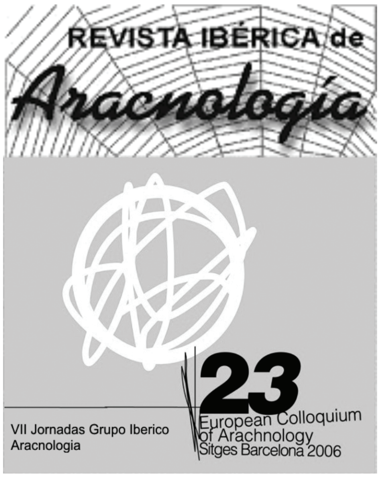

ARTÍCULO:

Linyphiid Spiders (Araneae, Linyphiidae) from African forest canopies

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ARTÍCULO:

Linyphiid Spiders (Araneae, Linyphiidae) from African forest canopies

Rimma R. Seyfulina & Domir De Bakker

Abstract

Africa's spider canopy fauna is still not very well known. This article reports on linyphiid spiders (Araneae, Linyphiidae) from several localities across tropical Africa obtained by canopy fogging (pyrethrum knockdown). We studied the species composition and diversity, the dominant structure, and the abundance of linyphiid spiders. Results show a large diversity and a very high number of new species (about 75%). The canopy fauna has a large number of species (at least 25%) that are typical for the canopy. The most speciose genus in the African forest tree crowns is *Mecynidis* Simon, 1894. Linyphiid spiders from the canopy were more abundant during the dry season in secondary and primary forests, but in swamp forests they were more numerous during the wet season. Differences between sites, despite being sampled with a different intensity, were largely dependent on geographic location. It is clear from our research that canopies can harbour a very large diversity of linyphiid spiders and that future research is indispensable for understanding the underlying patterns of distribution.

Key words: Arachnida, Araneae, Linyphiidae, spiders, Africa, forest, canopy fogging.

Arañas linífidas (Araneae, Linyphiidae) de los doseles de bosques africanos

Resumen:

La fauna de arañas asociadas al dosel de los bosques de Africa no está todavía muy estudiada. Este artículo contribuye al conocimiento de los linífidos (Araneae, Linyphiidae) procedentes de varias localidades de África tropical capturados mediante fumigación del dosel (pyrethrum knockdown). Se estudia la composición específica y diversidad, la estructura dominante y la abundancia de linífidos. Los resultados ponen de manifiesto la existencia de una alta diversidad y de un elevado número de especies nuevas (alrededor del 75%). La fauna asociada al dosel posee un número elevado de especies típicas de este medio (como mínimo un 25%). El género mas abundante en el dosel de los bosques africanos es *Mecynidis* Simon, 1894. Los linífidos del dosel en bosques secundarios y primarios son más abundantes durante la temporada seca, pero en los bosques pantanosos son más numerosos durante la temporada lluviosa. Las diferencias halladas entre localidades, a pesar de ser muestreadas con diferente intensidad, son en gran parte dependientes de su ubicación geográfica. De nuestra investigación se desprende que la fauna de linífidos asociada al dosel alberga una elevada diversidad y que son necesarias nuevos e intensos estudios para poder comprender los patrones fundamentales de su distribución.

Palabras clave: Arachnida, Araneae, Linyphiidae, arañas, Africa, Bosque, Fumigación del dosel.

Introduction

Despite the fact that spiders are considered one of the most abundant groups in canopies (Basset, 2001), the study of its diversity in the Afrotropical region is still in its infancy. Only one study (Sørensen, 2004) has been published so far. Other investigations of canopy arthropods on the continent were carried out for the largest part in montane forests in East Africa and focused mainly on specific groups like beetles (Wagner, 1997, 2000, 2001, 2003; Freund, 2004), ants (Dejean et al., 2000; Schulz & Wagner, 2002) and leafhoppers (McKamey, 1999) while general researches on canopy arthropods have also been done in lowland rainforests in West Africa (Basset et al., 1992; Watt et al., 1997; Lawton et al., 1998; Basset et al., 2001).

From the point of view of their taxonomy, Linyphiidae are among the most intensively studied spider families of the Afrotropical region (e.g. Holm, 1968; Jocqué & Scharff, 1986; Scharff, 1990 a, b). With more than 400 species described, the family ranks at the third place after Salticidae (640 sp.) and Lycosidae (470 sp.) in the Afrotropical region (Dippenaar & Jocqué, 1997). With the exception of Sørensen (2004), so far only the soil fauna and the fauna present in low vegetation has been investigated, mainly by means of pitfalls, litter sieving, beating and hand collecting (e.g. Holm, 1968; Jocqué & Scharff, 1986; Scharff, 1990 a, b; Sørensen et al., 2002).

We present the first numerical comparison of canopy assemblages of Linyphiidae spiders from 13 sites in tropical Africa. The goal of the study is to provide a primary description of the linyphiid canopy assemblages of this region. Species composition, species diversity, dominant structure, and abundance of linyphiid spiders for particular sites were studied. These parameters were compared between sites and, for some of them, between seasons and forest type.

