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CAMPEOPHAGY IN AFRICA : A STATE OF KNOWLEDGE REPORT

Campéophagie en Afrique : État de la connaissance

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"The use of insects as food for humans deserves greater recognition from governments and from donor agencies. Edible insects are a neglected resource to alleviate malnutrition and hunger." van Huis (1996)

RESUME

L'article passe en revue l'état de la connaissance relative aux groupes ethnolinguistiques africains consommant des chenilles (98 groupes sur base de 127 références), la diversité des ethnospecies qu'ils reconnaissent. Cette information est synthétisée sous forme d'une carte. Une liste des espèces consommées est fournie. La composition chimique des chenilles comestibles est résumée selon 4 tableaux abordant respectivement la composition globale, celle en acides aminés, en lipides et en vitamines. Ces synthèses sont brièvement discutées. ,
Mots-clés: Campéophagie - Chenilles - Afrique - Alimentation – Composition chimique.

ABSTRACT

The paper reviews data available regarding the African ethno-linguistic groups eating caterpillars (98 groups according to 127 sources) and the diversity of ethnospecies that they recognise. This information is mapped. A list of species eaten is provided. Chemical composition of edible caterpillars is summarised in 4 tables concerning general composition, amino acids, lipids and vitamins. These syntheses are briefly discussed.
Key words: Campeophagy-Caterpillars-Africa-Feeding-Chemical composition.

INTRODUCTION

Entomophagy is a subject receiving increasing interest during this last decade. With about 1500 edible insect species listed all over the world, more and more interest has recently been devoted to both diversity and nutritional aspects. Human consumption of insects considered some 104 families distributed into 14 orders (Table I). Of those, four orders take a dominant position regarding the amount of species involved, namely: Coleoptera, Coleoptera, Hymenoptera, Lepidoptera and Orthoptera; whilst as far as values regarding families are concerned Lepidoptera takes the top position with 21 families.
This paper will focus on the consumption of caterpillars, for which we introduce the-neologism of "campeophagy", derived from the greek, meaning to eat cartepillar.

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Tab.I- Diversity of families with edible insects in the world.
Diversité, à l'échelle mondiale, des familles présentant des insectes comestibles

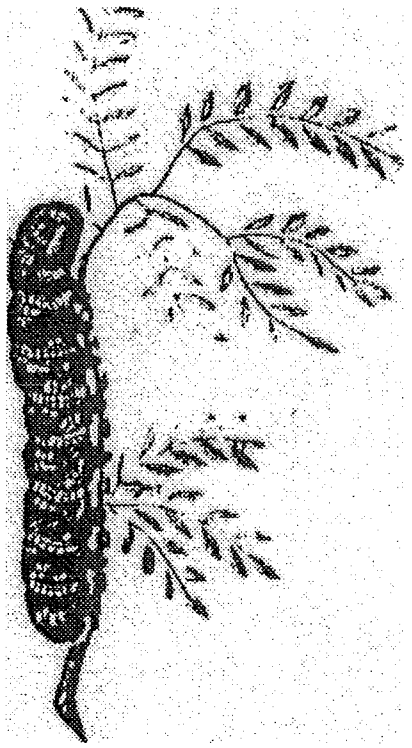
Orders	Families
Anisoptera	*Aeshnidae* *Libellulidae*
Anoplura	*Peliculidae*
Coleoptera	*Anobiidae* *Bruchidae* *Buprestidae* *Carabidae* *Cerambycidae* *Cicindelidae* *Chrysomelidae* *Curcul ionidae* *Dynastidae* *Dytiscidae* *Elateridae* *Histeridae* *Hydrophilidae idae* *Lucanidae* *Melolonthidae* *Passalidae* *Tenebrionidae*
Diptera	*Calliphoridae* *Chaoboridae* *Conopidae* *Culicidae* *Ephydridae* *Leptidae* *Muscidae* *Rhagionidae* *Sarcophagidae* *Stratiomyidae* *Syrphidae* *Tipulidae*
Ephemeroptera	*Baetidae* *Ephemeridae*
Hemiptera	*Belostomatidae* *Cicadidae* *Coreidae* *Corixidae* *Naucoridae* *Nepidae* *Notonectidae* *Pentatomidae* *Scutel leridae*
Homoptera	*Aphididae* *Cicadellidae* *Cicadidae* *Coccidae* *Dactylopidae* *Flatidae* *Fulgoridae* *Membracidae* *Psyllidae*
Hymenoptera	*Apidae* *Cynipidae* *Formicidae* *Halictidae* *Megachilidae* *Thynnidae* *Vespidae* *Xylocopidae*
Isoptera	*Hodotermitidae* *Rhinotermitidae* *Termitidae*
Lepidoptera	*Arctiidae* *Brahmaeidae* *Castniidae* *Cossidae* *Geometridae* *Hepialidae* *Hesperiidae* *Lasiocampidae* *Limacodidae* *Lymantriidae* *Mimallonidae* *Momphidae* *Noctuidae* *Notodontidae* *Nymphalidae* *Papi lionidae* *Pieridae* *Psychidae* *Pyralidae* *Saturniidae* *Sphingidae*
Neuroptera	*Corydalidae*
Orthoptera	*Acrididae* *Blattidae* *Catantopidae* *Gryllacrididae* *Gryllidae* *Gryllotalpidae* *Hemiacrididae* *Hymenopodidae* *Mantidae* *Mecopodidae* *Pamphagidae* *Phaneropteridae* *Phasmidae* *Pyrgomorphidae* *Tettigoniidae*
Plecoptera	*Perlolidae* *Pteronarcyidae*
Trichoptera	*Hydropsychidae* *Stenopsychidae*

