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Standardized Sampling Protocol For Spider Community Assessment In The Neotropical Rainforest

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We described, here, a standardized protocol to collect the maximum number of spiders per unit of effort from the different strata of a tropical forestry habitat. This would allow quantifying the richness of a site and would allow spatial and temporal comparisons between sites. This protocol was tested and applied in a pilot study at four sites representing three different forestry habitats of the natural reserve of La Trinité (French Guiana). Results showed every feeding guild was well represented and most of the 30 families found are represented by several individuals. Indices of species richness, number of singletons, species richness estimators from the accumulation curves and diversity and similarity indices were also calculated and all indicated that La Trinité is a rich and diverse site for spiders. The standardized protocol showed here its efficiency and its wide cover of micro-habitats and is, therefore, recommended for any impact assessment or diversity of spider study in tropical forestry environment.

Keyword: Araneae, Biodiversity, French Guiana, Guianese Shield, Impact Assessment.

1. Introduction

Spiders represent a mega diverse group of arthropods having a central ecological role as predator of the micro fauna [1, 2, 3]. Nevertheless, they remain poorly studied in many habitats especially in the tropical rain forest of French Guiana [4, 5, 6]. The last integrative spider studies for French Guiana is almost 70 years old [4] with few later addition.

To assess precisely spider biodiversity, the establishment of a sampling protocol, which can be repeated for comparisons, is crucial to collect the maximum number of individuals per unit effort without strong bias in the different micro-habitats [1, 7, 8]. Up to now, few studies refer to such attempt [9, 10] but in different habitats and climate. In addition, pitfall traps, which were used in these studies, are not efficient in Neotropical rainforest (first author's personal communication) to catch soil-dwelling spiders. Thus, a specific standard protocol is required for sampling efficiently tropical rain forest habitat.

French Guiana is situated in South America, nearby the equator, on the Guianese shield, north of the Amazonian area. This region is covered 97% by pristine primary forest. This forest represents one of the richest and one of the least studied environments, especially in respect to arthropods [11, 12, 13, 14] and deserves as such a special attention of the scientific community both for taxonomical purposes and for a better understanding of spider communities' distribution

and dynamics.
In this article, a standardized protocol is first described. This protocol aimed to collect the maximum number of spiders from the different strata of tropical forestry habitats and to compare two different sites or one site at two different periods. It is then tested in a case-study at the Natural Reserve of La Trinité, which holds three central types of habitat representative of the Guianese forest: Terra Firme (dry forest), flooded forest, and inselberg (a unique habitat of granite hill). This pilot-study had low and different sampling efforts between sites in order to test the real efficiency and applicability of this protocol *in vivo* and not assessing the entire biodiversity of La Trinité. So it aimed both at testing the efficiency of the protocol and at having first results about the abundance, the distribution and the species richness of spiders in Guianese tropical rain forest habitats. Thus, for the first time, quantitative and qualitative data on spider biodiversity from the Guianese shield are presented.

2. Materials and Methods:

2.1 The site:

This natural reserve stretches for 76,000 ha in the middle of the pristine Guianese rainforest, and holds several types of forestry habitats. Due to its isolation, this Natural Reserve is almost undisturbed by human activities.
The reserve of La Trinité was visited during an expedition organized by the Entomological Society of Antilles-Guyane (SEAG) from the 3rd to 12th of October 2010, corresponding to the end of the dry season. The base camp was located on the Inselberg itself (a granite mountain with a height reaching 700 metres in altitude) called Roche Bénitier. The different sampling sites were located in several habitats, up to the other camp called Aïa (Table 1) located at 3 km away from the base camp, downward and westward from the inselberg.
Sampling sites correspond to transect (120 metres long and 5 metres wide) within a relatively homogeneous habitat. These transects are situated in three Gentry plots, which are forest areas where trees were recently identified and phenology was investigated [15], and one at the bottom of the inselberg.

The plot P48 is located in the forest on the inselberg itself. It is a dry forest, not very dense, holding middle-sized trees (generally with a diametres at breast height (dbh) <30 cm). The plot P42 is a classical undisturbed forest constituted of vegetation from non-flooded area with a mixt of young small trees and big older ones (generally with a dbh >30 cm). It is located mid-way between the the camp of Aïa and the one from Roche Bénitier. The third plot, P45, is a flooded forest located between two creeks, next to camp Aïa. Its humid litter (fully inundated during the raining season) was five to ten centimetres of dead leaves and other vegetation detritus. The fourth plot (the only not being a Gentry plot) is also a flooded forest situated nearby a creek, at the bottom of the inselberg.

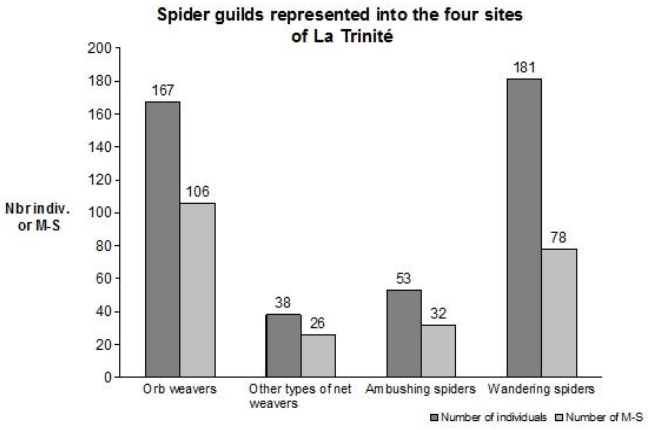

Fig.1: Number of individuals and M-S collected at the four sites of La Trinité, organized in feeding guilds.

