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Entomofaunal Diversity of the Upper Senegal River Basin in Mali

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Abstract: In West Africa, natural environments are strongly impacted by climatic crises such as those of the 70's and 80's but also by anthropogenic factors. The objective of this study was to update the knowledge about the entomological resources in the upper Senegal River basin in Mali. The captures took place in the Kayes region from June 2020 to May 2021 along streams, in fallows and fields over a distance of 100 to 200 m from the banks and in water at a depth of 0.5 to 1 m. Five trapping techniques were used (Swath net, fruit fly trap, buried trap, light trap and dip net). Captured insects were emptied into vials containing 70% alcohol, or kept in layers of cotton or newspaper. The study identified 23 orders, 108 families, 253 genus and 311 species for a total of 8797 individuals. The major orders frequently encountered were Coleoptera and Diptera. The species diversity H' ranged from 1.28 to 1.78 bits. This study contributes to a better knowledge of the entomological resources of the upper Senegal River basin in Mali. These results will enable the adoption of effective control measures for pests of tropical perennial crops. This work recommends that monitoring be implemented to document population dynamics.

Keywords: Diversity, Specie, Arthropods, Sudanian Zone, Senegal River, Mali

1. Introduction

Insects are the most numerous living beings on the surface of the globe. The number of species is estimated at about 10 to 30 million [1]. Only about 830,000 insects have been described so far [2]. They occupy almost all known habitat types outside the Polar Regions and the sea floor [3]. Also many species such as Hymenoptera, Coleoptera, are essential for the pollination of cultivated plants of the family Fabaceae but also Palmaceae [1].

In West Africa, natural environments are strongly impacted by eco-climatic crises such as those of the 70's and 80's but also by anthropogenic factors [4]. There are also environments with particular hydrological situations, constituting humid enclaves within drier domains (Niger River flood basin in Mali and the periphery of Lake Chad [5].

Mali is crossed by the two largest West African rivers: the Niger River and the Senegal River. These divide the country into two water sheds: the Niger River basin and the Senegal River basin [6]. The Niger River is 4200 km long, 1700 of which are in Mali. Its most important tributaries are the Sankarani and the Bani. The Bani River, 900 km long, has all of its tributaries in the south of the country: the Baoulé,

Dégou, Bagoé, and Banifing rivers [7].