CAMPEOHAGY IN AFRICA

We will successively review information regarding diversity of ethnolinguistic groups eating caterpillars, as well as their respective knowledge regarding ethnospecies recognition and finally diversity of edible caterpillars. Later chemical composition will be commented on.

If consumption of grasshoppers is already quoted in the Bible (SOUTHWOOD, 1977), interest from peoples inhabiting tropical Africa towards edible caterpillars is also ancient, as indicated in several comments of colonial period.

According to our knowledge, the oldest comment dealing with human consumption of caterpillars in Africa is to be found in a manuscript relating the Simon van der Stel expedition in 1685-86 (WATERHOUSE, 1932; PALMER & PITMAN, 1972). A drawing of Claudius (Fig. 1), presumably of *Imbrasia thyrrea* (OBERPRIELER *in litt.*), can be found in the manuscript, which is housed in Dublin and was edited in 1932 by Waterhouse. According to VAN DER STEL, "This caterpillar is called Aroube by the Namaquas and is found in their country. The monster is regarded by them as a delicacy and a dainty dish, for when they have first squeezed out of it all the green ordure, they impale it on a wooden spit and lay it on the embers until it is baked hard, and then they consign it with gusto to their eager bellies".



An edible caterpillar drawn by **Claudius on the Simon van der Stel expedition,** 1685-1686, **and figured in Icones Plantarum et Animalium**

Fig.1.- Drawing of *Imbrasia thyrrea*, an edible caterpillar, by Claudius in Simon van der Stel expedition's manuscript (after Palmer and Pitman 1972).
Dessin de Imbrasia thyrrea, une chenille comestible, par Claudius dans le manuscrit de l'expédition de Simon van der Stel (d'après Palmer et Pitman 1972)

DIVERSITY OF INFORMATION

Distribution and diversity of campeophagy has been approached through several sources, such as earlier explorers' accounts as well as travel stories, local dictionaries of colonial period, ethnographic studies, ethnozoological reports and finally local surveys. Synthesis of the information gathered is expressed in two différent ways: (a) a table where each source is quoted according to the ethnolinguistic group involved, (b) a map of distribution of ethnolingusitic groups practising campeophagy (used of colour was made to express the richness of edible ethnospecies recognised and encountered).