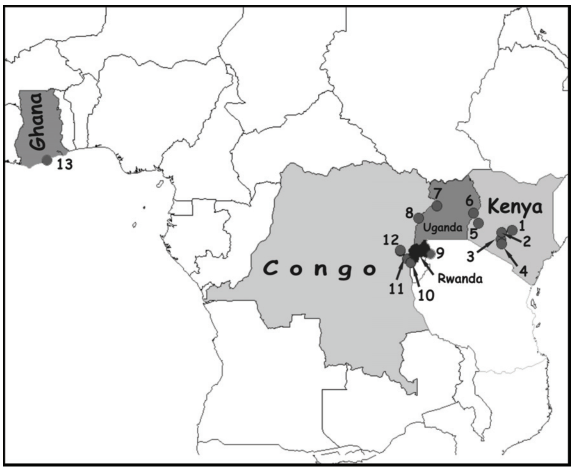

Figure 1. Sampling localities: Kenya, 1 - Mount Kenya National Park, 2 - Aberdare National Park, 3 - Gatamayu, Kikuyu Escarpment, 4 - ICIPE-Property, Langata, 5 - Kakamega Forest; Uganda, 6 - Mount Elgon, 7 - Budongo Forest, 8 - Semliki Forest; Rwanda, 9 - Ibanda Makera, Rusumo, 10 - Nyungwe, Masenkoko, 11 - Cyamudongo, Nyakabuye; Congo, 12 - Irangi, Kivu-Sud; Ghana, 13 - Kakum National Park.

Materials and methods

Study sites

The collections were made in 13 sites with montane forest: Congo DR (1993, 1 site, Wagner, 1997), Rwanda (1993, 3 localities, Wagner, 1997), Kenya (1999, 2001-2003, 5 localities, Freund, 2004), Uganda (1997, 3 localities, Wagner, 2000, 2001, 2003) and one site with lowland rainforest: Ghana (2005, 1 site) (Fig. 1, Table I). In some of them the identity of individually fogged trees was noted. Fifteen different tree species were sampled (Table I).

Sampling method

Spiders were sampled with the pyrethrum knockdown method following the protocol outlined by Stork (1987). Advantages and disadvantages of this technique are discussed in Stork & Hammond (1997). In all studies (Table I), an insecticide fogger Swingfog SN50 was used to disperse an approximately 1% natural pyrethrum solution dissolved in diesel. Per sample, the fogging machine was operated from the ground for approximately 10-15 minutes at dawn. Falling arthropods were captured in nylon collecting nets each covering ca. 1 m^2, which were installed under the fogged area (one crown of a tree). The number of nets used differed per site. All nets were suspended among parallel lines strung across the plot in an even array, thus producing an almost continuous collecting surface. Depending on the site, drop time lasted one to two hours. All material was assembled in one recipient and kept in alcohol or formaldehyde before further sorting (Wagner 1997, 2000, 2001, 2003; Freund, 2004).

Data analysis

Only adult specimens were counted. To estimate abundance and species diversity, number of individuals per sample (tree, App. 1), individual-based rarefaction (Fig. 5) and Margalef index values (Magurran, 1988) (Table II, Fig. 4) were calculated for each site except two (Nyungwe and Irangi, see Table II), which had very low spider specimen numbers. For three sites (Kakamega Forest, Budongo Forest, Kakum National Park, see Table III), number of individuals per sample, rarefaction curved and calculation of similarity indexes (Jaccard and Sørensen) were carried out separately for different forest types and/or seasons (Table IV) to compare the spider assemblages under different conditions. In these analyses, the two separate dates from Budongo Forest (1995, 1997) and Mount Kenya (1999, 2002) (Table I) were taken together for reasons of convenience. The analyses were performed with MS STATISTICA 5.1. Diversity statistics and cluster analysis of the entire data set were computed with EcoSim700 and PC-ORD 4.0, respectively. MS EXCEL 9.0 was used for graphic representation of the data.

Results

Species composition

The totality of the samples contained 3,401 adult specimens of Linyphiidae divided over 84 species (App. 1). When we look at all the data (not shown), Linyphiidae comprise 17.5% of the total amount of adult specimens collected and 7.5% of all the species. Many of the identifications were primarily done on a morphospecies basis and after checking with all the available literature, only 67 taxa could be identified to genus and 20 to species level (Table II, App. 1). We observe a high number of new species for certain sites, such as Kakamega Forest (100%), Semliki Forest (100%) and Budongo Forest (95%) (Table II).

The most speciose genus is *Mecynidis* Simon, 1894 (26% of species, 12% of individuals, App. 1). Specimens of this genus are reported from most of the studied localities (9 out of 13), but only three species out of a total of 22 occurred in more than one site. These spiders are typical inhabitants of Afrotropical forest canopies building their webs among dry twigs or between two leafs (Scharff, 1990a; Dippenaar-Schoeman & Jocqué, 1997). Currently the genus *Mecynidis* includes eight species (Scharff, 1990b). Species recorded in the canopy samples are apparently all new except one (*M. muthaiga* Russell-Smith & Jocqué, 1986) and another one which might prove to be the poorly documented *M. dentipalpis* Simon, 1894. Due to this high observed richness and the fact that a lot of forests remain unexplored, the total number of *Mecynidis*-species that exists in Africa is difficult to estimate. 1 (see below)