2.2 Specimen collection:

A standardized protocol was established specifically to sample the spider fauna in rainforest and to collect a maximum number of specimens from a specific habitat at each stratum. The protocol is described and used for the first time in this study. This protocol allows comparisons to be made quantitatively (species richness and abundance) and qualitatively (communities found) between different sites or between different periods at a single (Table 1).

The four sampling techniques used in this protocol allow the collection of spiders from every accessible strata of the studied habitat except the canopy. They were:

Table 1: Sampling sites with the sampling efforts used for each of the four studied site. Each number correspond to the number of hours spend to collect specimen with respectively a sweep net, a beating tray, a "thief" for the litter, and by sight at night.

Sampling Sites	Type of Habitat	GPS point (UTM)	Sampling Effort
Inselberg P48	Inselberg	22N0232697-0510954	4, 2, 1, 2
Inselberg' swamp	Flooded forest	22N0232800-0510002	1, 0, 0, 1
Swamp P45	Flooded forest	22N0231967-0509224	1, 1, 1, 0
Terra Firme P42	Terra Firme	22N0232072-0509938	2, 2, 1, 0

A. By sight (or by hand)

1. **Method:** During night
2. **Materials:** Tweezers, head light
3. **Targeted species:** Wandering and hunting spiders running on trunks, leaves and leaf litter. Mygalomorph spiders, which make tubular webs and/or live in burrows.

B. Sieve

1. **Method:** Sieving the leave litter with the surface layer of the litter itself in the sieve.
2. **Materials:** Litter sieve
3. **Targeted species:** Hunting spiders living in leaf litter and burrows and minute spiders burrowed in the first layer of the soil.

C. Sweeping

1. **Method:** Sweeping herbs, bushes and young or small trees from 10 cm to 1.5 m.
2. **Materials:** a strong triangular framed sweep net (50 cm X 70 cm with a 10 cm handle).
3. **Targeted species:** Species hunting on low vegetation, ambushing on flowers and young web weaving spiders in low vegetation and bark.

D. Beating

1. **Method:** Beating the higher vegetation (from 1.5 to 2.0 m in height) and collecting the falling animals in the beating trays.
2. **Materials:** a wooden stick, a beating tray, a mouth pooter.
3. **Targeted species:** Ambushing species on higher vegetation and flowers and orb web weaving spiders and entangled web weaving spiders dwelling in branches and higher vegetation.

The three last techniques are used during day time because they are efficient in catching active spiders and spiders hidden in the vegetation. The first technique is used only during night time to collect specifically hunting spiders and mygalomorph species, which are active at night and hidden in burrow during daytime and therefore, not reachable during the sampling during the day. These techniques are, thus, complementary in space (strata) and in time (diurnal and nocturnal species). Each of these techniques was used for every habitat a certain number of hours (representing the sampling effort) to collect specimens from every strata. Although some other types of trap showed their utility [10] (for pitfall traps and [6] for the Malaise and window pane traps), we used in the present study only the "active way" of catching spiders to observe exactly by the collectors the micro-habitats where specimens were collected from.

Table 2: Total number of individuals collected during the sampling mission in the Natural Reserve La Trinité in October 2010, with the number of the identified M-S.

Families	Number of individuals	Number of estimated M-S
Anyphaenidae	1	1
Araneidae	90	62
Clubionidae	9	4
Corinnidae	3	1
Ctenidae	44	16
Deinopidae	6	4
Dictynidae	9	8
Dipluridae	2	2
Eresidae	2	2
Gasteracanthidae	23	13
Gnaphosidae	3	2
Hersiliidae	1	1
Undetermined	3	3
Mimetidae	18	13
Mysmenidae	1	1
Oonopidae	2	1
Oxyopidae	4	3
Philodromidae	32	17
Pholcidae	1	1
Salticidae	90	32
Scytodidae	10	5
Segestriidae	6	5
Senoculidae	1	1
Sparassidae	5	4
Synotaxidae	4	2
Tetragnathidae	18	9
Teraphosidae	6	1
Theridiidae	9	7
Thomisidae	14	9
Uloboridae	18	9
Zodariidae	7	6
TOTAL	**442**	**244**

2.3 To standardize fully the spider sampling, the best is to use the same unit effort for each technique for every site to be able of direct comparison to each other. This protocol should be used in this manner.

Nevertheless, for the need of the pilot study, we tested different sampling effort in order to both test the efficiency of each technique and the threshold of minimum sampling effort required for catching enough materials for robust statistical analyses. In this case, the ratio species richness/general unit effort can be used for either more practicalities (e.g possibility of staying longer to a site and have more data on the contrary, incidents which shorter one sampling technique at one site) or to optimize resources on a sampling. Here, the protocol should be considered as semi-standardized and results therefore considered with care.

3.1 Storage and identification of materials:

Samples were stored in labelled tubes and filled with 70% of ethanol. In some cases; a leg (first left leg when present if not the second) was removed and stored in absolute alcohol for further molecular studies (phylogeny and bar-coding).

Identification at the family level and at the Morpho-Species (M-S) level was accomplished by the author. Final identification at the species level is on-going and is made by a network of more than 30 arachnologists around the world,

and which will be described in other taxonomic publications.

Once identified, specimens are stored in the collections of the specialists' institutions and types of new species sent to the National Natural History Museum of Paris (MNHN).