Table II presents the ethnolinguistic units for which we have been able to quote the consumption of caterpillars. All together some 133 sources relating human consumption of caterpillars (and pupae) were consulted. At present we are able to quote some 97 ethnolinguistic groups practising campeophagy in Africa; that is 9.3 % of the diverse groups recognised for that continent. The list drawn is unquestionably incomplete and further research should add more groups. An increasing interest regarding campeophagy has to be reported, as indicated by figure 2, with about 49 papers, related to this matter, published for the last decade.

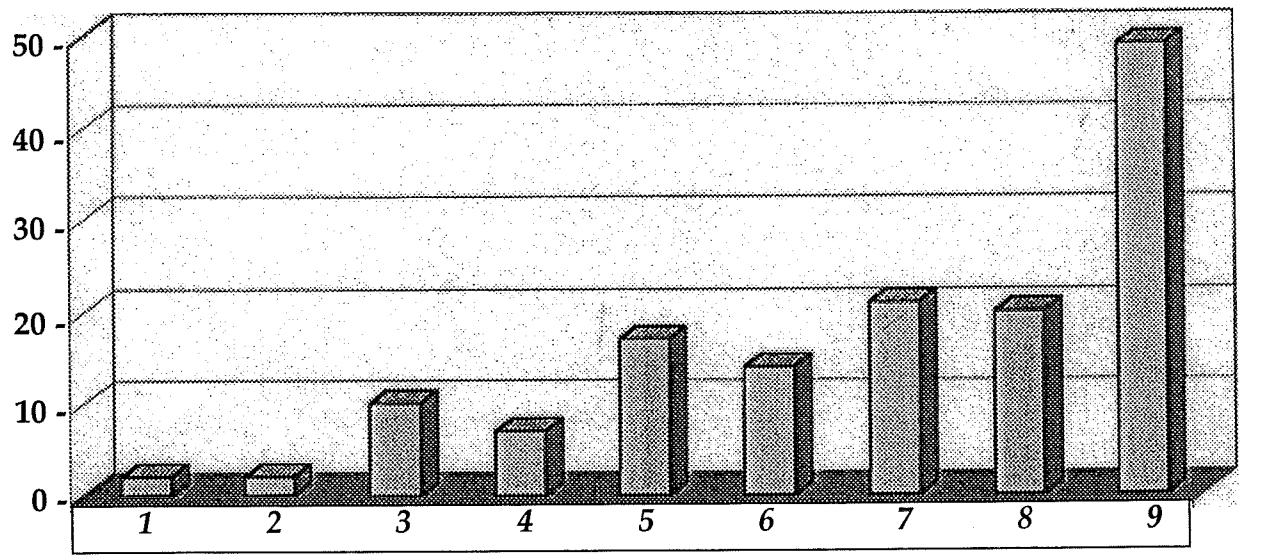


Fig. 2.- Number of publications dealing with edible caterpillars in Tropical Africa (period 1911-2000).
Nombre de publications abordant le thème des chenilles comestibles d' Afrique tropicale (période 1911--2000)

Tab II- Diversity of edible caterpillars according to ethnolinguistic units and (countries) [N : reference number, E : number of ethnospecies recognised, L : number of Linnean species (caterpillar supported by scientific determination)]..
Diversité des chenilles comestibles selon les groupes ethnolinguistiques et les (pays) [N: nombre de référence, E: nombre d'ethnospecies reconnues, L : nombre d'espèces linnéennes (chenilles pourvues d'une détermination scientifique)].