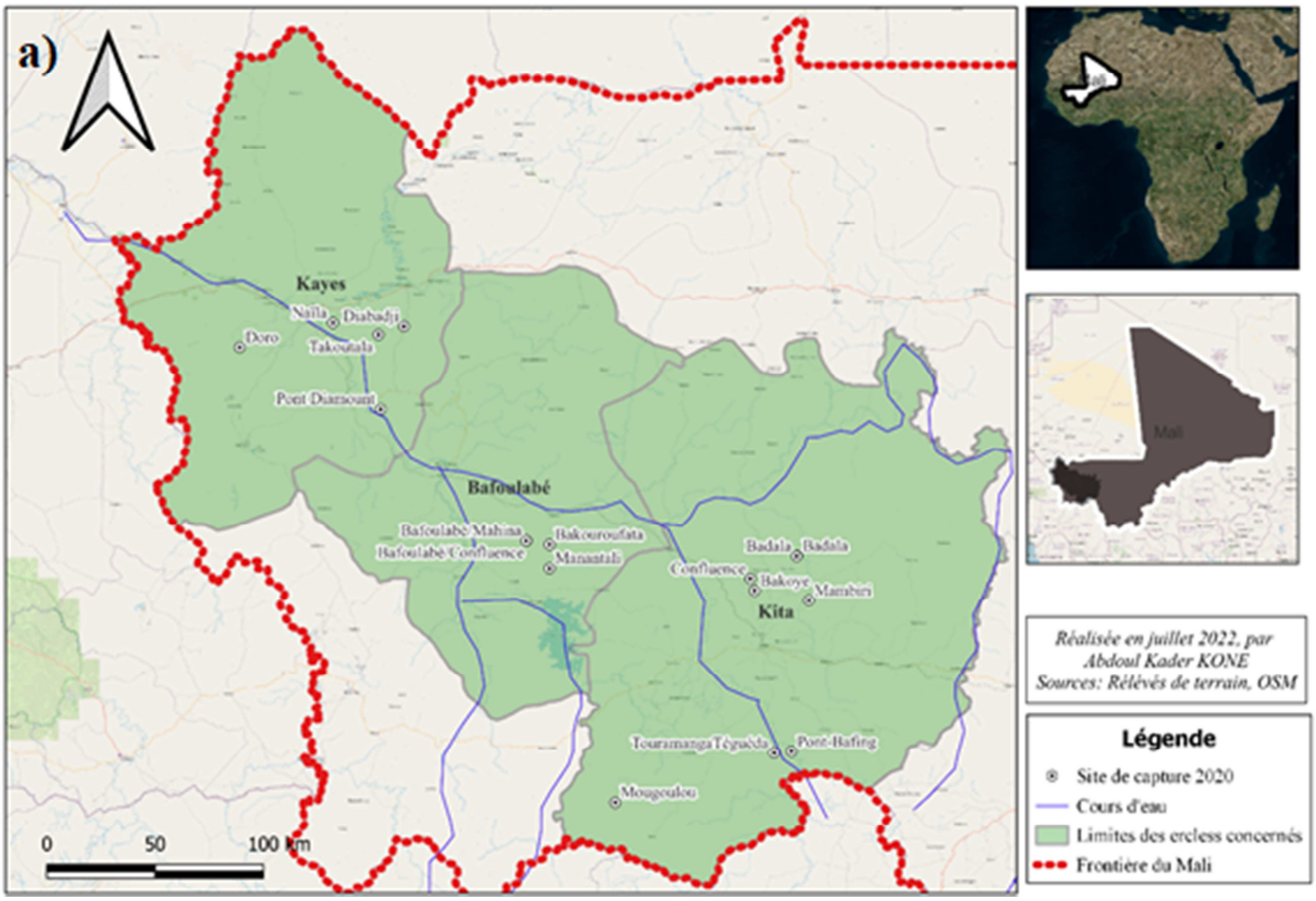
These rivers have their course in the northern Guinean (Sankarani with Ouassoulou-Balé, Baoulé) and southern Sudanian (Bagoé and Banifing) bioclimatic zones. They provide more than 80% of Mali's perennial surface water resources, i.e. 56 billion m^3 of water in an average year, 88 billion m^3 of water in a wet year and 24 billion m^3 of water in a dry year [7]. They also play an important role in the socio-economic life of the local populations and in the preservation of biodiversity [8].

These rivers cross the classified forest area, including 25 classified forests covering an area of 386,429 ha of forest formations and a wildlife reserve [9]. Forest formations along rivers provide natural habitats for macrofauna (reptiles, birds and mammals) and microfauna (insects). The vegetation is made up of Andropogonées crossed by bush fires, with a variable woody cover (20 to 70%) and forest patches. It rains from 750 mm to 1300 mm per year, with a dry season of 4 to 6 months, imposing stops in development for many species [5].

There are several threats to the rivers of the Senegal River and the biological resources they support [10]. These rivers are generally natural habitats for many animals and plants (reptiles, birds and mammals, insects, aquatic plants, mollusks, fish). In Mali, biological diversity in general and entaumofauna in particular around rivers is poorly documented. The only partially known insects are those that attack crops and domestic animals. The aim of this project was to assess the entomological resources of the Upper Senegal River Basin in Mali for their rational exploitation and management. This study is a contribution to a better knowledge of these entomological resources.

2. Materials and Methods

The inventories took place from June 2020 to May 2021 in the Kayes region in upper Senegal River basin in Mali. The captures took place during three excursions to the sites of Kéméta (Bakoye), Sitaféto (Bafing), Lake Touréla (Mankandjanloutoudenia), Badala (Bakoye) for the first set (Excursion1). Excursion 2 concerned the sites of the second group: Badala Touranmagantikèda (Bakoye), Sitaféto (Bafing), Badala (Baoulé-Badingo), Sékokoto (Bafing), Toukoto (Bakoye-Baoulé). The sites in the third set were inventoried during excursion3. These are: Samé-Plantation (Senegal River), Doro (Lake Doro), Diabadji (Lake Magui) and Fekola on the Falémé River (Figure 1).