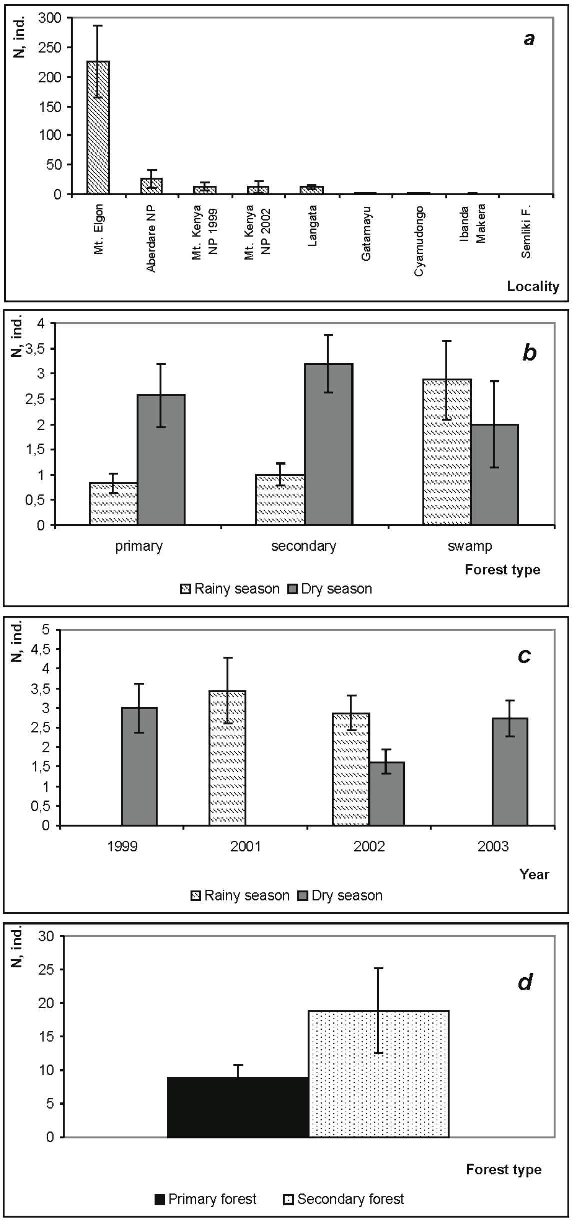

Figure 2. The captures of linyphiid spiders in localities studied: a – in Mount Elgon (1997), Aberdare National Park (1999), Mount Kenya National Park (1999, 2002), Langata (1999), Gatamayu (1999), Cyamudongo (1993), Ibanda Makera (1993), Semliki Forest (1997); b – in Budongo Forest (1995, 1997), c - in Kakamega Forest (1999, 2001-2003), d – in Kakum National Park, (N – Number of individuals per sample).

Abundance

The relative abundance of linyphiid spiders in the canopy samples varies considerably from one site to the other (Fig. 2, App. 1). The abundance of linyphiids in Mt. Elgon is significantly higher than in the other sites due to the high number of *Oreocyba elgonensis* (Fage, 1936) (about 50% of all spiders and 90% of the spiders in one particular site, Fig. 3, 1). These were collected on African holly (*Ilex mitis* (L.) Radlk.) that was present in one sample area only. Apart from this case, the highest abundance of linyphiid spiders has been found in Kenya and in Ghana (2-26 ind./sample and 13 ind./sample respectively, App. 1, Fig. 2 a, c, d).

Material from Kakamega Forest and Budongo Forest allows comparison of spider abundance between seasons (wet versus dry) as well as between forest types in the latter case (Fig. 2 b, c). In Budongo Forest, linyphiid spiders from the canopy were more abundant during the dry season than they were during the wet season, in secondary as well as in primary forest. The opposite tendency occurred in the swamp forest where more linyphiids were found in the wet season (Fig. 2 b). There seems to be no significant discrepancy between primary and secondary forests in Budongo, although there is a clear difference in Kakum National Park in Ghana (Fig. 2 d). However, during the rain season, linyphiids were more abundant in the swamp forest than in the dry plots. In part, this pattern is the result of differences in the relative abundance of the species. One species (Genus sp. 12) prevailed during the dry season (Fig. 3: 12-14), whereas different species dominated in dry (*Mecynidis* spp.) and wet (*Toschia* sp.) plots in the wet period of the year (Fig. 3: 9-11). All specimens of the latter species except one were caught in the swamp forest exclusively in the rainy season. Contrary to Budongo Forest, linyphiid spiders in Kakamega Forest were more numerous

1: Chao 1richness estimation for this genus is 26 species in sites studied (CHAO, 1984).