N	Ethno-linguistic units (country)	References	Number of caterpillars E	L
29	Kono (Guinea-Conakry)	Villiers 1957	+	
39	Sénoufo (Burkina Faso)	Ouedraogo *et al.* 2003	1	1
50	Dioula=Dyula (Burkina Faso)	Ouedraogo *et al.* 2003	1	1
66	Bambara (Mali)	Bergier (1941)	+	
87	Lobi (Burkina Faso)	Ouedraogo *et al.* 2003	1	1
91	Karaboro (Burkina Faso)	Ouedraogo *et al.* 2003	1	1
96	Birifor (Burkina Fso)	Ouedraogo *et al.* 2003	1	1
96a	Bobo Madaré (Burkina Faso)	Ouedraogo *et al.* 2003	1	1
97	Dagara (Burkina Faso)	Ouedraogo *et al.* 2003	1	1
97a	Dafing (Burkina Faso)	Ouedraogo *et al.* 2003	1	1
97b	Tiéfo (Burkina Faso)	Ouedraogo *et al.* 2003	1	1
154	Bariba (Nigeria)	Fasoranti, Ajiboye 1993	+	1
173	Nupe (Nigeria)	Fasoranti, Ajiboye 1993	+	1
174	Yoruba (Nigeria)	Golding 1942	+	
174	Yoruba (Nigeria)	Ene 1963	+	
174	Yoruba (Nigeria)	Ashiru 1988	+	1
174	Yoruba (Nigeria)	Fasoranti, Ajiboye 1993	+	1

N	Ethno-linguistic units (country)	References	Number of caterpillars	
			E	L
211	Holoholo (D.R. Congo)	Schmitz 1912	+	
301	Fang=Pangwe (Equat.Guinea) Guinea)	Tessmann 1913	21	
301	Fang (Gabon)	Sarraco-Lanata (in litt.)	5	
316	Nzebi (Gabon)	Rougeot 1955	+	1
316	Nzebi (Gabon)	Sarraco-Lanata (in litt.)	12	
318	Kota (Gabon)	Sarraco-Lanata (in litt.)	4	
336	Teke (Gabon)	Sarraco-Lanata (in litt.)	17	
342 a	Kongo (Ntandu) (D.R. Congo)	Latham 1999a-b, 2000	22	12
342 b	Kongo (Ndibu) (D.R. Congo)	Kimba Kasalwe (in litt.)	27	
343	Yaka (D.R. Congo)	Lechien in Leleup & Daems 1969	+	
356	Mongo (D.R. Congo)	Chinn 1945	31	2
356 b	Mongo (Ngandu) (D.R. Congo)	Takeda 1990	-	
356 c	Mongo (Twa) (D.R. Congo)	Pagezy 1988	31	7
358	Yansi (D.R. Congo)	Tango Muyay 1981	33	
359	Mbala (D.R. Congo)	Adriaens 1953	9	4
359	Mbala (D.R. Congo)	Mbemba & Remacle 1992	24	
361	Songo (D.R. Congo)	de Beaucorps 1941	+	
362	Sondi=Sonde (D.R. Congo)	Leleup & Daems 1969	4	2
363	Pende (D.R. Congo)	Leleup & Daems 1969	7	3
363	Pende (D.R. Congo).	Daems in Leleup & Daems 1969	18	
380	Luba-Kasai (D.R. Congo)	Colle 1913, Katya Kitsa 1989	9	
385	Lunda (Zambia)	Mbata 1995	6	
385	Lunda-Ruund (Zambia)	Demesmaecker 1997	15	
386	Tshokwe (D.R. Congo)	Roeges in Leleup & Daems 1969	+	
386	Tshokwe (Angola)	Silow 1976	+	
388	Holo (D.R. Congo)	Denis 1964	> 6	
391	(U)Mbundu south	Bossard 1996	+	
397	Ganguella (Angola)	Pinto Serpa 1881, Baiao 1939	+	
398	Luimbi (Angola)	Baum 1903	+	
399	Luc(h)asi (Zambia)	Silow 1976	+	
399	Luc(h)asi (Zambia)	Mbata 1995	1	
403	Lwena=Luvale (Zambia)	White 1959	18	
403	Lwena=Luvale (Zambia)	Mbata 1995	4	
404	Ndembo (Zambia)	Silow 1976	+	
405	Kaonde (Zambia)	Mbata 1995	5	
406	Mbunda (Zambia)	Silow 1976	31	
406	Mbunda (Zambia)	Mbata 1995	1	
406 b	Yauma=Iauma (Angola)	Silow 1976	+	
407	Nkoya (Zambia)	Silow 1976	12	
407 b	Mashasha (Zambia)	Silow 1976	+	
410	Nkangala (Zambia)	Silow 1976	+	
421 g	Tswana (Kwena) (Botswana)	Livingstone 1857	1	1
421 n	Tswana (Tlokwa) (Botswana)	Grivetti 1979	5	1
423	(Si)Ndebele (Zimbabwe)	Chavanduka 1975	1	2
424	Gwembe Tonga (Zambia)	Scudder 1962	+	
424	Tonga (Zambia)	Mbata 1995	2	
427	Lenje (Zambia)	Torrend 1931	+	
429	Lala (Zambia)	Thomson 1954	+	
429	Lala (Zambia)	Mbata 1995	1	
430	Nsenga (Zambia)	Mbata 1995	10	
431	Kunda (Zambia)	Mbata 1995	1	
433	Nyanja-Ngosi (Zambia)	Mbata 1995	3	
433	Nyanja (Malawi)	Mkanda, Munthali 1994	13	
435	Bisa (Zambia)	Mbata & Chidumayo 1999	8	
435	Bisa (Zambia)	Mbata & Chidumayo 2003	8	