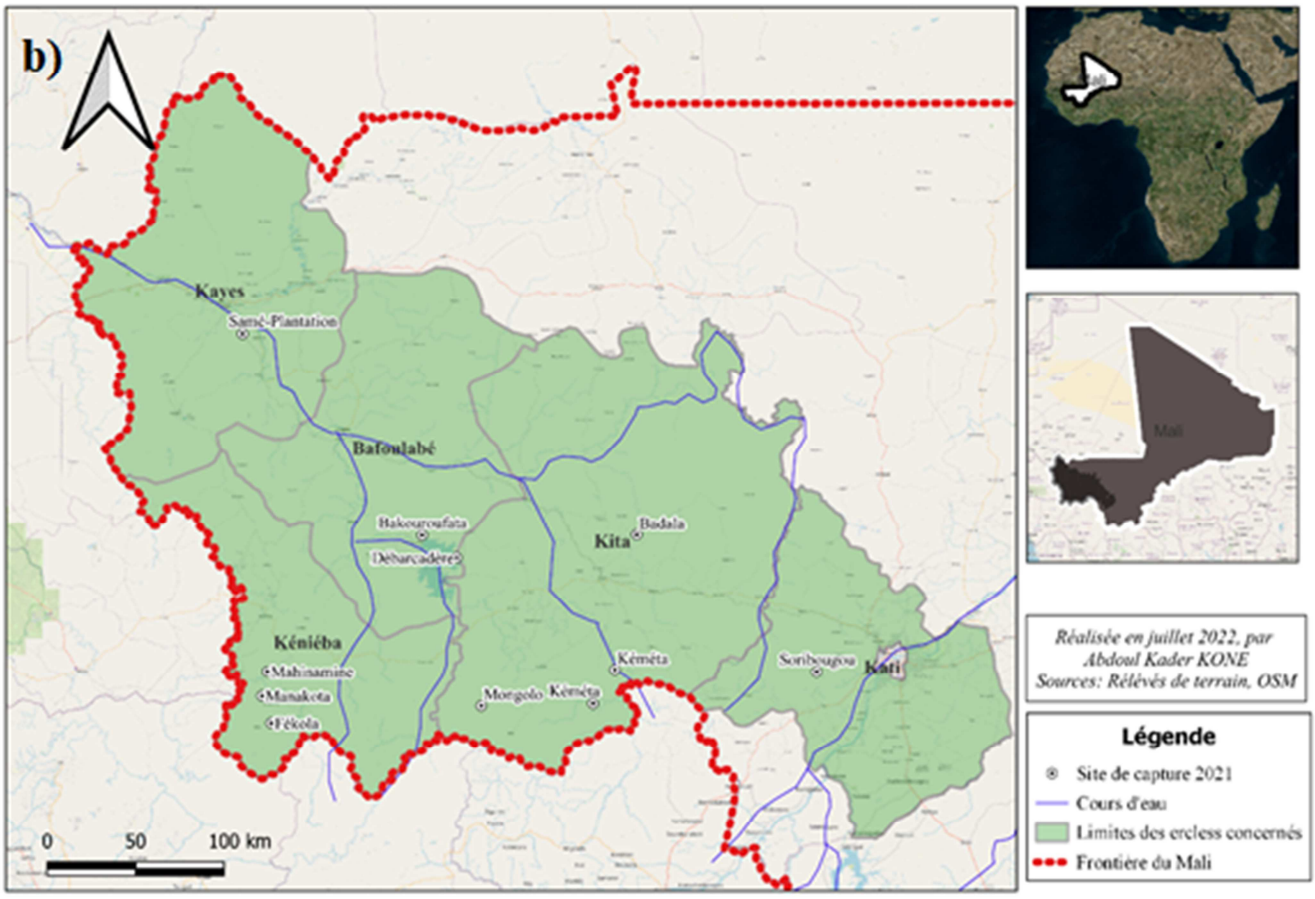


Figure 1. *Location of capture sites in 2020 (a) and 2021 (b).*

Five Arthropods capture techniques were used (Swath Net, Fruit Fly Trap, Buried Trap, Light Trap and Net) at each site. Captures were made along streams in fallows and fields at a distance of 100 to 200 m from the banks and in water at a depth of 0.5 to 1 m.

A 1.5 m long dip net was used in the water at a depth of 0.5 to 01 m to collect all arthropods in the water;

The mowing net with a 1 m long handle tied to a hoop with mosquito netting on it was used in grasses at a rate of 20 strokes per catch at ground level [11]; The buried trap is a device made with an empty mineral water bottle cut in the middle at 10 cm high buried in the ground, containing a mixture of rotten banana and bleach. There were six such traps per site. They were set up in the morning around 8:00 a.m. and emptied 12 hours later.