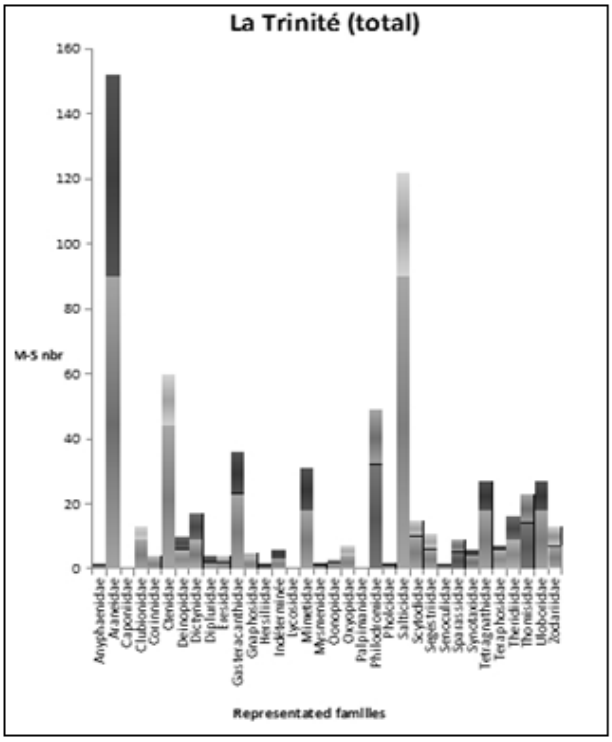

Fig.2.1: Number of individuals (lower bars) and number of M-S (higher bars) collected on the four studied sites of La Trinité added and ordered in families.

3.2 Data Analysis:

Each individual was photographed and classified into the Family and the feeding guilt to which it belonged. A M-S number was also assigned to it with its photography to ensure its temporary identification.

Then, these data were analysed statistically using *EstimateS 8.2* [16] to obtain several diversity indices, diversity estimators and accumulation curves to describe the spider richness and composition at different habitats of La Trinité.

The species richness (number of M-S identified) of La Trinité, the species richness estimators (Chao 1, Chao2, Jack Knife1, Jack Knife2, Michaelis-Menten) and the singleton (M-S with only one individual) and doubleton numbers (M-S with only two individuals) are summarized both in relation to the number of collected individuals (Fig. 3.1) and in relation to the number of sampling sites (Fig.3.2). The different estimators used are not equally sensitive to the different parameters, depending on the composition, on the number of M-S and on number of individuals [17]. Therefore, the calculation of all these widely used parameters gives an inferior and a superior estimation in which the real species richness (total number of M-S of a site) is actually located.

The four most common indices of diversity (Fisher's alpha, Shannon, Shannon exponential, Simpson) were also calculated to get, like for the species richness estimators, a range of values, depending of the specific sensitivity of each index. They indicate more information about community structure and composition than species richness by taking into consideration, the relative abundance of a species (rare or common).

The number of species common to two sites was also calculated. A similarity index between each site was also computed to identify similarity of M-S distribution between two sites. Four similarity indices are also used in this study (Jaccard classic, Sørensen classic, Morisita-Horn, Bray-Curtis). These indices represent the similarity between two sites. Their values are, therefore, situated between 0 and 1, where 0 represent no similarity at all between the two sites and 1, a hundred per cent of similarity.

4. Results and Discussion:

4.1 The standardised protocol efficiency:

Although the protocol was tested in not optimal condition to test its efficiency (low sampling effort and collecting period during the dry season when arthropods are less abundant) we could collect 442 specimens belonging to 244 M-S at the Trinité sites. Every feeding guild was well represented and most of the 30 families found are represented by several individuals (Fig.1 and Fig. 2.1). Sixteen families, belonging to the four feeding guilds, have at least 10 individuals. This abundance and diversity suggest that the standardized protocol is efficient for sampling most of niches of a habitat and most of spiders dwelling there. The calculation of sampling

efforts per site, although the sampling effort between sites are different, allow a relative comparisons between sites. The number of specimens collected per unit of sampling effort is varying from 10.6 for the site TFP42 to 26.7 for the FF45 (Table 3) which is higher than other protocols tested by the author but should, however, be compared to other protocols in development.

Nevertheless, raw data (Annex 1) show that 162 M-S out of 244 are represented only by one individuals (singletons), which indicate both that the site is very diverse with few individuals per species and that it is also under-sampled [8].

Therefore, this pilot study shows that the standardized protocol presented here is efficient to sample the diversity of spider communities in tropical forests, but requires obviously a bigger sampling effort to collect enough specimens of each M-S found.

Table 3: Ratio of the M-S numbers sampled per sampling units (defined as one hour of sampling par an active method) for the four studied sites of La Trinité. IP48= Inselberg plot 48, FF1= Flooded Forest of the Inselberg, FF45= Flooded forest plot 45, TFP42= Terra Firme plot 42.

Sites	Total sampling effort	Nbr of M-S	Ratio of M-S nbr/ sampling unit
IP48	9	137	15.2
FF1	2	36	18.0
FFP45	3	80	26.7
TFP42	5	53	10.6

4.2 Species Richness and Abundance:

Although the number of specimens collected is low, first results and conclusions can be drawn. Firstly, high species richness for the four feeding guilds can be noticed (Fig.1). The two dominant guilds (orb weavers and wandering spiders) both include the higher number of families (6 and 14 respectively) and the most diverse families, with the Araneidae (62 M-S) for the orb weavers and Salticidae (32 M-S) and Ctenidae (16 M-S) for the wandering spiders. Logically these two guilds included in this study the highest number of individuals (167 and 181 respectively) and the highest number of M-S (106 and 78). The wandering spiders, although very diverse, are the only one of the four guilds having a species richness ratio lower than 50% (78x100/181=43.1%), which means that several individuals of one species can be collected easily.