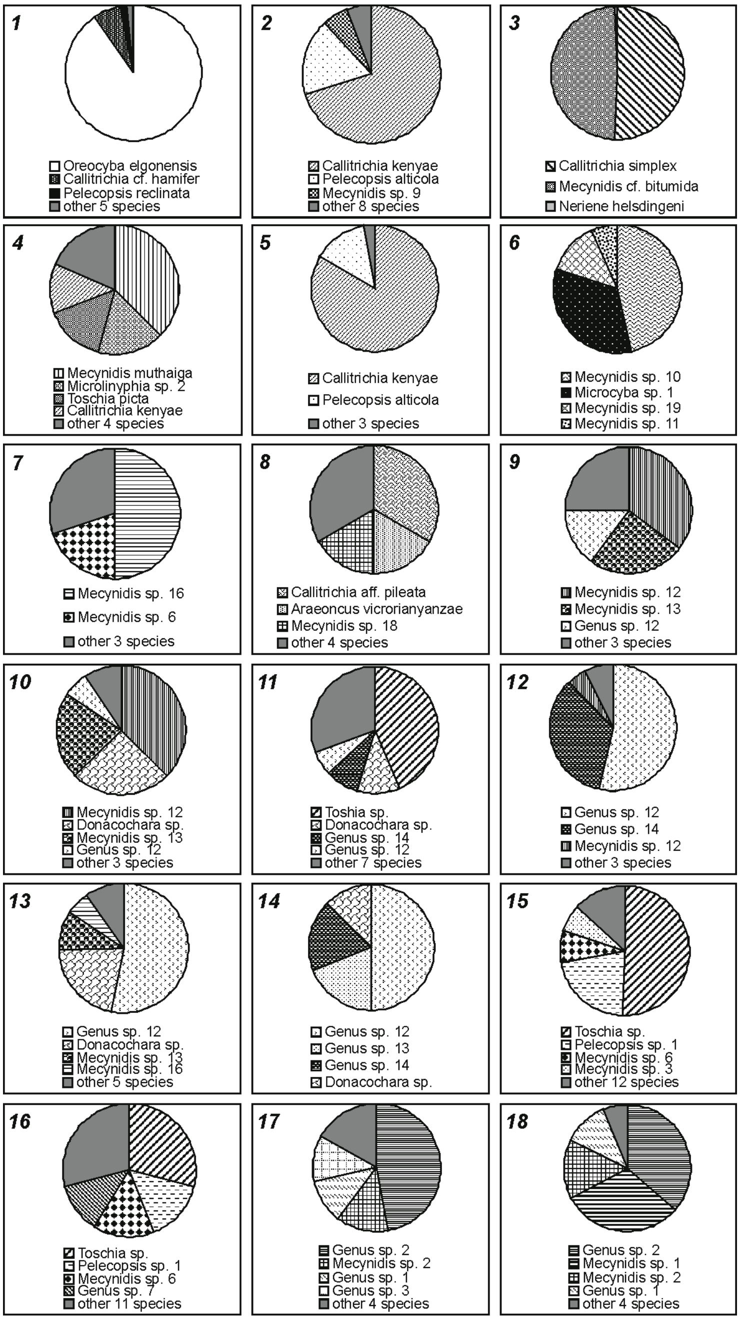

Figure 3. The ratio in abundance between linyphiid species recorded in localities studied: 1 - Mount Elgon; 2 - Mount Kenya National Park; 3 – Langata; 4 – Gatamayu; 5 – Aberdare National Park; 6 – Semliki Forest; 7 - Ibanda Makera; 8 – Cyamudongo; 9 - Budongo Forest, rain season, primary forest (1995); 10 – Budongo F., rain season, secondary forest (1995); 11 – Budongo F., rain season, swamp forest (1995); 12 - Budongo F., dry season, primary forest (1997); 13 - Budongo F., dry season, secondary forest (1997); 14 - Budongo F., dry season, swamp forest (1997); 15 - Kakamega Forest, rain season (2001-2002), 16 - Kakamega F., dry season 1999, 2002-2003); 17 - Kakum National Park, primary forest, 18 - Kakum NP, secondary forest.

during the wet season (Fig. 2 c, 2002). However it should be considered that the sampling period for Budongo Forest started in June, while for Kakamega it fell mainly in October (Table III).

Species diversity

The Margalef index-values noticeably fluctuate between sites (Fig. 4, Table II). Individual-based rarefaction curves support the observed differences in the value of the Margalef index (Fig 5). It is obvious that species richness depends on numbers of the caught animals and it is rather difficult to compare samples of a different order of magnitude as for instance those from Cyamudongo (12 ind.) and Mt. Elgon (1805 ind.). However, we see a similar pattern with the samples of comparable size. Budongo Forest (231 ind., 19 species), Mt. Kenya (258 ind., 11 species) and Aberdare National Park (211 ind., 5 species) have remarkably different values of the Margalef index (see also the rarefaction curves in Fig. 5 a, c) and are thus widely separated on the diagram (Fig. 4) in which the localities are ordered in function of the magnitude of that index. Both the latter are geographically close together (see Fig. 1, points 1 and 2) and have a similar tree cover dominated by *Podocarpus latifolius* (Thunb.) R.Br. ex Mirb., which were fogged in both locations 2 (see below). The differences in diversity

2: In Mt. Kenya *Afrocrania volkensii* crowns were treated also, but only 5% of collected spiders fall on their share.

thus seem to be caused by the number of samples, i.e. treated trees – 120, 18, 8 in Budongo Forest, Mt. Kenya, Aberdare National Park, respectively (Table I). This result is far from surprising and is a general phenomenon that similar to what can be expected when the number of samples differs significantly. According to the rarefaction curves, species diversity in Budongo Forest was higher in the rainy season, at least in primary and swamp forest canopies (Fig. 5 c). There was no difference in species diversity between seasons in Kakamega Forest (Fig. 5 d). Our data do not confirm the hypothesis by which a higher richness and abundance of linyphiids would be expected when moving to higher altitudes (Sørensen 2003) as species richness and numbers in the site at the lowest altitude (Kakum National Park, see Table I) have not the lowest values (Fig. 2, 4).

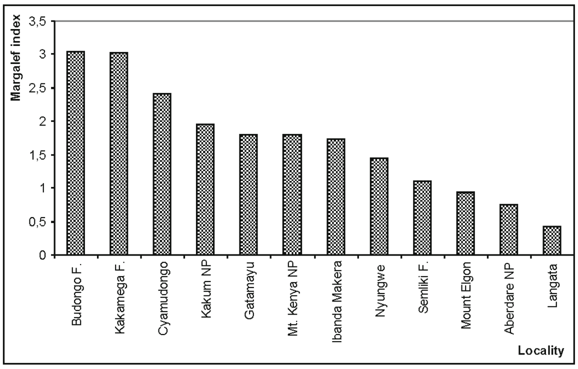

Figure 4. Values of Margalef index in the localities studied.

SIMILARITY

The cluster dendrogram illustrating the similarity of the species communities from the studied sites does not show a clear pattern (Fig. 6). The differences in the sample size might result in some unobserved overlaps in species.