The light trap, made with the light of a 9 volt flashlight, suspended at about 1.5 m from the ground above a basin containing water mixed with a detergent (liquid soap). It was used for night catches (7pm to 6am);

Fruit fly trap (Mac Phail) containing a food (3 Comppoment or 3C) or sex attractant (Methyl Eugenol, Cuelure, Trimedlure, Terpine acetate) plus an insecticide (DDVP) for 12 hours. Two attractant/insecticide combinations (Invader b-Lok (Methyl Eugenol + Malathion) and M3 Fruit Fly Bait Station (Protein Hydrolysate + Alpha-Cypermethrin) were used.

Captured Arthropods were emptied into vials containing 70% alcohol, often kept in a layer of cotton or newspaper for Lepidoptera (butterflies). All individuals were returned to the Entomology-Parasitology laboratory of the Faculty of Science and Techniques (FST) for identification (Figure 2).

Crioceris duodecimpunctata *Zeugodacus cucurbitae* *Danaus chrysippus*

Figure 2. *Illustration of some identified species (from left to right: Crioceris duodecimpunctata, Zeugodacus cucurbitae, Danaus chrysippus).*

Species were determined with the help of several documents such as the practical identification manual of the main locusts of the Sahel and West Africa [12-14, 5].

Data analysis

The determination of species richness is based on the calculation of Shannon-Weaver indexes (H') and Piélou equitability (E). The Shannon index is a function of the probability *Pi* of each species *i* being present in a set of individuals [15]. Its value was calculated from the following formula:

$$H' = -\sum_{i=0}^{1} Pi * \log_2 Pi \quad (1)$$

Piélou equitability was used to assess the distribution of individuals among all species present at each site. It is calculated by the following formula:

$$E = \frac{H\prime}{LogS} \quad (2)$$

In this equation, H' represents the Shannon index, S the number of species, Log (S) the maximum diversity.

3. Results

The study identified 23 orders, 108 families, 253 genus and 311 species for a total of 8797 individuals captured (Table 1).

Table 1. *Species richness of arthropods caught at the sites.*

Orders	Families	Genus	Species	Numbers
Aranea	Agelenidae	*Agelena*	*Agelenoides*	3
	Areineae	*Liniphia*	*Triangularis*	11
		Lycosa	*Narbosensis*	7
	Locosidae	*Neoscona*	*Puactigera*	2
		Pardosa	*Amentata*	14
Basomatofora	Planorbiae	*Bulinus*	*Globossus*	2
			Truncatus	104
Chormatida	Chormitidae	*Chordeuma*	*Silvestre*	1
Coleaptcera	Anthicidae	*Anticus*	*Floralis*	5
	Cantaridae	*Cantharis*	*lilivida*	11
			rustica	23
	Carabcidae	*Rhagonycha*	*fulva*	2
		Anticus	*antherinus*	4
		Badister	*bipustulatus*	3
		Brooscus	*cephaletes*	15
		Carabus	*depressus*	1
		Chaenius	*vostinus*	4
			nigricornis	2
		Cicindela	*duodeum*	2
			guttata	1
			sexguttata	1
		Dromius	*globocus*	14
			Natatus	4
			quadrimaculata	36
		Dyschirius	*Sp*	19
		Harpalus	*affinis*	12
		Lebia	*ornata*	1
		Odacanta	*melanura*	4
		Patrobus	*ogicornis*	1
		Plerostichus	*modidus*	76
			nigritus	27
	Cerambicidae	*Leptura*	*rubia*	2
			scutellata	2
		Acalymma	*vittata*	3
		Cassida	*flaveola*	1
		Chrysomela	*populi*	4
		Criocerius	*lLilii*	14
			duadecimpunctata	4
			Sp	1
	Chryromelidae	*Disonycha*	*alternata*	2
		Donacia	*vulgaris*	2
		Hispella	*Atra*	2
		Lilioceris	*lilii*	54
		Melasoma	*populi*	2
		Nisotra	*delecta*	32
			uniformis	41