When M-S are grouped into families (Table 2 and Fig. 2.1), 30 families can be found at La Trinité. The four dominant families are the Araneidae and the Salticidae with 90 individuals each, the Ctenidae with 44 individuals and the Philodromidae with 32 individuals. The most diverse are, respectively, the Araneidae (62 M-S), the Salticidae (32), the Philodromidae (17) and the Ctenidae (16).

Looking at each site separately (which represent 3 types of habitat), remarkable differences can be noticed:

On the inselberg site (IP48) and on the Terra firme site (TFP42), the families Araneidae and Salticidae are by far the most numerous with respectively, 58 individuals and 40 for the site IP48, and 12 and 19 for the site FTP42 (Fig. 2.2 and 2.3). They have also the highest species richness: respectively 41 and 16 for IP48, and respectively, 11 and 12 for the site TFP42. The presence of high density of the indicator species *Theraphosa blondi* (Latreille, 1804, Theraphosidae) suggests that these two sites are not impacted by humans, and are relatively wet (although they were found dry in this season), and rich in prey. With their huge size they are eating often small vertebrates prey as well as big arthropods.

In the two flooded forest sites (FPI and FP45), this dominance is less marked, with a higher presence of other families such as the Ctenidae, the Gasteracanthidae, the Mimetidae, the Philodromidae, the Tetragnathidae, the Thomisidae and the Uloboridae (Fig. 2.4 and 2.5).

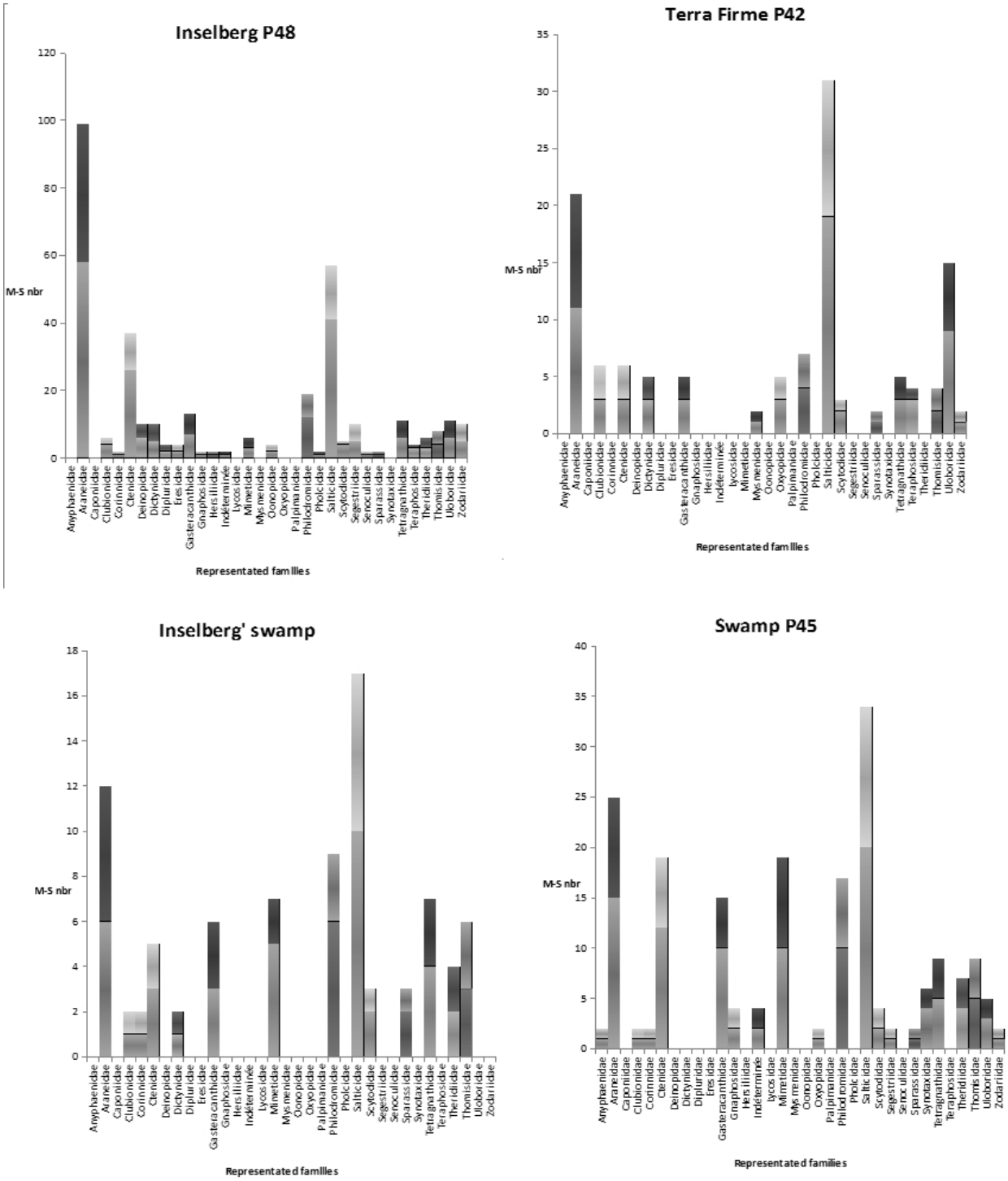

Fig.2.2-2.5: Number of individuals (lower bars) and of M-S (higher bars) collected at the four sites of La Trinité, separated and classified by families. Each histogram represents one of the sites: 2.2=IP48, 2.3= TFP42, 2.4= FFI and 2.5= FFP45.Fig. 3.1: Accumulation curve representing specific richness (number of M-S) at a site, depending on the number of collected individuals.

