useful information that ecologists can use as a tool to understand and monitor the health of an ecosystem.

Kihansi Gorge forest is a portion of the Eastern Arc Mountains Forests in Tanzania, one of the 25 global biodiversity hotspots (Myers et al. 2000). Between 1994 and 1999, the Government of Tanzania established a Lower Kihansi Hydropower Project (LKHP) to meet the country's demand for power supply. Implementation of the LKHP facility required diversion of 98% of Kihansi River water that used to pass through the Kihansi River Gorge.

Reduction of the river flow had effects on climatic conditions and ecological systems of the gorge, with one major catastrophe being the extinction of the endemic frog, *Nectophrynoides asperginis*) in the wild (SSC 2009). Various studies have been conducted to understand effects of the LKHP on the Kihansi gorge ecosystem health by focusing on amphibians (Channing et al. 2006, Vandvik et al. 2014), vegetation (Quinn et al. 2005) birds (Cordeiro et al. 2006), and Coleoptera (Zilihona and Nummelin 2001), but no study was specific to Lepidopterans. The goal of this project was to establish a checklist of butterflies occurring in the Kihansi gorge to serve as a baseline for monitoring of the gorge ecosystem health. The key questions were *what* and *how many* species of butterfly occur in the gorge with respect to time and space.

Materials and Methods

The Kihansi Gorge forest is located between latitudes 8° 34' and 8° 37' South, and longitudes 35° 49' and 35° 51' East, in the South-Central Tanzania (Figure 1). The gorge lies along the Kihansi River, covering an area of 20 km^2 at an elevation ranging from 300 m to 1100 m. The gorge consists of four vegetation types, including the moist forest, spray wetlands vegetation, deciduous woodland, montane and submontane secondary vegetation (Lovett et al. 1997). The montane and submontane vegetation are common at mid and high altitudes (above 580 m), probably representing areas of cleared forests or woodland by agriculture and fire (Lovett et al. 1997). Annual rainfall totals ≥ 1500 mm, falling between November and May each year. Mean annual temperature ranges from 16 °C (June and July) to 31 °C (January and February).

Butterfly sampling was conducted twice a week for 136 days between October 2005 and February 2007. The sampling was carried along a walking trail 4,069 m long, from the lower portion of the gorge (distance = 1826 m; altitude = 300 – 580 m) through mid (distance = 940 m; >580 – 700 m) to upper gorge (distance = 1303 m; altitude > 700 – 1190 m). The trail transverses various vegetation types, mainly moist forest, spray wetlands vegetation, deciduous woodland, montane and submontane secondary vegetation. Butterflies were captured using malaise traps and sweep nets. The malaise traps were used because were the only traps available to us with no financial implications. The two techniques were employed to ensure maximum capture of butterfly species occurring in the gorge. Garmin GPS were used to mark the altitude where the traps were positioned.