Orders	Families	Genus	Species	Numbers
			gallaeciana	1
		Oulema	*melanopus*	102
			obscura	2
			undulata	3
		Phyllotreta	*memorium*	5
			striolata	3
		Trichispa	*sericea*	2
	Cleridae	*Zenodossus*	*panguineus*	1
		Calvia	*duodecimguttata*	11
		Cassida	*circcumdata*	3
		Cheilomenes	*lunata*	3
			bipustulatus	46
		Chilocorus	*politus*	24
			stigma	2
	Coccinelidae	*Chrysolina*	*Sp*	28
		Cryptiaemus	*montrouzieri*	4
		Cynegetis	*impunctata*	274
		Exochomus	*nigripennis*	6
		Scymnus	*Sp*	1
		Stethorus	*Sp*	1
			pinitillum	1
		Anthonomus	*ouadrigibbus*	1
		Apion	*pomanae*	7
		Cleonis	*spp*	2
		Comopolites	*sodidus*	2
		Cylias	*punctacollis*	2
	Cucurlionidae	*Hylobius*	*piccus*	1
		Otiorrhynchus	*clavipes*	1
		Phyllobius	*glautus*	14
		Phyllobius	*viridiacris*	2
		Polydrusus	*impressifrons*	3
		Agabus	*bipustilatus*	10
		Cybister	*lateralimarginalis*	3
	Dytiscidae	*Hygrobus*	*sp1*	2
		Platambus	*sp2*	1
		Agriotes	*lineatus*	3
	Elateridae	*Echodacus*	*chrysomeloides*	3
	Geotrupidae	*bolbocera*	*falli*	1
		hydrophilus	*piceus*	67
	Hydrophilidae	*Hydrophilus*	*sp3*	2
	Lucanidae	*Lucanus*	*cervus*	1
	Lycidae	*Dyctioptera*	*aurora*	2
		Lytta	*vesicatoria*	4
	Meloidae	*Mylabris*	*variabilis*	33
	Naucoridae	*Ilyacoris*	*cinicoides*	2
	Oedemeiidae	*Acanca*	*bicolor*	12
	Pyrochroidae	*Pyrochroa*	*coccinea*	3
		Copris	*lunaris*	2
	Scarabaeidae	*Homoloplia*	*ruticola*	1
		Hoplia	*philanthus*	2
		Bleduis	*furcatus*	11
		Paederus	*littoralis*	2573
	Staphylinidae		*Sp*	2
		Staphylinus	*caesareus*	51
			olens	13
Dermaptera	Forficulilidae	*Forficula*	*auricularia*	10
	Agromyzidae	*Phytomyza*	*ilicis*	27
		Asilus	*sericeus*	4
	Asiliadae		*Sp*	11
		Empis	*livida*	1
	Bombilidae	*Thyridantros*	*fenestratus*	1
Diptera	Calliphoridae	*Lucilia*	*caesar*	2
	Chloropidae	*Lipara*	*lucens*	3
		Oscinella	*frit*	13
	Conopidae	*Physonocops*	*Sp*	4
	Culicidae	*Culex*	*pipens*	16
	Diospidae	*Diospis*	*thoracica*	104