Species composition in Budongo Forest and Kakamega Forest has not changed from rainy to dry season or between forest types in any regular way (Table IV). The highest similarity was observed between the primary and swamp forest plots during the dry season. During the rainy season the species composition in the primary forest is as different from those of the other samples of that year as from the composition in the same forest during the dry period. It is apparent that seasonal fluctuations tend to be more pronounced than fluctuations from year to year. For Kakamega Forest for instance, the similarity between rainy and dry season within the same year (2002) is lower than between the same periods (rain and dry consequently) of different years.

The dominant species of the different localities are only rarely identical. Exceptions are for example *Callitrichia kenyae* Fage, 1936 which is the most abundant species both on Mt. Kenya and in Aberdare National Park, situated not far apart from each other. (Fig. 3: 2, 5), *Toschia* sp. dominates the linyphiid spider fauna in Kakamega Forest and the swamp plots of Budongo Forest during the rainy season (Fig. 3: 11, 15-16). Yet, another species dominated the Budongo Forest during the rainy and dry season, as well as there were some differences between forest types (Fig. 3: 9-14). In Kakamega Forest, such changes could not be observed (Fig. 3: 15-16).

Discussion

The high number of new species in some sites (Kakamega Forest, Budongo Forest and Semliki Forest) reflects the fact that these sites were never surveyed in detail for spiders in the past. Sites with a low proportion of new species are either sites which were already intensively sampled in the past (e.g., Mt. Kenya, Mt. Elgon) or are nearby one of these well known sites and are expected to have a similar linyphiid fauna. This further implies that prior research, which was mostly restricted to ground level or lower strata, yielded a species assemblage with a clear overlap with the canopy fauna. But it also means that the fauna of that habitat has a large number of species (at least 25%, see the column "% of new species" in Table II) that are typical for the canopy since they were not found in these sites in the past (Scharff, 1990b, 1992).

We could not justify the hypothesis addressed by Sørensen (2004) by which a higher richness and abundance of linyphiids would be expected when moving to higher altitudes, but it might be due the large differences in sample size between the sites. Furthermore, we are aware that differences in tree structure, tree height, and epiphyte cover will probably have a significant effect on the present fauna like past research has shown for temperate forests (Gunnarsson, 1990; Halaj et al., 1998, 2000; Sundberg & Gunnarsson, 1994). Because these parameters were not recorded in a standardized manner, we did not include them in our analysis. Differences in similarity of the linyphiid fauna due to altitude are also rejected since the data from Semliki (670 m a.s.l.) do not cluster with the other sites at lower elevations (Kakum National Park) (see Table I). The latter, however, splits up directly from the rest possibly, which is likely to be a combined effect of its distance from the other sites and its different habitat type. The hypothesized occurrence of a geographic barrier between the eastern and western African forests (situated between Mt. Kenya and western Kenya, Lovett & Wasser, 1993) is not corroborated either, since Langata, which is close to Mt. Kenya, Aberdare National Park and Gatamayu does not cluster with those sites (see Fig. 1). So far, the main factor explaining the differences appears to be sheer distance. Nevertheless, the conclusion about similarity of the sites studied in species composition remains premature, as more research and data is necessary to have certainty about this topic.

The present study shows the obvious distinction of canopy linyphiid faunas and clearly illustrates the need for further research to expand our basic knowledge about African canopy spiders and to clarify the patterns of observed differences between sites.

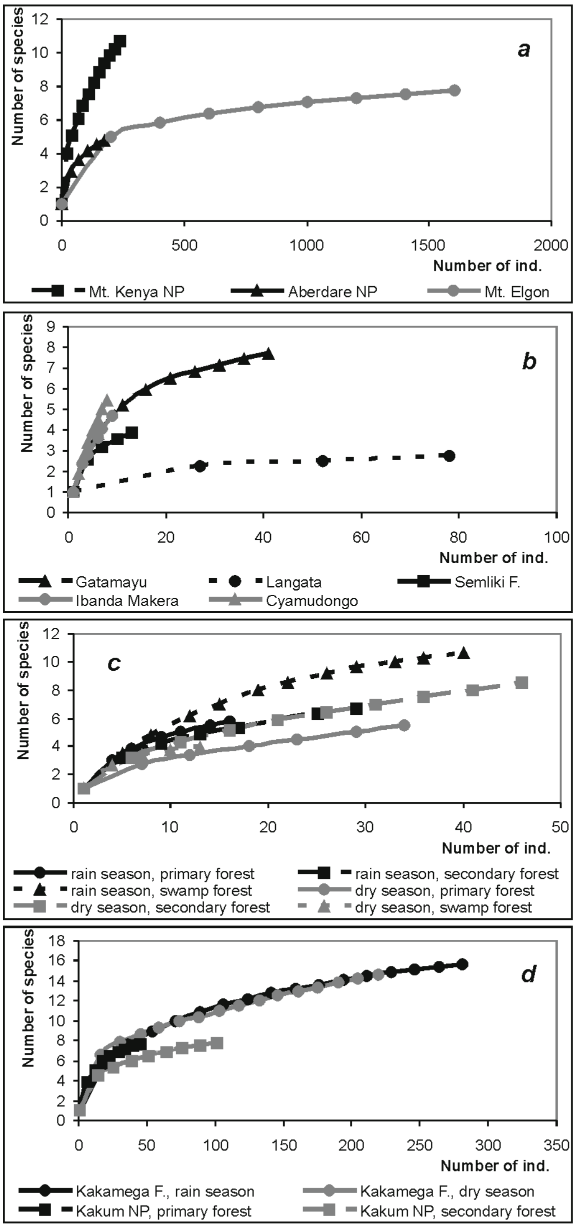

Figure 5. Individual-based rarefaction curves for localities studied: a – Mount Kenya National Park, Aberdare National Park, Mount Elgon; b - Gatamayu, Langata, Cyamudongo, Ibanda Makera, Nyungwe; c – Budongo Forest, d – Kakamega Forest, Kakum National Park.