The M-S richness related to the total sampling effort (i.e. the number of hours spends in sampling with an active sampling method) can also be a good indicator of the diversity and richness of a site (Table 2). We obtain, here, for IP48 15,2 M-S per hour of active sampling, 18 for FFI, 26,7 for FFP45, and 10.6 for TFP42 (Table 3). Therefore, it appears clearly with this indicator that in La Trinité, during dry season, the flooded forests, especially nearby water, are much richer in individuals and species numbers than the Inselberg habitat and even more than the Terra Firme one.

4.3 Species Richness Estimation:

At La Trinité, 244 M-S were collected (observed species richness). According to the calculated estimators of richness, the lowest estimation would be of 392 M-S (±55.49) according to JK1, and the highest one would be of 897 M-S according to MM. Thus, it appears that the sites were under-sampled and that many species were not yet collected (from 148 to 653 M-S) and that the site chosen is extremely rich in spider species. By comparison, the estimated species richness of four sites in La Trinité represents about half of the total number of spider species of metropolitan France (1500 species) [18] with all its diverse ecosystems (Mountains, oceanic coast, Mediterranean and temperate forests, etc..) and its large surface (552, 000 km^2). The big divergence between the different estimators is mainly caused the high number of singletons –under-sampling) and also probably due to the high variances of the three habitats.

Accumulation curves reveal, with to their asymptotic shape, the minimal numbers of individuals (Fig.3.1) or sampled sites (Fig. 3.2) necessary to assess the total species richness of the site. At La Trinité, most of the estimator curves reach their plateau at around 260 collected individuals or 2.5 sampling sites. Nevertheless, for each estimator, the M-S numbers still increase slowly but continuously, even after the number of collected individuals (452) and even after the number of sampling sites (4).

In La Trinité forest, the collection of minimum 250 individuals or of 2.5 sites seems to be needed to correctly estimate the total number of species. Additional samplings provide less M-S but still allow refining the total species richness, and reduce variances between estimators.

4.4 Diversity Index:

The four indices of diversity calculated in this study, although using different parameters sensitivity and or/different parameters, (e.g Shannon's index is sensitive to the presence of rare species) show an extreme richness of local biodiversity of spiders (Table 4). Shannon's index has normally a value lying between 1.5 (low diversity) to 3.5 (high diversity). At La Trinité the Shannon's index is 5.19. In comparison, in Peckmezian's study at the Cloud Forest Reserve in Costa Rica [19], the Shannon's index varied from 1.7 in a secondary forest to 2.7 at a primary one. Nevertheless, even if this comparison shows that the primary forest of La Trinité is richer, no precise comparison between these two results is possible due to a different sampling protocol. Peckmezian sampled extensively but not using a standardized protocol as described above, and here the sampling effort remains low.

Similarly, the three other indices have a minimum of 1 (which means one single species found) and a maximum value of the number of individuals identified (in this case each spider collected would be a different species). With indices values situated between 167.8 and 222.2, they confirm that the site of La Trinité is highly diverse and rich.

4.5 Comparison of M-S Distribution Between Sites:

Here, the index values vary between 0.073 (Jaccard classic index between FFP45 and TFP42) for the least similar sites and 0.264 (Morisita-Horn index between FFI and FFP45) and 0.317 (Morisita-Horn index between IP48 and the FFP45) for the highest values (Table 5).

Clearly, the closest species distribution between sites are between the two flooded forest as indicated by the four similarity indices (which

reached their highest values except one here, although their values are still not very high, from 0.126 for the Jaccard index to 0.264 for the Morosita-Horn). This relatively low similarity can be explained by both the different type of flooded forests where one is situated between two middle rivers and very low while the other is along a smaller creek right at the bottom of the inselberg and also by the under-sampling found previously. The distance between the two sites (2 km of undisturbed forest without any barrier) is likely to be too low to play a major role in the difference of spider species assemblages.