Orders	Families	Genus	Species	Numbers
	Lonchaeidae	*Lonchaea*	*chorea*	1
	Muscidae	*Musca*	*domestica*	3
	Simuliidae	*Brachypalpoides*	*lenta*	1
		simulium	*sp*	2
	Syrphidae	*Ischisdon*	*aezyptius*	2
		Syrphus	*ribesii*	1
	Tabanidae	*Chrysops*	*frugidus*	2
	Tephritidae	*Bactrocera*	*dorsalis*	209
			bremii	3
		Ceratitis	*ditissima*	1
			sp	1
		Zeugodacus	*cucurbitae*	9
Haplotaxida	Acanthosomatidae	*Acanthosoma*	*haemorrhoidale*	3
	Alydidae	*Alydus*	*eurinus*	2
			calcaratus	2
	Belostomatidae	*Lethocerus*	*amercanus (larve)*	53
	Berythidae	*Neides*	*tipularis*	5
		Berytinus	*minor*	2
	Cercopidae	*Cercopis*	*sp*	2
			vulnerata	5
		Philaneus	*spumarius*	2
	Cicadellidae	*Anaceratagalia*	*laeivis*	73
		Balclutha	*punctata*	11
		Cicadella	*viridis*	6
			sp	3
		Jaccobiasca	*formosana*	6
		Penthimia	*nigra*	13
		Elymana	*sulphurella*	2
			facialis	7
		Thamnotetix	*confinis*	5
		Lyristes	*plebejus*	1
		Ulopa	*reticulalta*	41
		Idiacerus	*vitreus*	10
	Cidnidae	*Sehirus*	*bicolor*	1
	Coreidae	*Leptoglossus*	*oppositus*	4
		Mirperus	*sp4*	35
		Acanthocephala	*terminalis*	1
		Coreus	*marginatus*	3
		Leptoglossus	*occidentalis*	3
Hemiptera		*Phyllomorpha*	*laciniata*	1
/Heteroptera	Corixidae	*Cymalia*	*coleoptrata*	12
	Cydnidae	*Sehirus*	*dibius*	25
	Dictyopharidae	*Epiptera*	*europaea*	7
	Geocoridae	*Geocoris*	*punctipes*	8
			bullatus	4
	Gerridae	*Aquarius*	*najas*	23
		locustris	*guerris*	173
	Isssidae	*Isssus*	*coleoptratus*	1
	Lumbricidae	*Lumbricus*	*terrestris*	17
	Lygaeidae	*Lygaeus*	*saxillaris*	5
			pondurus	2
		Lygus	*ineolaris*	1
			rugulipennis	3
		Spilostethus	*elegans*	3
			rivularis	4
	Miridae	*Miris (leptoterna)*	*dolabrata*	726
	Nabidae	*Nabis*	*sp*	12
	Nepidae	*Nepa*	*cinerea*	2
		Ranatra	*linealis*	4
	Notonectidae	*Notonecta*	*glauca*	33
			undulata	2
	Pemtatamidae	*Acrosternum*	*hilare*	1
		Aelia	*acuminata*	2
		Dolycoris	*baccarum*	9
		Nezara	*viridula*	49
		Pentatoma	*rufipes*	2
		Picromerus	*bidens*	343

Orders	Families	Genus	Species	Numbers
			nigridens	5
		Piezodorus	*sp6*	5
	Pyrrhocoridae	*Dysdercus*	*cingulatus*	2
		Pyrrhocoris	*apterus*	2
		Empicoris	*vagabundus*	2
	Reduviidae	*Phonoctoruis*	*faxiata*	6
		Platymeris	*bigutta*	2
		Rhinocoris	*iracundus*	1
	Rhopalidae	*Chorosoma*	*schillingi*	4
		Calidea	*dregii*	1
	Scutelleridae	*Eurygaster*	*testudinaria*	3
		Eugaster	*maura*	4
	Tettigometridae	*Tettigometra*	*impressopunctata*	23
Heteroptera	Tingidae	*Tingis*	*cardui*	3
	Aphelinidae	*Coccophagus*	*sp*	23
	Apidae	*Apis*	*mellifera*	157
		Xylocopa	*iris*	1
	Braconidae	*Diachamimorpha*	*longicauda*	3
	Crabronidae	*Cerceris*	*rubuensis*	3
			barbarcus	1
		Componotus	*lateralis*	3
	Formicidae		*vagus*	30
		Crabro	*cribarius*	6
		Dorylus	*nigricans*	6
		Formica	*rufa*	21
		Amblyteles	*armatorius*	1
	Icchnemonidae	*Ichneumons*	*suspiciosus*	5
		Netelia	*testacea*	10
Hymenoptera	Megachilidae	*Clalicodona*	*parietina*	1
	Pompilidae	*Pompilus*	*cinercus*	13
			sp	17
	Pteromalidae	*Pteromalus*	*puparum*	5
	Scoliidae	*Scolia*	*flavifrons*	3
		Ammophila	*sabulosa*	3
		Liris	*praetermissa*	1
	Sphecidae	*Podalonia*	*Sp*	3
		Sceliphron	*destillatorium*	2
			spirifex	3
		Delta	*unquiculatum*	1
	Vaspidae	*Vespa*	*crabro*	5
		Polites	*gullicus*	4
		Dolichovespula	*media*	1
		Hodotermes	*mosambicus*	2
Isoptera	Hodotermitidae	*Microhodoterme*	*viator*	2
			albipes	6
Julida	Julidae	*Tachypodoiulus*	*niger*	19
	Erebidae	*Utetheisa*	*pulchella*	3
	Geometridae	*Scopula*	*flolactata*	8
	Gracillaridae	*Pyllocnistris*	*cinella*	15
	Hepialidae	*Hepialus*	*humuli (l)*	2
		Lycophotia	*porphyrea*	1
	Noctuidae	*Mormo*	*mauro (l)*	2
		Spodoptera	*frugiperda*	3
Lepidoptera			*Sp*	1
		Danaus	*chrysippes*	134
	Nymphalidae		*Sp*	6
		Melanargia	*gafathea*	5
	Pieridae	*Colias*	*crocea*	2
		Pieris	*rapae*	55
	Sphingidae	*Agrius*	*convolvuli*	1
		Ladogo	*camilia*	1
		Empusa	*pennata*	1
Mantodea	Mantidae	*Mantis*	*religiosa*	13
			Sp	2
Neoptera	Perlidae	*Periodes*	*microcephala*	1
Neuroptera	Mymeleontidae	*Acanthaclisis*	*baetica*	2
		Formicales	*nostras*	6