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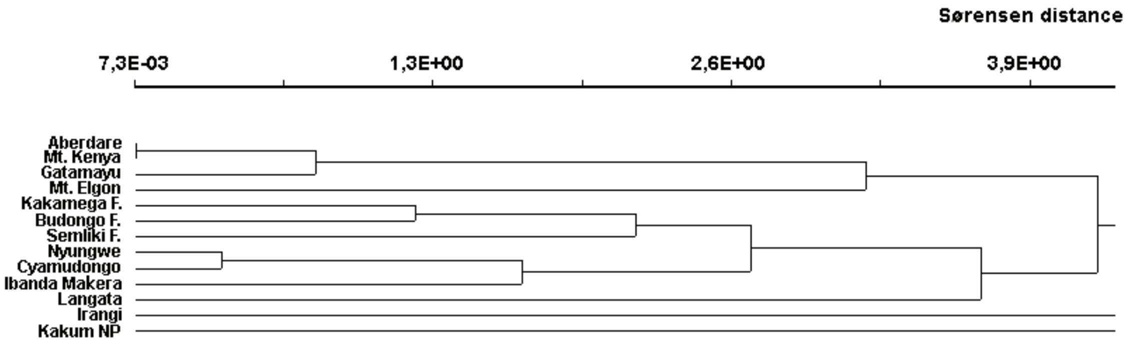

Figure 6. Similarity of studied localities in species composition according to Sørensen distance.

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Table I. Characteristics of sampling sites.

Abbreviations: Forest type: low. rain – lowland rain forest, mont. rain – mountain rain forest, prim. – primary forest, sec. – secondary forest, sw. – swamp forest; N - Number of samples (trees); Tree species : A. v. - *Afrocrania volkensii* (Harms) (Cornaceae), C. a. - *Cynometra alexandri* C.H.Wright (Leguminosae), C. g. - *Carapa grandiflora* Sprague (Meliaceae), E. g. - *Elaeis guinensis* Jacq. (Arecaceae), F. c. - *Ficus capensis* Thunb. (Moraceae), H. a. - *Hagenia abyssinica* (Bruce) (Rosaceae), H. d. - *Heinsenia diervilleoides* K. Schum. (Rubiaceae), I. m. - *Ilex mitis* Radlk. (Aquifoliaceae), L. f. - *Lannea fulva* Engl. (Anacardiaceae), P. l. - *Podocarpus latifolius* (Thunb.) (Podocarpaceae), R. a. - *Rinorea beniensis* Engl. (Violaceae), T. n. - *Teclea nobilis* Delile (Rutaceae), T. r. - *Trichilia rubescens* Oliv. (Meliaceae), T. st. - *Tabernaemontana stapfiana* Britten (Apocynaceae), T. sm. - *Teclea simplicifolia* (Engl.) (Rutaceae).

Country	Locality	Year	Co-ordinates	Height	Tree species	Forest type	Season	N
Congo DR	Irangi, Kivu-Sud	1993	1°54'S/28°27'E	950m	*C. g.*	mont. rain	rain	5
Ghana	Kakum National Park	2005	5°20'55"N/1°23'W	159m	no data	low. rain: prim., sec.	dry	12
Kenya	Aberdare National Park	1999	0°23'S/36°46'E	2750m	*P. l.*	mont. rain	dry	8
Kenya	Gatamayu, Kikuyu Escarpment	1999	0°58'S/36°42'E	2330m	*T. n., T. st., P. l.*	mont. rain	dry	24
Kenya	ICIPE-Property, Langata	1999	1°20'S/36°46'E	1650m	*T. sm.*	mount rain	dry	8
Kenya	Kakamega Forest	1999, 2001-2003	0°22'N/34°50'E	1600m	*H. d., T. n.*	mont. rain	dry, rain	200
Kenya	Mount Kenya NP	1999	0°10'S/37°09'E	2550m	*A. v., P. l.*	mont. rain	dry	16
Kenya	Mount Kenya NP	2002	0°14'S/37°37'E	2000-2500-3000m	*P. l.*	mont. rain	rain	3
Rwanda	Cyamudongo, Nyakabuye	1993	2°34'S/28°59'E	1750m	*C. g.*	mont. rain	rain	8
Rwanda	Ibanda Makera, Rusumo	1993	2°09'S/30°55'E	1350m	*T. n., L. f.*	mont. rain	dry, rain	12
Rwanda	Nyungwe, Masenkoko	1993	2°49'S/29°18'E	2700m	*H. a.*	mont. rain	dry	2
Uganda	Budongo Forest	1995	1°45'N/31°25'E	1200m	*C. a., R. b., T. r., T. n.*	mont. rain: prim., sec., sw.	rain	72
Uganda	Budongo Forest	1997	1°45'N/31°25'E	1200m	*C. a., R. b.*	mont. rain: prim., sec., sw.	dry	48
Uganda	Mount Elgon	1997	1°10'N/34°26'E	2900m	*I. m.*	mont. rain	dry	8
Uganda	Semliki Forest	1997	0°44'N/29°57'E	670m	*C. a., E. g., F. c.*	rain	dry	24

Table II

Spider species richness and abundance in canopy samples studied (Samples marked with asterisk were not taken into account by providing statistic analysis; see text for further details).