N	Ethno-linguistic units (country)	References	Number of caterpillars	
			E	L
436	Aushi (Zambia)	Kisimba & Muzinga (in litt.)	+	1
437	Lamba (Zambia)	Doke 1931	+	
437	Lamba (Zambia)	Demesmaecker 1997	21	18
438	Sanga (DA. Congo)	Lambrecht & Bernier 1961	1	1
439	Aushi (D.R. Congo)	Malaisse et al. 2003	1	1
441	Tabwa (D.R. Congo)	Bergier 1941	+	
441	Tabwa (D.R. Congo)	Kimba Kasalwe (in litt.)	+	
442	Bemba (D.R. Congo)	Malaisse & Parent 1981	35	26
442	Bemba (D.R. Congo)	Malaisse 1997	38	24
442	Bemba (D.R. Congo)	Malaisse (present paper)	40	27
442	Bemba (Zambia)	Richards 1939	6	
442,	Bemba (Zambia)	Mbata 1995	26	
449 b	Malila (Tanzania)	Latham (in litt.)	1	
464	Lega-Shabunda (D.R. Congo)	Bergier 1941	+	
531	Gogo (Tangania)	Cole 1902	+	
531 b	Sandawe (Tanzania)	Newman 1975	+	
544	Ngindo (Tanzania)	Crosse-Upcott 1958	+	
550	Yao (Mozambique)	Harris 1940	+	1
558	Tumbuka (Zambia)	Mbata 1995	+	
571	Venda (Zimbabwe)	Wessmann 1908	+	
571	Venda (Zimbabwe)	Stayt 1931		
571	Venda (Zimbabwe)	Jackson 1953	9	1
574	Thonga	Junod 1927	+	
574	Thonga	Silow 1976	+	
575	Ronga	Silow 1976	+	
576	Swazi (Swaziland)	Beemer 1939	1	
577 b	Pedi (Sotho Central) (R.S.A.)	Quinn 1959	5	5
582	Shona-Ndau (Zimbabwe)	Benhura, Chitsaku 1990	1	1
583	Shona-Karanga (Zimbabwe)	McGregor 1995	+	
584	Shona (Zimbabwe)	Duncan 1933	6	
584	Shona (Zimbabwe)	Gelfand 1971	7	1
584	Shona (Zimbabwe)	Chavanduka 1975	5	3
584 a	Shona (Zezuru) (Zimbabwe)	Biehler 1950	+	I
584 a	Shona (Zezuru) (Zimbabwe)	Hannan 1959	+	1
591	Nandi (Kenya)	Yagi 1997	+	
684	Zande(R.D. Congo)	Emin-Pacha 1888	+	
684	Zande(R.D. Congo)	de Schlippé 1956	+	
684	Zande(R.D. Congo)	De Smet 1972	+	
689	Medje(R.D. Congo)	Bequaert 1921	+	
800	Gbaya-Bodoe (Central Afr. Rep.)	Roulon-Doko 1980, 1998	59	13
804	Bwaka (Central Afr. Rep.)	Bergier 1941	+	
804a	Bwaka = (Y)Aka (C.Afr. Rep.)	Bahuchet 1985, Hladik 1995	11	8
804b	Issongo (Central Afr. Rep.)	Hladik 1995	12	7
804c	Bofi (Central Afr. Rep.)	Malaisse (present paper)	17	9
821	Yangere(Central Afr. Rep.)	Masseguin & Antonini 1938	21	
889	Dama(n) (Namibia)	Oberprieler 1995	4	4
909	Mofu (Cameroun)	Seignobos et al. 1996	3	
986	Ebira (Nigeria)	Fasoranti, Ajiboye 1993	+	1
990	Bassa (Cameroun)	Merle 1958	3	
993	San (Namibia)	Oberprieler 1995	3	3
993	San (Botswana ?)	Nonaka 1996	7	1
994	Nama(n) (Namibia)	Oberprieler 1995	4	4
1000	Antankarana (Madagascar)	Bergier 1941	+	
1001	Sakalava (Madagascar)	Bergier 1941	+	
1004	Merina (Madagascar)	Bergier 1941	+	
1006	Betsileo (Madagascar)	Ellis 1838	+	