Orders	Families	Genus	Species	Numbers
		Myrmeleon	*formicarus*	3
		Palpares	*libelluiloides*	2
	Calopterigidae	*Calopteryx*	*virgo*	5
	Coenagrionidae	*Ceodogonata*	*Spp*	2
		Ichnura	*elegans*	8
	Gomphidae	*Gomphus*	*adelphus*	2
			pulchellus	14
	Lestidae	*Leste*	*sponsa*	29
		Leucorrhinia	*dubia*	8
Odanata			*depressa*	2
			luctuosa	4
		Libellula	*lydia*	4
	Libellulidae		*quadrimaculata*	3
			Sp	13
		Sympetrum	*danae*	12
			pedemontanum	15
		Tarnetrum	*fonscolombii*	5
		Acrida	*bicolor*	2
		Acrotylus	*Sp*	3
		Aiolopus	*thalossinus*	17
		Catantops	*Stramineus*	28
		Catatoipus	*puscocoerulipes*	1
		Chrotogonus	*senegalensis*	11
		Cryptocattantops	*hacmorrhoidalis*	11
		Diabolocatantops	*axillaris*	1
		Dociostaurus	*Sp*	4
		Exopropacris	*modica*	36
		Gastrimarcuis	*afiicanus*	1
		Harpezocutantops	*stylfer*	2
	Acrididae	*Krassela*	*amabile*	5
		Kraussaria	*angulifera*	1
		Locusta	*migratoria*	108
			bivettatus	1
		melanopus	*punctulatus*	4
			bolli	3
			sanguinipes	1
		Morphacris	*fasciata*	43
Orthoptera		*Nomacris*	*septemfasciata*	22
		Oedaleus	*Senegalensis*	27
			Sp	5
		Schistocera	*gregaria*	3
		Tylotropiduis	*dialymus*	2
		Zacomps	*festa*	1
		Acheta	*domestica*	1112
	Gryllidae	*Gryllus*	*campestris*	1
		Oecanthus	*fultoni*	2
			cognata	42
	Pyrgomorphidae	*Pyrgomopha*	*bispinosa*	2
			conica	3
		Zonocerus	*variegatus*	95
			angusta	2
			arenosa	1
	Tetrigidae	*Tetrix*	*arenosa, angusta*	2
			ornata	3
			subulata	19
		Isophya	*pyrenea*	60
	Tettigoniidae	*Phaneroptera*	*nana*	1
		Nemo	*trix*	3
Polydesmida	Paradoxomatidae	*Oxidus*	*gracilis*	132
	Polydesmidae	*Polydesmus*	*angusta*	2
Scolopendromorpha	Cryptopidae	*Cryptops*	*hortensis*	2
	Odontopygidae	*Blaniulus*	*guttatus*	2
Scorpionida	Buthinidae	*Buthus*	*occitanus*	1
Trombiforma	Trobidiidae	*Trobiduim*	*holosericeium*	2

Overall, the family with the highest species richness is the Acrididae with 26 species, 8.36% of the Arthropods population. It is followed by the Chryromelidae with 20 species and the Carabcidae with 19 species. The most

frequently encountered orders of Arthropods were Coleoptera, Hemipheteroptera, Orthoptera, Diptera, Hymenoptera and Lepidoptera. The three field excursions resulted in the inventory of 311 species grouped into several genus, families and orders. The richness of the Arthropod population at the sites visited is presented in Table 2.