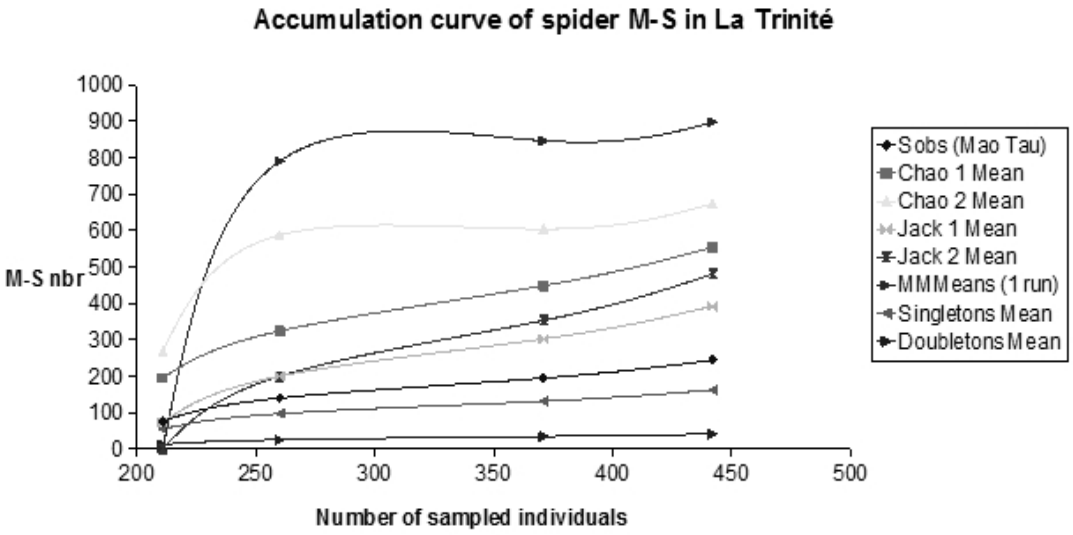

Fig.3.1: Accumulation curve representing specific richness (number of M-S) at a site, depending on the number of individuals collected.

The lowest values, showing the lowest similarity in species distribution for the four indices are either between the inselberg site IP48 and the two flooded forest (0.075 and 0.073 for the Jaccard Classic index) or between FFP45 and TFP42 (Sørensen Classic and Bray-Curtis) or between FF1 and TFP42 (Morisita-Horn). These results indicate that there is the most differences between spider assemblages between drier habitat (Terra firme and Inselberg) and wetter habitat such as flooded forest. This suggests, therefore, that spider communities follow a pattern depending on the humidity of the habitat, which might be correlated to the plant distribution pattern varying also with the quantity of water on the soil.

Between the Terra Firme TFP42 and the inselberg IP48 the similarity indices are still weak but show the second most similar spider communities, although they are not the closest sites. This finding confirms the probable link between the humidity and the associated vegetation and the spider communities' distribution.

The high value of the Morisita-Horn index (0.317) between the two sites IP48 and FFP45 does not fit in this hypothesis, but it may be a biased value because these two sites where the sampling efforts were the highest and the number of M-S found the highest (respectively 137 for the IP48 and 80 for the flooded forest P45). Thus, the number of M-S in common at the two sites (which may be cosmopolitan species found everywhere in the Guianese forest) is the highest (21 M-S) and show therefore the highest value at the most sensitive similarity index (Morisita-Horn). This value is not confirmed by the three others indices which might confirm the hypothesis of biased sampling described above.

Finally, the relatively low values of all these similarity indices, especially between the ones between the two flooded forest sites might indicate that the tropical rainforest of the Guianese shield is not homogeneous concerning the spider communities and that different habitats and even micro-habitat have to be considered for micro-fauna samplings and for biodiversity assessment.

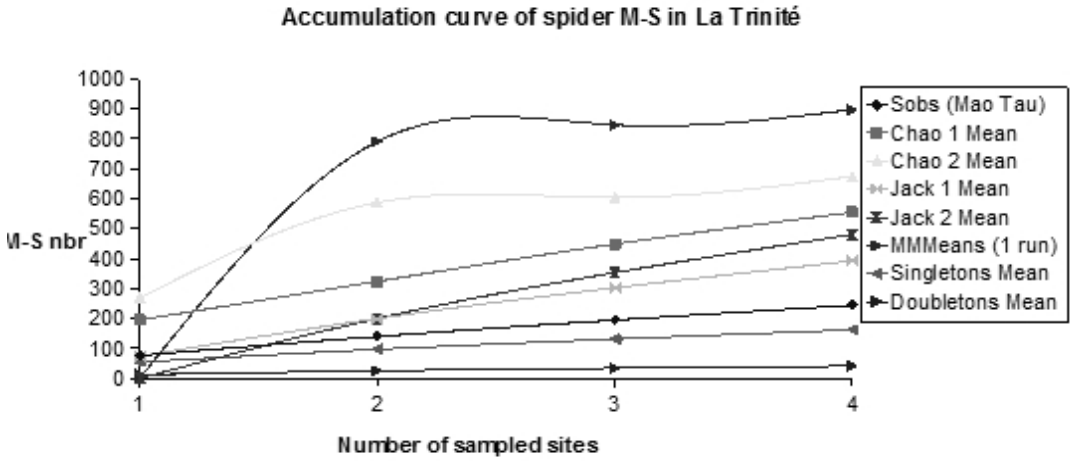

Fig.3.2: Accumulation curve representing specific richness (number of M-S) at a site, depending on the number of sampled sites.

5. Conclusions:

For the first time, a standardized protocol was used to describe quantitatively and qualitatively spider communities in tropical rain forest and then tested in a pilot study in three habitats and four sites of the tropical rainforest of La Trinité, French Guiana.

This standardised protocol was used in not optimal conditions to test its actual efficiency. Although a total low number of specimens were caught –due to the low sampling effort and a period of low abundance- enough individuals were collected per unit of effort and its wide cover of micro-habitat (especially the different strata) shows the efficiency and practicality of this protocol. Raw data (not shown here) and changing sampling effort per site indicate that not only the sampling effort has to be increased for a good sampling but also the effort can be equal among the four techniques (for example 2; 2; 2; 2), each of them bringing about the same number of specimens (but different communities) per sampling unit for one site.

When used with higher and same sampling effort for every site, this protocol gives enough materials to obtain quantitative and qualitative data on spider community distribution, which allows a direct spatial and temporal comparison between sites. This inclusive protocol is, therefore, recommended for any impact assessment or study of the diversity of spiders in tropical forestry environments.