Country	Locality	Number of ind.	Number of species	Margalef index	Number of new species	% of new species
Kenya	Mount Kenya NP	258	11	0,93	4	36
Kenya	Aberdare NP	211	5	0,43	2	40
Kenya	Gatamayu	48	7	0,75	2	29
Kenya	Langata	103	3	1,74	1	33
Kenya	Kakamega Forest	538	8	1,44	8	100
Uganda	Mount Elgon	1805	8	1,96	2	25
Uganda	Budongo Forest	231	19	3,05	18	95
Uganda	Semliki Forest	15	4	1,8	4	100
Rwanda	Ibanda Makera	10	5	1,81	4	80
Rwanda	Nyungwe*	2	2	1,11	1	50
Rwanda	Cyamudongo	12	7	2,42	6	86
Congo DR	Irangi, Kivu-Sud*	2	1	0	1	100
Ghana	Kakum NP	166	11	3,02	10	91
Total		3401	84	10,21	64	76

Table III

Number of samples (N) in Budongo forest (BF), Kakamega forest (KF) and Kakum National Park (KNP)

Locality	Forest type	Rainy season		Dry season	
		Date	N	Date	N
BF	primary	June-July, 1995	24	January, 1997	16
BF	secondary	June-July, 1995	32	January, 1997	16
BF	swamp	June-July, 1995	16	January, 1997	8
KF	secondary	no samples		Jan-Febr, 1999	8
KF	secondary	Sept-Oct, 2001	48	Jan-Febr, 2002	48
KF	secondary	Sept-Oct, 2002	48	Jan-Febr, 2003	48
KNP	primary	no samples		November, 2005	6
KNP	secondary	no samples		November, 2005	6

Table IV

Similarity indexes in Budongo and Kakamega plots

Abbreviations: D – dry season, Pr – primary forest, R – rainy season, Sc – secondary forest, Sw – swamp forest.

Locality		Jaccard index						Sørensen index					
BUDONGO FOREST	Plot	R/ Pr	R/ Sc	R/ Sw	D/ Pr	D/ Sc	D/ Sw	R/ Pr	R/ Sc	R/ Sw	D/ Pr	D/ Sc	D/ Sw
	R/ Pr	1						1					
	R/ Sc	0,30	1					0,46	1				
	R/ Sw	0,31	0,29	1				0,47	0,44	1			
	D/ Pr	0,33	0,30	0,31	1			0,50	0,46	0,47	1		
	D/ Sc	0,25	0,45	0,54	0,36	1		0,40	0,63	0,70	0,53	1	
	D/ Sw	0,25	0,22	0,36	0,67	0,30	1	0,40	0,36	0,53	0,80	0,46	1
KAKAMEGA F.	Plot	R/2001	R/2002	D/1999	D/2002	D/2003		R/2001	R/2002	D/1999	D/2002	D/2003	
	R/2001	1						1					
	R/2002	0,56	1					0,72	1				
	D/1999	0,43	0,62	1				0,60	0,76	1			
	D/2002	0,38	0,44	0,64	1			0,55	0,61	0,78	1		
	D/2003	0,64	0,60	0,58	0,50	1		0,78	0,75	0,74	0,67	1	

Appendix I

Linyphiid species composition of canopy samples studied.

No.	Taxon	Locality													Total	
		Kenya					Uganda			Rwanda			Congo	Ghana		
		Mt Kenya NP	Aberdare NP	Gatamayu	Langata	Kakamega F.	Mt Elgon	Budongo F.	Semliki F.	Ibanda Makera	Nyungwe Masenkoko	Cyamudongo	Irangi, Kivu-Sud	Kakum NP	ind.	%
1	*Araeoncus vicrorianyanzae* Berland, 1936					3					1	2			**6**	<1
2	*Callitrichia* aff. *pileata*											4			**4**	<1
3	*Callitrichia* aff. *simplex*							3							**3**	<1
4	*Callitrichia* cf. *hamifer*						119								**119**	4
5	*Callitrichia kenyae* Fage, 1936	182	176	6											**364**	11
6	*Callitrichia silvatica* Holm, 1962	1													**1**	<1
7	*Callitrichia simplex* (Jocqué & Scharff, 1986)				52										**52**	2
8	*Callitrichia* sp.					1									**1**	<1
9	*Donacochara* sp.							29							**29**	1
10	*Erigone prominens* Bösenberg & Strand, 1906					1									**1**	<1
11	*Genus* sp. 1													19	**19**	1
12	*Genus* sp. 2													66	**66**	2
13	*Genus* sp. 3													9	**9**	<1
14	*Genus* sp. 4													1	**1**	<1
15	*Genus* sp. 5													1	**1**	<1
16	*Genus* sp. 6													1	**1**	<1
17	*Genus* sp. 7					33									**33**	1
18	*Genus* sp. 8					1									**1**	<1
19	*Genus* sp. 9					1									**1**	<1
20	*Genus* sp. 10						1								**1**	<1
21	*Genus* sp. 11	2													**2**	<1
22	*Genus* sp. 12							80							**80**	2
23	*Genus* sp. 13							7							**7**	<1
24	*Genus* sp. 14							23							**23**	1
25	*Genus* sp. 15							1							**1**	<1
26	*Genus* sp. 16									1					**1**	<1
27	*Genus* sp. 17									1					**1**	<1
28	*Gibbafroneta* sp.												2		**2**	<1
29	*Improphantes* aff. *falcatus*		1												**1**	<1
30	*Laminafroneta bidentata* (Holm, 1968)	1													**1**	<1