Table 2. *Summary of the numbers of Arthropods caught at all sites and by excursion.*

Sites	Orders	Families	Genus	Species	Number
Kéméta	12	45	59	66	417
Touréla	13	33	46	56	498
Sitaféto	14	67	106	118	434
Badala	8	21	23	23	115
Excursion 1	19	92	164	196	1464
Badala-Bakoye	10	24	36	38	372
Sitaféto/Bafing	9	18	26	27	117
Badala-Baoulé/Badingo	11	29	43	45	360
Sékokoto-Bafing	10	17	27	27	86
Toukoto	11	36	68	75	5553
Excursion 2	15	58	121	130	6484
Samé plantation	11	24	28	31	207
Doro	7	16	16	16	146
Diabadji	8	18	21	22	194
Manakoto	9	21	25	26	208
Fékola	5	11	17	17	94
Excursion 3	12	41	57	65	849
All excursions	23	108	253	311	8797

Specific diversity was highest in the first set during the first trip with 196 species, followed by the second trip with 130 species. The third trip recorded 80 species (Table 3).

Table 3. *Specific diversity of Arthropods in the upper Senegal River basin in Mali.*

Excursions /Indexes	H' (bits)	Number	H'max. (bits)	E
Excursion 1	1.28	196	2.14	0.60
Excursion 2	1.70	130	1.57	0.87
Excursion 3	1.78	80	1.40	0.95

The alpha diversity analysis shows values for the specific diversity index H' that vary between 1.28 and 1.78 bits depending on the excursions. The Arthropod population was balanced at the capture sites on excursion 3 and to a lesser extent on excursion 2, but more diverse at the sites on the first excursion with an equitability of 0.60.

4. Discussion

The species of Arthropods associated with the rivers of the upper Senegal River basin in Mali had not been the subject of many systematic inventories. The most frequent and abundant orders in this area are Coleoptera with 414 individuals followed by Diptera (251 individuals), Orthoptera (244 individuals), Polydesmida (133 individuals). In contrast, numbers from 1 to 86 were recorded for the other orders (86 individuals for Hymenoptera) and only one individual for Neoptera and Chormatida.

The specific diversity of the study sites varying between 1.28 and 1.78 bits depending on the excursions is higher than that obtained by Damerdji and Cheikh Miloud [16] along the Algerian coastline. This difference can be linked to the density of the vegetation giving by place a suitable habitat for some terrestrial but also aquatic Arthropodes. It could also explain the very high frequency of the first two orders (Coleoptera, Diptera) in the study area. All the capture sites are located in the western part of the Malian Sahel where the vegetation is dominated by a shrubby savanna. The variation observed in the populations and species encountered could also be related to the periods of the trips. Climate would also affect arthropod sighting frequencies as shown by Assitoun et al. [17] but also Camara et al. [11].

The variation of the stand between two excursions could be related to other meteorological factors such as soil moisture but also air moisture. These factors would strongly affect the viability and mobility of some species [18]. Miridae are known to occur in the forest and humid regions from Guinea to Cameroon [19]. Hence the presence of this order of Arthropods in some of the capture sites.

The trapping techniques used in the study allowed the capture of several individuals of Arthropod species. They are not new and have been used by other researchers such as Morin et al. [20] to detect pests of tropical perennial crops and reduce their populations with the use of attractants.

5. Conclusion

Recent decades have been marked in West Africa by sustained population growth and high climate variability. In Mali, in addition to these two factors, there has been an unprecedented growth in the extractive industry, whose harmful effects on biodiversity are recognized by many scientists. This combination of factors has strongly contributed to the destruction of habitats through deforestation and the release of toxic products into the environment. The objective of this study was to inventory the entomological resources in the upper Senegal River basin in Mali. The number of Arthropods identified varied greatly from one excursion to another and from one site to another. They were made up of several orders, families, genus and species. A total of 8797 individuals were captured, all species combined, at all study sites. The number of orders varied from 5 to 23, but the families varied from 16 to 153 depending on the site. The major orders frequently encountered were: Coleoptera and Diptera. These results reveal a surprising diversity of entomofauna in the study area. They will allow the adoption of effective control measures against rainfed crop pests and Arthropods of veterinary interest. This work recommends that monitoring be implemented to better understand the impact of anthropogenic factors on population dynamics.

Conflict of Interest Statement

The authors declare that they have no conflict of interest regarding this article.

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