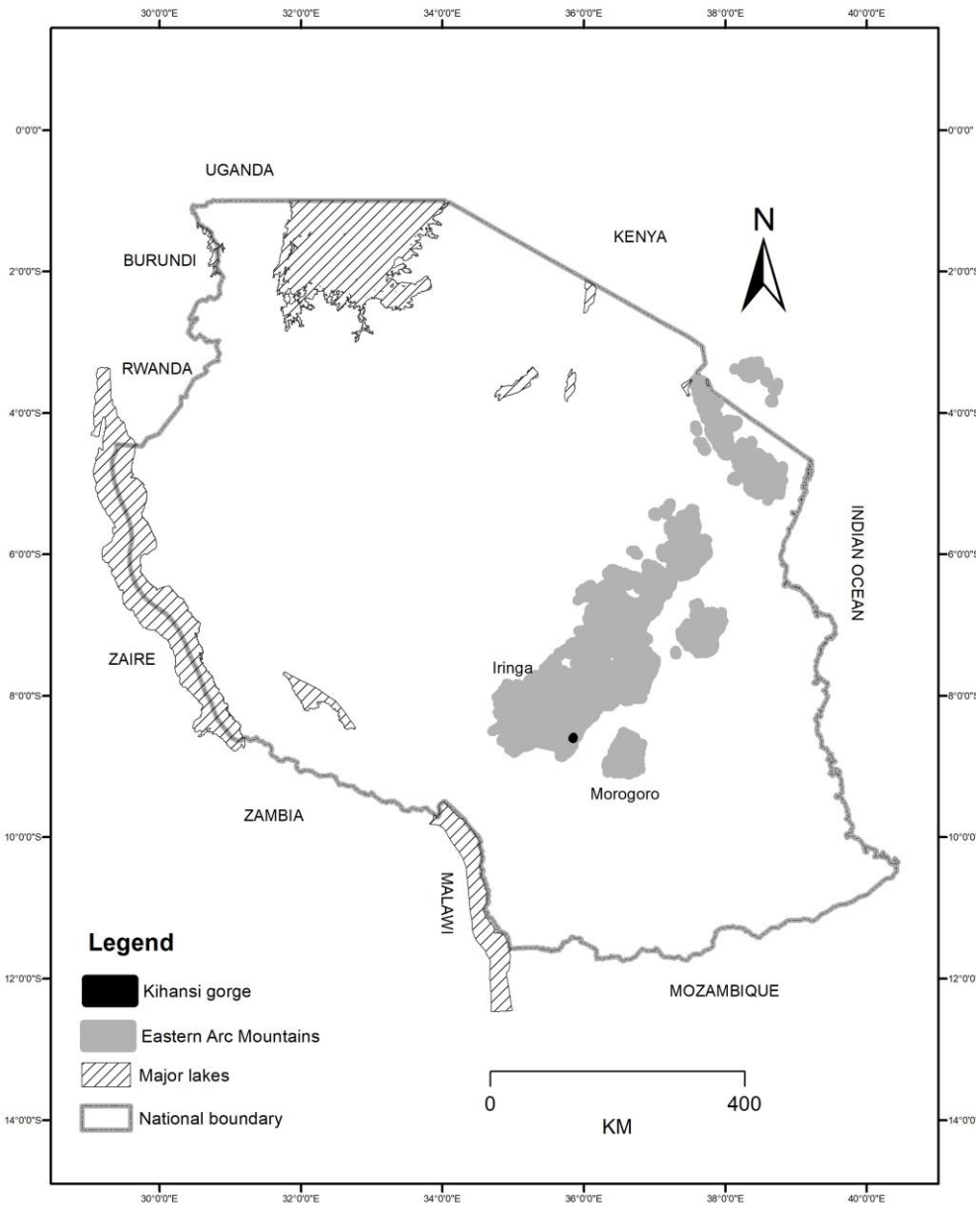

Figure 1: A map of Tanzania showing the location of the study area, Kihansi Gorge.

Three malaise traps were positioned at lower, mid and upper portions of the gorge, and were 5-m away from the walking trail in order to avoid human disturbance. The terrain of Kihansi gorge is quite rugged in most places. Hence, depending on accessibility of the gorge location, positions of the traps were randomly varied within each location on weekly bases throughout the sampling period. Banana bait was added in a tiny plastic container, then hooked by a rope at the roof of the trap near the outlet to the collecting vessel attached on the highest point of the trap, so that after feeding, the butterflies would fly following the outlet and get trapped in the collecting vessel. The traps were visited and emptied twice a week. At the same time butterflies sighted flying along the trail or around the traps were caught using sweep nets. Butterflies caught were identified using Kielland (1990) and Larsen (1991), and unidentified individuals were recorded by code names. Voucher specimens for both identified and unidentified individuals were prepared and sent to butterfly taxonomists at the African Butterfly Research Institute in Nairobi for identification or confirmation of identified specimens.

At the end of the survey, a butterfly species checklist was prepared. The checklist included four variables, which are butterfly species name, family, date (month) and location (lower, mid and upper) of species occurrence. Butterfly species caught for each month were marked as present/absent. Species with missing information on date and location were recorded but were not considered for analysis.