+ : at least one species, no precise values given.

The following publications were also consulted and are taken into account in values of Figure 2 : ABE'ELE 1998, BANI 1995, BELl & MC GEOCH 1996, BLOOMHILL 1958, BODENHEIMER 1951, BRANDON . 1987 a-b, CUNNINGHAM 1996, de ALMEIDA 1946, DEFOLIART 1991b, 1995, FERREIRA 1995, GASHE *et a1.*1997, GOMEZ *et a1.*1961, GREEN 1998, GRIMES 1996, HOLDEN 1991, HULSTAERT 1961, JERMINI *et a1.*1997, KASSNER 1911, MALAISSE 1983, MALAISSE *et al.* 1974, MALAISSE-MOUSSET *et al.* 1970, MENZEL & D'ALUSIO 1998, Merriweather 1968, MIGNOT 2003, MUNTHALI & MUGHOGHO 1992, SCHOLTZ 1982, SEYDEL 1939, STYLES 1995, THIRY 1980, TURK 1990, VAN DEN BERG 1974, VAN DEN BERG *et a1.*1973, VELCICH 1963.

MAPPING THE ETHNOLINGUISTIC GROUPS PRACTISING CAMPEOPHAGY

A map dealing with distribution of ethnolinguistic groups for Africa has been collated from previous essays (MURDOCK, 1959, BARTHOW, 1978), as well as more local information dealing with information dealing with Angola (MILHEIROS, 1967), Bas – Congo (BOONE, 1973) , Burkina Faso (GRIMES, 1996), Ivory Coast (VENNETIER, 1983), South – East Congo (BOONE, 1961), Tanzania (Thomas, 1975), Zambia (ANON, 1998).

Ethnolinguistic groups practising campeophagy are reported on this map (Figure 3). A coloured scale is used to denote richness of caterpillar's ethnospecies recognised.

DIVERSITY OF EDIBLE SPECIES

According to present knowledge regarding edible caterpillars in Tropical Africa, some 65 species, duly determined, are involved; they belong to 10 families (Table III). From ethnospecies encountered in diverse publications, at least some thirty other species are concerned.

It should be noted that colour photographs of edible species are to be found in MALAISSE, (1997) (24 species), LATHAM, (1999a, 2000), (12 linnean species, 8 ethnospecies), whilst OBERPRIELER, (1995) provides colour plates of 22 species of Saturniidae.