Table 4: Index of diversity at La Trinité (four sites pooled)

Index	Fisher's Alpha	Shannon	Shannon exponential	Simpson (reciprocity)
Value	222.2	5.19	180.7	167.8

The test of this standardized protocol on four sites representing three different habitats (namely inselberg, flooded forest and Terra Firme) of the natural reserve of La Trinité, leads to the collection of 442 spiders representing 244 Morpho-Species belonging to 30 families. The species richness of this site (number of M-S), the number of singletons found (only one individuals for one M-S), the species richness estimators from the accumulation curves, diversity indices and similarity indices calculated all go to the same direction:

The Guianese tropical rainforest of La Trinité is a rich site for the arachno-fauna, with species richness estimations ranging from 392 to 897 M-S, with also high beta diversity (high index of diversity and low similarity index between sites).

Although, the protocol was proven to be efficient, sampling effort is low and thus the four sites remain under-sampled. Their extreme richness and numerous micro-niches, which explained also the high number of singletons and partly the low similarity between sites requires therefore a higher sampling effort. Due to sampling bias (low and different sampling effort) required for testing the protocol, the following results are informative and have to be considered with cares (especially the comparison).

Table 5: Comparison of M-S distribution between the four sites of La Trinité, with four similarity indices values for each pairwise comparison.

Comparisons	Number of M-S in each site	Number of M-S common between two sites	Jaccard Classic	Sørensen Classic	Morisita-Horn	Bray-Curtis
IP48-FF1	137-36	12	0.075	0.139	0.222	0.13
IP48-FFP45	137-80	21	0.107	0.194	0.317	0.198
IP48-TFP42	137-53	19	0.111	0.2	0.221	0.162
FF1-FFP45	36-80	13	0.126	0.224	0.264	0.2
FF1-TFP42	36-53	7	0.085	0.157	0.149	0.116
FFP45-TFP42	80-53	9	0.073	0.135	0.156	0.109

The two flooded forests studied appear to be richer and more diverse than the Terra Firme and the Inselberg site, which have a very high dominance of only two spider families (Araneidae and Salticidae). There exists a dominance of several families in numbers of individuals and also in species richness on the four sites: the Araneidae, the Ctenidae, the Philodromidae, the Salticidae and the Thomisidae. These families belong to each of the feeding guild, which suggest first the collection methods are efficient to sample inclusively and in a homogeneous way the numerous micro-habitats where spiders are dwelling and second that every micro-habitat is well inhabited by the spider communities (dead trunk, on bark, on and in vegetation, in leaf litter etc.).

The species composition (not only the species richness) is still difficult to assess due to the lack of knowledge of spider taxonomy from the Guianese shield. The rarity of one species and its specificity to a habitat is currently assessed by the author in order to develop a specific index.

Now the protocol is shown to be efficient, more studies of the arachno-fauna of this region should follow. For this, spiders should be collected more intensively (increasing the sampling efforts with the same standardised protocol) and at different seasons (wet and dry seasons) as the humidity level of the habitat seems to play a major factor in the spider community (differences between the flooded forests and the two other sites). It would also be better to use the quantitative protocol (same sampling effort between sites). This would allow getting closer to discover the real species richness of the site.

ANNEXE 1: Raw Data Show That 162 M-S out of 244 are Represented only by one Individual

Unité d'effort (SN-B-H-T)		4-2-3-0	2-0-0-0	1-1-1-0	2-2-1-0	
Family	**SPECIES**	**IP48**	**BFI**	**BFP45**	**TFP42**	**Trinité 2010**
ANYPHAENIDAE	SP.1			1		1
ARANEIDAE	SP.1					0
	SP.4		1			1
	SP.8	1				1
	SP.26	1				1
	SP.27	9		2	1	12
	SP.29	1				1
	SP.31	2				2
	SP.36			1		1
	SP.37	2	1			3
	SP.39	1				1
	SP.40	1				1
	SP.45	1				1
	SP.46	1				1
	SP.47	1				1
	SP.48	1				1
	SP.49	1				1
	SP.50	1			1	2
	SP.51				1	1
	SP.52				1	1
	SP.53				1	1
	SP.54				1	1
	SP.55				1	1
	SP.56				1	1
	SP.57	1			2	3
	SP.58				1	1
	SP.59				1	1
	SP.60	1				1
	SP.61	1				1
	SP.62	1				1
	SP.63	1				1
	SP.64	1	1	1		3
	SP.65	1				1
	SP.66	2				2
	SP.67	1		1		2
	SP.68	1				1
	SP.69		1			1
	SP.70		1			1
	SP.71		1			1
	SP.72	4				4
	SP.73	2				2
	SP.74	1				1
	SP.75	1				1
	SP.76	1				1
	SP.77	1				1
	SP.78	2		2		4
	SP.79	1				1
	SP.80	1				1
	SP.81	1				1
	SP.82	1				1
	SP.83	2				2
	SP.84	1				1