Proportions of species in each family were computed by taking the total number of all species in each family and divide by the total number of all species recorded in each month in order to understand a group of butterflies that was dominant over the other in each month. The same approach was used to compute proportions of species that were either unique to gorge locations or were common throughout the gorge.

Results

Two hundred and thirteen (213) butterfly species were documented in Kihansi gorge between October 2005 and February 2007, of which 50.2% belong to the family Nymphalidae, 19.2% family Lycanidae, 17.8% family Hesperiidae, 7.5% family Pieridae, 5.6% family Papilionidae, and 0.5% family Riodinidae (Table 1). The Nymphalids and some females of *P. dardanus* were caught in the malaise traps while species in the other families were caught using sweep nets. Of the 213 species, only 130 had complete information about species occurrence in terms of time and space. Fifty to seventy percent of the 130 species recorded each month in the gorge were Nymphalids, followed by Papilionids, which contributed 5 – 28% (Figure 2). The Pierids were recorded between January and November except in July, but the proportions of species recorded in those months were relatively lower than that of Papilionids as they ranged between 4 and 18% (Figure 2). The Lycaenids were recorded in the gorge throughout the year except in June, July and August, and Hesperiids were also recorded throughout the year except in January, August and September (Figure 2).

Sixty-six species (51% of all the butterfly species) were observed throughout the gorge, i.e., from lower, through mid to upper gorge. Thirty-four species (26%) were observed only at the upper gorge, while 26 species (20%) came from the lower gorge and 4 species (3%) from the mid gorge. Majority of the species in the family Nymphalidae were either observed throughout the gorge or were unique to certain locations of the gorge (Table 2).

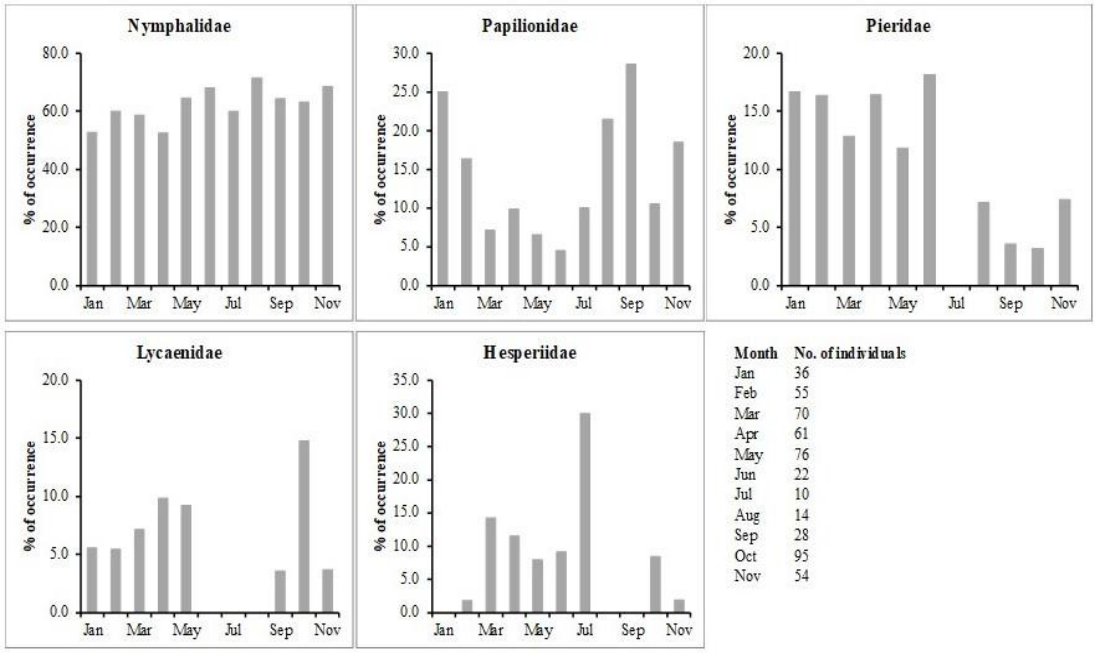

Figure 2: Temporal occurrences of butterflies in the Kihansi Gorge. The percentages of occurrence were computed by taking the total number of individuals (per family) recorded per month divide by the total number of individuals in all families in that respective month.