Appendix 1. Continuation

No.	Taxon	Kenya					Uganda			Rwanda			Congo	Ghana	Total	
		Mt Kenya NP	Aberdare NP	Gatamayu	Langata	Kakamega F.	Mt Elgon	Budongo F.	Semliki F.	Ibanda Makera	Nyungwe Masenkoko	Cyamudongo	Irangi, Kivu-Sud	Kakum NP	ind.	%
31	*Lepthyphantes nigropicta* Bosmans, 1979	2		2											**4**	<1
32	*Lepthyphantes* sp. 1						4								**4**	<1
33	*Lepthyphantes* sp. 2							1							**1**	<1
34	*Mecynidis* cf. *bitumida*				50										**50**	1
35	*Mecynidis* cf. *muthaiga*	3													**1**	<1
36	*Mecynidis muthaiga* Russell-Smith & Jocqué, 1986			18											**18**	1
37	*Mecynidis* sp. 1													40	**40**	1
38	*Mecynidis* sp. 2													24	**24**	1
39	*Mecynidis* sp. 3					38									**38**	1
40	*Mecynidis* sp. 4					38									**38**	1
41	*Mecynidis* sp. 5					18									**18**	1
42	*Mecynidis* sp. 6					58		1		2		1			**62**	2
43	*Mecynidis* sp. 7					6									**6**	<1
44	*Mecynidis* sp. 8					1									**1**	<1
45	*Mecynidis* sp. 9	16		5											**21**	1
46	*Mecynidis* sp. 10								7						**7**	<1
47	*Mecynidis* sp. 11								1						**1**	<1
48	*Mecynidis* sp. 12							22							**22**	1
49	*Mecynidis* sp. 13							23							**23**	1
50	*Mecynidis* sp. 14							3							**3**	<1
51	*Mecynidis* sp. 15							1							**1**	<1
52	*Mecynidis* sp. 16							6		5					**11**	<1
53	*Mecynidis* sp. 17											1			**1**	<1
54	*Mecynidis* sp. 18											2			**2**	<1
55	*Mecynidis* sp. 19								2						**2**	<1
56	*Meioneta* cf. *usitata*							1							**1**	<1
57	*Meioneta habra* Locket, 1968	1													**1**	<1
58	*Meioneta prosecta* Locket, 1968						6	1							**7**	<1
59	*Microcyba* sp. 1							3	5						**8**	<1
60	*Microcyba* sp. 2										1				**1**	<1
61	*Microlinyphia aethiopica* (Tullgren, 1910)						1								**1**	<1

Appendix 1. Continuation

No	Taxon	Kenya					Uganda			Rwanda			Congo	Ghana	Total	
		Mt Kenya NP	Aberdare NP	Gatamayu	Langata	Kakamega F.	Mt Elgon	Budongo F.	Semliki F.	Ibanda Makera	Nyungwe Masenkoko	Cyamudongo	Irangi, Kivu-Sud	Kakum NP	ind.	%
62	*Microlinyphia* sp. 1	1													**1**	<1
63	*Microlinyphia* sp. 2		3	8											**11**	<1
64	*Neriene helsdingeni* (Locket, 1968)				1										**1**	<1
65	*Oedothorax* sp.					7									**7**	<1
66	*Oreocyba* cf. *propinqua*					1									**1**	<1
67	*Oreocyba elgonensis* (Fage, 1936)						1632								**1632**	48
68	*Pachydelphus* sp.													2	**2**	<1
69	*Pelecopsis alticola* (Berland, 1936)	46	29												**75**	2
70	*Pelecopsis* cf. *senecicola*							4							**4**	<1
71	*Pelecopsis humiliceps* Holm, 1979			1											**1**	<1
72	*Pelecopsis physiter* (Fage, 1936)					6									**6**	<1
73	*Pelecopsis reclinata* (Holm, 1962)						26								**26**	1
74	*Pelecopsis* sp. 1					101									**101**	3
75	*Pelecopsis* sp. 2											1			**1**	<1
76	*Pelecopsis* sp. 3											1			**1**	<1
77	*Pseudomicrocentria minutissima* Miller, 1970									1					**1**	<1
78	*Simplicistilus tanuekes* Locket, 1968													1	**1**	<1
79	*Toschia picta* Caporiacco, 1949	5	2	7			16								**30**	1
80	*Toschia* sp.					220		21							**241**	7
81	*Tybaertiella krugeri* (Simon, 1894)					2									**2**	<1
82	*Tybaertiella* sp.			1		1		1							**3**	<1
83	*Walckenaeria* sp. 1													2	**2**	<1
84	*Walckenaeria* sp. 2					1									**1**	<1
	Total, ind.	**258**	**211**	**48**	**103**	**538**	**1805**	**231**	**15**	**10**	**2**	**12**	**2**	**166**	**3401**	100
	Total, ind. /sample ± standard error of mean	13,6 ± 5,7	26,4 ± 14,9	2 ± 0,4	12,9 ± 3,5	2,7 ± 0,3	112,8 ± 41,6	1,9 ± 0,2	0,6 ± 0,2	0,8 ± 0,5	1 ± 0,0	1,5 ± 1,1	0,4 ± 0,2	13,8 ± 3,5	7,4 ± 1,7	