	SP.85	1				1
	SP.86	1				1
	SP.87	1				1
	SP.88	1				1
	SP.89			1		1
	SP.90			2		2
	SP.91			3		3
	Aspidolasius SP.1			1		1
	HYPOGNATHA SP.1	1				1
	EDRICUS SP.1	1				1
	EDRICUS SP.2			1		1
CAPONIIDAE	SP.1					0
CLUBIONIDAE	SP.4	1				1
	SP.5	3			1	4
	SP.6		1		1	2
	SP.7			1	1	2
CORINNIDAE	SP.3	1	1	1		3
CTENIDAE	SP.9	4		2	1	7
	SP.10	3	2	3	1	9
	SP.18			2		2
	SP.20			1		1
	SP.23			1		1
	SP.24			1		1
	SP.27	2		2		4
	SP.28	1				1
	SP.33	5	1			6
	SP.37	5				5
	SP.38				1	1
	SP.39	1				1
	SP.40	1				1
	SP.41	2				2
	SP.42	1				1
DEINOPIDAE	Deinopis SP.1	2				2
	SP.3	1				1
	Deinopis SP.4	2				2
	Deinopis SP.5	1				1
DICTYNIDAE	SP.2				2	2
	SP.3				1	1
	SP.4	1				1
	SP.5	1				1
	SP.6	1				1
	SP.7	1				1
	SP.9		1			1
	SP.10	1				1
DIPLURIDAE	SP.1	1				1
	SP.2	1				1
ERESIDAE	SP.1	1				1
	SP.2	1				1
GASTERACANTHIDAE	SP.4			1		1
	SP.6				1	1
	MICRATHENA SP.8	1				1
	Micrathena SP.9		1			1
	SP.10		1			1
	SP.11	1				1
	SP.12			1		1
	Micrathena gracilis		1	1		2

	Micrathena triangularis	2		1		3
	Micrathena schreibersii			6		6
	Micrathena sexspinosa	1				1
	Gasteracantha cancriformis	1				1
	Chaecitis SP.1	1			2	3
GNAPHOSIDAE	SP.10			1		1
	SP.11			1		1
HERSILIIDAE	SP.1	1				1
MIMETIDAE	SP.4	1				1
	SP.5	1				1
	SP.6		3			3
	SP.7		2	1		3
	SP.8	1				1
	SP.9			1		1
	SP.10			1		1
	SP.11			1		1
	SP.12			1		1
	SP.13			1		1
	SP.14			1		1
	SP.15			1		1
	SP.16			2		2
MYSMENIDAE	SP.2				1	1
OONOPIDAE	SP.1	2				2
OXYOPIDAE	Oxyopes SP.1				2	2
	Oxyopes SP.2			1		1
	SP.3				1	1
PHILODROMIDAE	SP.2				2	2
	SP.5				1	1
	SP.7	1				1
	SP.8				1	1
	SP.9	4				4
	SP.10	2	2	1		5
	SP.11		2	1		3
	SP.12		2			2
	SP.13	1				1
	SP.14	1				1
	SP.15	1				1
	SP.16	2				2
	SP.17			1		1
	SP.18			2		2
	SP.19			1		1
	SP.20			1		1
	SP.T4			3		3
PHOLCIDAE	SP.3	1				1
SALTICIDAE	SP.1	3		1	1	5
	SP.3	3	2			5
	SP.19			1		1
	SP.20			2		2
	SP.25		1		2	3
	SP.26				1	1
	SP.29	2			2	4
	SP.36	3			1	4
	SP.37	1			1	2
	SP.38	1				1
	SP.39	1				1
	SP.40	1				1

	SP.41		1	1	5	7
	SP.42				1	1
	SP.43				2	2
	SP.44				1	1
	SP.45				1	1
	SP.46	7	3	5	1	16
	SP.47	10		1		11
	SP.48	1				1
	SP.49	1		1		2
	SP.50		1			1
	SP.51		1			1
	SP.52	4	1	1		6
	SP.53	1		1		2
	SP.54	1				1
	SP.55	1				1
	SP.56			1		1
	SP.57			2		2
	SP.58			1		1
	SP.59			1		1
	SP.60			1		1
SCYTODIDAE	SP.2				2	2
	SP.3			1		1
	SP.5		2			2
	SP.6	4				4
	SP.7			1		1
SEGESTRIIDAE	SP.1	1				1
	SP.2	1				1
	SP.3	1				1
	SP.4	1				1
	SP.5	1		1		2
SENOCULIDAE	SP.1	1				1
SPARASSIDAE	SP.3				1	1
	SP.4		2			2
	SP.5	1				1
	SP.6			1		1
SYNOTAXIDAE	SP.1			3		3
	SP.2			1		1
TETRAGNATHIDAE	SP.4		1			1
	SP.5		2	1		3
	SP.6	1			2	3
	SP.7	1	1	1	1	4
	SP.8	1				1
	SP.9	1				1
	Leucauge SP.10	2				2
	SP.11			2		2
	SP.12			1		1
THERAPHOSIDAE	SP.1 Teraphosa leblondii	3			3	6
THERIDIIDAE	SP.3		1			1
	SP.4		1			1
	SP.5	1				1
	SP.6	1		2		3
	SP.7			1		1
	SP.8			1		1
	ANOLESIMUS EXIMIUS	1				1
THOMISIDAE	SP.4			1		1
	SP.5		1		1	2

	SP.22			1		1
	SP.24			2		2
	SP.26				1	1
	SP.27	1	1	1		3
	SP.28	1				1
	SP.29	1	1			2
	SP.30	1				1
ULOBORIDAE	SP.8	1			1	2
	SP.9	1				1
	SP.10				1	1
	SP.11				1	1
	SP.12				2	2
	SP.13	1			1	2
	SP.14	2		2	3	7
	SP.15	1				1
	SP.16			1		1
ZODARIIDAE	SP.5	1				1
	SP.7	1				1
	SP.8	1			1	2
	SP.9	1				1
	SP.10	1				1
	SP.11			1		1
UNDETERMINED	SP.1			1		1
	SP.2			1		1
	SP.5	1				1

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