Discussion

The 213 butterfly species documented in Kihansi Gorge contribute 14.2% of the 1700 species known from Tanzania. Three of the documented species are either endemic to the area or represent an extension of the known range. These include a new species *Charaxes mtuiae*, Collins, Congdon and Bampton (2017) and two other species including *Etesiolaus pinheyi*, Kielland (1986) and *Artitropa reducta*, Aurivillius (1925) (Hesperiidae) that were known to be endemic to other East Usambara, Kimboza and Udzungwa National Park (Congdon and Bampton 2005). The presence of such species indicates that the Kihansi gorge is important for conservation.

Butterfly species in the families Nymphalidae, Papilionidae and Pieridae were present in the gorge throughout from January to November (except in July for the Pierids) while species in the families Hesperiidae and Lycaenidae were not present between June and September (Figure 2). June and July are the coldest months in Kihansi gorge when maximum temperatures are about 16 °C (Lovett et al. 1997) and also, from June through mid or late October is a dry season in the gorge when butterfly food can be scarce. Therefore, the cold conditions and low food availability might have contributed to poor detection or resulted in a lower numbers of the Hesperiids, Lycaenids and Pierids (Figure 2) in the gorge. The Nymphalidae is so far the largest family in Tanzania with 657 species (Congdon and Bampton 2005). Hence, the highest proportion of its occurrence throughout the year (Figure 2) over other butterfly families

is not surprising. However, the Nymphalids are attracted to baits (fermented fruits), while species from other families were not. Thus, these results were to the large extent influenced by the sampling technique.

The species in Papilionidae and Pieridae families were present in the gorge throughout the year except in July for the Pieridae (Figure 2). The Papilionids and Pierids have similar behaviour as they like visiting flowers and damp areas (Larsen 1991). Such behaviour might have as well influenced their detection throughout the sampling period. The frequency of occurrence of the Lycaenids, was the lowest compared to the Nymphalids, Papilionids, Pierids and Hesperiids. It is possible that they were under sampled because most of the Lycaenids are smallest in size and can be poorly detected (Larsen 1991).

Kihansi Gorge is composed of a diverse number of plant species from more than 45 families (Lovett et al. 1997) of which > 50% are utilized by butterflies recorded in the gorge (Kielland 1990, Larsen 1991). Butterfly species that are common throughout the gorge may indicate availability of their food plants throughout the gorge, hence their favourable climatic conditions. On the other hand, those butterfly species observed as unique to either lower, mid or upper gorge may also indicate their requirements for survival is on those specific gorge locations.

The present butterfly checklist provides baseline information that could guide future research and assessment of Kihansi gorge ecosystem health. The butterfly species that were specific to certain gorge locations may serve as ecological indicators because they appear to be favoured by environmental conditions of those locations. Furthermore, this checklist may guide butterfly farm investors to consider investing in the area as means of improving the livelihoods of the communities living around the Kihansi River Catchment. It could be a motivation for long-term conservation of the area.

Acknowledgments

The Lower Kihansi Environment Management Project and all Kihansi Gorge attendants (2004 – 2009) are acknowledged for the support during the fieldwork. Thanks to Dr. Luc Leblanc from the University of Idaho and the anonymous reviewers for reviewing this manuscript.

References

Channing A, Finlow-Bates KS, Haarklau SE and Hawkes PG 2006 The biology and recent history of the critically endangered Kihansi Spray Toad *Nectophrynoides Asperginis* in Tanzania. *J. East African Nat. Hist.* 95: 117–138.

Congdon C and Bampton I 2005 Some Endemic Butterfly Species of Eastern Arc and Malawi, *Report*. Submitted to African Butterfly Research Institute (ABRI).

Cordeiro NJ, Lovett JC, Mulungu E, Maina GG, and Gerstle JH 2006 Initial trends of bird assemblages before and after river diversion in an endemic-rich African forest. *Biodiv. Conserv*. 15: 971– 983.

Kielland J 1990 Butterflies of Tanzania. Hill House Melborne London.

Larsen TB 1991 *The Butterflies of Kenya and their Natural History*. New York: Oxford University Press.

Larsen TB 2005 Butterflies of West Africa. Apollo Books. Brill.com.

Lovett JC, Hatton J, Mwasumbi LB and Gerstle JH 1997 Assessment of the impact of the lower Kihansi hydropower project on the forests of Kihansi Gorge, Tanzania. *Biodiv. Conserv*. 6: 915–933.

Luoto M, Heikkinen RK, Pöyry J and Saarinen K 2006 Determinants of the biogeographical distribution of butterflies in boreal regions. *J. Biogeogr.* 33*:* 1764–1778.

Myers N, Mittermeier RA, Mittermeier CG, Da Fonseca GA, and Kent J 2000 Biodiversity

hotspots for conservation priorities. *Nature* 403(6772): 853–858.

Quinn CH, Ndangalasi HJ, Gerstle J and Lovett JC 2005 Effect of the Lower Kihansi Hydropower Project and post-project mitigation measures on wetland vegetation in Kihansi Gorge, Tanzania. *Biodiv. Conserv.* 14: 297–308.

SSC (Species Survival Commission) 2009 The IUCN Red List of threatened species updates 2009: Amphibian Facts.

Vandvik V, Måren IE, Ndangalasi HJ, Taplin J, Mbago F and Lovett JC 2014 Back to Africa : monitoring post-hydropower restoration to facilitate reintroduction of an extinct-in-the-wild amphibian. *Ecosphere* 5(8): 1–16.

Williams MC 2006 Butterflies and skippers of the Afrotropical region. http://atbutterflies.com/intro.htm

Zilihona IJE and Nummelin M 2001 Coleopteran diversity and abundance in different habitats near Kihansi waterfall, in the Udzungwa Mountains, Tanzania. *Biodiv. Conserv.* 10: 769–777.

Appendices of Tables

Table 1: A Checklist of the butterflies of Kihansi Gorge [√ = present, blank cells = no record: Species* = species recorded by Colin Congdon and Ivan Bampton in 2006. [Abbreviations: LKG = Lower Kihansi gorge (300 m – 580 m), MDG = Mid Kihansi gorge (> 580 m – 700 m), and UPG = Upper Kihansi gorge (>700 m – 1190 m)]

Family /Species	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Gorge Location
Papilionidae													
Graphium angolanus (Goeze)				√	√				√	√	√		L
Graphium antheus (Cramer)				√				√	√	√			L
Graphium colonna (Ward)	√	√	√	√				√	√	√			U
Graphium leonidas (Fabricius)	√	√											L
Graphium policenes (Cramer)	√	√		√					√	√			U
Graphium polistratus (Grose-Smith)				√									L
Graphium porthaon (Hewitson)	√	√		√					√	√			L
Papilio dardanus (Brown)	√	√	√	√	√	√	√	√	√	√	√	√	LMU
Papilio demodocus (Esper)	√	√	√	√	√				√	√	√	√	L
Papilio echerioides (Trimen)	√	√	√	√	√				√	√	√	√	MU
Papilio nireus (Linnaeus)	√	√	√	√	√					√	√	√	MU
Papilio ophidicephalus (Oberthür)	√	√								√	√		U
Pieridae													
Appias lasti (Grose-Smith)*													N
Belenois aurota (Fabricius)	√	√	√	√	√			√	√	√	√	√	LMU
Belenois creona (Cramer)		√	√	√						√	√	√	LMU
Belenois thysa (Hopffer)		√	√							√	√		LMU
Catopsilia florella (Fabricius)	√	√	√	√	√					√	√		LMU
Colias electo (Linnaeus)*													N
Colotis evenina (Wallengren)		√	√										LU
Eurema brigitta (Stoll)	√	√	√		√	√					√		LMU
Eurema desjardinsi (Boisduval)	√	√	√		√	√					√		LMU
Eurema hapale (Mabille)	√	√	√		√	√					√		LMU

Eurema hecabe (Linnaeus)	√	√	√		√	√					√		LMU
Eurema senegalensis (Boisduval)					√								N
Mylothris agathina (Cramer)					√						√		L
Nepheronia argia (Fabricius)					√						√		U
Nymphalidae													
Acraea anemosa (Hewitson)	√	√	√		√						√		U
Acraea cabira (Hopffer)					√			√					U
Acraea encedon (Linnaeus)			√	√							√		N
Acraea eponina (Cramer)				√									N
Acraea insignis (Distant)	√	√	√		√						√		U
Acraea johnstoni (Godman)*													N
Acraea natalica (Boisduval)*													N
Acraea oncaea (Hopffer)*													N
Acraea perenna (Doubleday)*													N
Acraea pharsalus pharsaloides (Holland)			√		√						√		U
Acraea quirina rosa (Eltringham)			√		√						√		MU
Acraea servona (Godart)			√		√						√		LMU
Acraea sotikensis (Sharpe)				√	√						√		LU
Acraea vuilloti (Mabille)*													N
Amauris albimaculata (Butler)				√									U
Amauris echeria (Stoll)				√									U
Amauris niavius dominicanus (Trimen)	√	√	√	√	√	√	√	√	√	√	√	√	LU
Amauris ochlea (Boisduval)*													N
Antanartia schaeneia (Trimen)*													N
Aphysoneura pigmentaria (Karsch)				√					√				
Bebearia orientis (Karsch)				√	√								L
Bematistes aganice (Hewitson)										√			N
Bematistes quadricolor (Rogenhöfer)*													N

Bicyclus danckelmani (Rogenhofer)				√									LMU
Bicyclus ena (Hewitson)		√	√	√	√				√	√			LMU
Byblia anvatara (Boisduval)		√	√		√						√		LMU
Catuna sikorana(Rogenhofer)	√	√	√	√	√	√	√	√	√	√	√	√	LMU
Charaxes achaemenes (C. & R. Felder)*													N
Charaxes acuminatus (Thurau)			√	√	√								LM
Charaxes aubyni (van Someren & Jackson)*													N
Charaxes baumanni (Rogenhofer)				√									L
Charaxes boueti (Feisthamel)		√		√						√			LMU
Charaxes brutus alcyone (Stoneham)		√		√	√					√		√	LMU
Charaxes candiope (Godart)				√						√		√	LMU
Charaxes castor (Cramer)		√	√	√	√								L
Charaxes cithaeron (C. & R. Felder)	√	√	√	√	√					√	√	√	LMU
*Charaxes congdoni (*Collins)				√						√			MU
Charaxes sp. nr. *contrarius* (van Someren)				√									N
Charaxes dilutus (Rothschild)					√								MU
Charaxes druceanus (Butler)				√	√					√			MU
Charaxes ethalion (Boisduval)*													N
Charaxes fionae (Henning*													N
Charaxes guderiana (Dewitz)				√	√					√			L
Charaxes jahlusa (Trimen)			√	√	√					√			MU
Charaxes lucyae (van Someren)		√		√						√			L
Charaxes macclounii (Butler)		√		√						√			LMU
Charaxes pollux (Cramer)	√	√		√	√	√			√	√			LMU
Charaxes protoclea azota (Hewitson)		√		√	√	√				√		√	LMU

Charaxes mtuiae (Collins, Congdon & Bampton)				√				√					U
Charaxes varanes (Cramer)		√		√	√	√				√			M
Charaxes violetta (Grose-Smith)	√	√	√	√	√	√		√	√	√	√	√	LMU
Charaxes zoolina (Westwood)*													N
Coenyropsis bera (Hewitson)				√									LMU
Cymothoe aurivillii (Staudinger)				√									MU
Cyrestis camillus (Fabricius)		√	√		√						√		L
Danaus chrysippus alcippus (Cramer)	√	√	√	√	√	√		√	√	√	√	√	LM
Danaus dorippus dorippus (Klug)					√								L
Euphaedra neophron violacea (Butler)		√	√	√	√	√	√	√	√	√	√	√	L
Euphaedra zaddachi (Dewitz)	√		√	√	√	√			√	√	√	√	MU
Euptera kinugnana (Grose-Smith)				√	√	√			√	√	√	√	LMU
Euryphura achyls (Hopffer)					√					√			L
Euryphura concordia (Hopffer)				√	√								L
Eurytela dryope (Cramer)		√	√		√						√		MU
Eurytela hiarbas (Drury)		√	√	√	√						√		LU
Euxanthe tiberius (Grose-Smith)	√		√	√						√		√	LMU
Euxanthe wakefieldi (Ward)				√						√		√	LMU
Gnophodes betsimena (Boisduval)	√		√	√						√		√	LMU
Hamanumida daedalus (Hübner)			√		√						√		L
Harma theobene (Doubleday)			√	√	√			√			√		LU
Henotesia perspicua (Trimen)				√									N
*Hypolimnas dubius**													N
Hypolimnas misippus (Linnaeus)		√	√										L
Junonia hierta cebrene (Trimen)		√	√		√					√	√		LMU
Junonia natalica (C. & R. Felder)*													N
Junonia orithya (Linnaeus)									√				LMU
Junonia sophia (Fabricius)	√												LMU
Junonia terea (Druce)	√	√	√		√				√		√		LMU
Melanitis leda (Linnaeus)	√	√	√	√	√				√	√		√	LMU

Melanitis libya (Distant)		√	√	√									LMU
Neocoenyra fulleborni (Thurau)				√						√			U
Neptis laeta (Overlaet)	√	√	√	√	√	√			√	√	√	√	LMU
Neptis nina (Staudinger)*													N
Neptis ochracea (Neave)*													N
Neptis saclava marpessa (Hopffer)	√	√	√	√	√	√			√	√	√	√	LMU
Phalanta phalantha (Drury)		√	√	√	√						√		LMU
Physcaeneura jacksoni (Carcasson)		√	√	√	√				√	√	√		LU
Precis actia (Distant)*													N
Precis antilope (Feisthamel)				√									N
Precis octavia (Cramer)										√			U
Precis tugela (Trimen)				√	√	√					√		U
Protogoniomorpha parhassus (Druce)	√	√	√	√	√	√	√	√	√	√	√	√	LMU
Protogoniomorpha temora (Felder)	√	√	√	√	√	√	√	√	√	√	√	√	LMU
Pseudacraea boisduvali trimenii (Butler)					√		√						MU
Pseudacraea eurytus (Linnaeus)			√		√								MU
Pseudacraea lucretia (Cramer)			√										L
Pseudargynnis hegemone (Karsch)				√									N
Salamis anacardii				√						√			M
Sevenia amulia (Cramer)*													N
Sevenia boisduvali (Wallengren)*													N
Sevenia morantii (Trimen)				√						√			U
Sevenia natalensis (Boisduval)*													N
Sevenia pseudotrimeni Kielland*													N
Tirumala formosa formosa (Godman)				√									N
Vanessa cardui (Linnaeus)			√		√						√		LMU
Ypthima granulosa (Butler)	√	√	√	√						√	√	√	U
Ypthima sp.			√										U

Ypthimomorpha itonia (Hewitson)*											N
Lycaenidae											
Actizera lucida (Trimen)				√							N
Alaena nyassa (Hewitson)*											N
Alaena picata (Sharpe)*											N
Anthene larydas (Cramer)				√							U
Anthene lunulata (Trimen)				√							U
Anthene rubrimaculata (Strand)		√									U
Axiocerses punicea (Grose-Smith)			√								LMU
Axiocerses sp. (*styx* complex)			√								MU
Baliochila hildegarda (Kirby)					√						L
Baliochila megadentata (Henning & Henning)				√							L
Cacyreus lingeus (Stoll)				√							L
Cupidopsis cissus (Godart)*											N
Deudorix dinochares (Grose-Smith)				√							N
Eicochrysops hippocrates (Fabricius)				√							N
Etesiolaus pinheyi (Kielland)*											N
Euchrysops malathana (Boisduval)*											N
Euchrysops osiris (Hopffer)					√						U
*Freyeria trochilus**											N
Hemiolaus caeculus (Hopffer)			√		√					√	L
Hypolycaena buxtoni Hewitson*											N
Hypolycaena philippus (Fabricius)										√	U
Lachnocnema bibulus (Fabricius)*											N
Leptosia alcesta (Hübner)				√							N
Leptotes pirithous (Linnaeus)	√			√	√			√	√	√	U
Myrina dermaptera (Wallengren)*											N
Myrina silenus (Fabricius)		√	√								L

Oboronia bueronica (Karsch)	√	√	√	√					√	√	√	U
Pentila pauli (Staudinger)*												N
Pentila tropicalis (Boisduval)					√					√		U
Pilodeudorix zeloides (Butler)*												N
Spalgis lemolea (Druce)				√								N
Spindasis apelles (Oberthür)*												N
Spindasis sp.					√							U
Teriomima puella (Kirby)				√								N
Thermoniphas micylus (Cramer)*												N
Tuxentius ertli (Aurivillius)				√								N
Uranothauma heritsia (Hewitson)*												N
*Virachola vansomereni montana**												N
Virachola sp.*												N
Zizeeria knysna (Trimen)					√					√		U
Hesperiidae												
Abantis venosa (Trimen)				√								N
Acada biseriatus (Mabille)			√									L
Acleros ploetzi (Mabile)*												N
Ampittia capenas (Hewitson)*												N
Ampittia parva (Aurivillius)*												N
Artitropa erinnys (Trimen)*												N
Artitropa reducta Aurivillius*												N
Astictopterus stellata (Mabille)*												N
Borbo borbonica (Boisduval)			√		√					√		LMU
Borbo fatuellus (Hopffer)*												N
Borbo lugens (Hopffer)			√		√		√			√		N
Celaenorrhinus galenus (Fabricius)			√		√	√	√			√		MU
Celaenorrhinus sanjeensis (Kielland)			√	√	√	√	√			√		MU
Celaenorrhinus zanqua (Evans)*												N
Coeliades forestan (Stoll)*												N

Coeliades libeon (Druce)*								N
Coeliades pisistratus (Fabricius)			√					N
Coeliades sejuncta (Mabille & Vuillot)*								N
Eagris sabadius (Gray)		√						MU
Eretis lugens (Rogenhofer)		√						U
Gorgyra bibulus (Riley)*								N
Metisella abdeli (Krüger)			√					U
Metisella congdoni (de Jong & Kielland)			√					U
Metisella decipiens (Butler)*								N
Monza punctata (Aurivillius)*								N
Pardaleodes incerta (Snellen)				√				U
Parosmodes moranti (Trimen)								U
Platylesches galesa (Hewitson)*								N
Platylesches picanini (Holland)*								N
Sarangesa maculate (Mabile)							√	MU
Sarangesa motozi (Wallengren)							√	MU
Sarangesa seineri Strand*								N
Semalea pulvina (Plötz)*								N
Spialia dromus (Plötz)*								N
Tagiades flesus (Fabricius)	√	√	√				√	U
Teniorhinus harona (Westwood)		√				√		U
Xanthodisca vibius (Hewitson)		√		√				LU
Zophopetes nobilior (Holland)			√					N
Riodinidae								
Abisara delicata (Lathy)*								N

Table 2: Proportion of butterfly species in Kihansi gorge with respect to space (Total species n = 130; numbers in the brackets are total numbers of species recorded per family)

Family	Upper gorge (> 750 – 1100 m)	Mid gorge (> 580 – 750 m)	Lower gorge (300 – 580 m)	Throughout the gorge (300 m – 1100 m)
Nymphalidae	0.11 (14)	0.03 (4)	0.11 (14)	0.35 (45)
Hesperiidae	0.05 (6)	0	0.01 (1)	0.054 (7)
Lycaenidae	0.08 (10)	0	0.03 (4)	0.015 (2)
Papilionidae	0.02 (3)	0	0.05 (6)	0.02 (3)
Pieridae	0.01 (1)	0	0.01 (1)	0.07 (9)
Total	**0.26 (34)**	**0.03 (4)**	**0.2 (26)**	**0.51 (66)**