The species eaten belong to Saturniidae : *Athletes gigas* Sonthonnax, *A. semialba* Sonthonnax, *Bunaea alcinoe* (Stoll), *Bunaeopsis aurantiaca* (Rothschild), *Cinabra hyperbius* (Westwood), *Cirina forda* (Westwood), *C. forda butyrospermi* Vuillet, *Epiphora bauhiniae* (Guérin-Méneville), *Gonimbrasia hecate* (Rougeot), *G. rectilineata* (Sonthonnax), *G. zambesina* (Walker), *Goodia kunzei* (Dewitz), *Gynanisa ata* Strand, *G. maja* (Klug), *Heniocha dyops* (Maassen), *Imbrasia anthina* (Karsch), *I. belina* (Westwood), *I. epimethea* (Drury), *I. ertli* Rebel, *I. macrothyris* (Rothschild), *I. melanops* Bouvier, *I. obscura* Butler, *I. petiveri* (Guerin-Meneville), *I. rhodina* Rothschild, *I. rubra* (Bouvier), *I. truncata* Aurivillius, *I. ryrrhea* (Cramer), *Lobobunaea christyi* (Sharpe), *L. goodü* Holland, *L. phaedusa* (Drury), *L. satzcrnus* (Fabricius), *Melanocera nereis* (Rothschild), *M. parva* Rothschild, *Micragone ansorgei* (Rothschild), *M. cana* (Aurivillius), *M. herilla* (Westwood), *Nudaurelia richelmanni* Weymer, *P. discrepans* Butler, *Tagoropsis flavinata* (Walker), *Urota sinope* (Westwood), *Usta terpsichore* (Maassen & Weyding), *U. wallengrenü* (Felder & Felder). Other edible caterpillars belong to the family Notodontidae - *Anaphe panda* (Boisduval), *A. reticulata* Wallcer, *A. venata* Butler, *Antheua insignata* Gaede, *Drapedites uniformis* Swinhoe, *Desmeocraera sp.*, *Elaphrodes lactea* (Gaede), *Ipanaphe carteri* Walsingam as well as two ethnospecies (MALAISSE & PARENT, 1980), to the Sphingidae, namely Herse *convolvuli* (Linnaeus), *Hippotion eson* (Cramer), *Acherontia atropos* (Linnaeus), *Nephele comma* Hopffer, several species of *Platysphinx* including *P. stigmatica* (Distant); four Noctuidae - *Helicoverpa armigera* (Hübner), *Spodoptera exempta* (Walker) and *S. exigua* (Hübner), *Sphingomorpha chlorea* Cr., as well as *Prodenia sp.*-, at least two Limacodidae, " tubambe " in Katanga, or "kavambe" for the Mbunda or *Hadraphe ethiopica* Bethune-Baker and " zviwizi " in Zimbabwe, two Lasiocampidae , *Bombycomorpha pallida* Distant and *Gonometica postica* Walker (QUIN, 1959), two Psychidae (PAGEZY, 1988), of which *Eumeta cervina* Druce (BEQUAERT, 1921; BERGIER, 1941) ; finally one caterpillar of Brahmaeidae (*Dactylocerus lucina* Drury), of Hesperidae (*Coeliades libeon* Druce) and of Lymantrüdae (*Rhypopteryx poecilanthes* Colenette). Beside these species attested by a scientific deter-

mination, it should be remembered that, according to our field observations and diverse notes (ADRIAENS, 1953, de FOLIAERT 1991a, McGREGOR, 1995, ROULON-DOKO, 1998, TANGO MUYAY, 1981), that caterpillars of the families Agaristideae, Cossidae, Geometridae, Nymphalidae (Acraeineae et Nymphalineae) are edible.

Table III. Species diversity of edible caterpillars in Africa.
Diversité spécifique des chenilles comestibles d'Afrique.

Families	Species	References
Brahmaeidae	*Dactylocerus lucina Drury*	Malaisse & Lognay 2003
Lasiocampidae	*Bombycomorphapallida Distant*	Ramos Elorduy 1991
	Gonometa postica Walker	Quin 1959
	Pachymeta robusta Aurivillius	Malaisse & Roulon-Doko (in prep.)
Limacodidae	*Hadraphe ethiopica Bethune-Baker*	Malaisse & Lognay 2003
Lymantrüdae	*Il*	Latham 1999
	Rhypopteryx poecilanthes Colenette	Malaisse & Lognay 2003
Noctuidae	*Helicoverpa armigera (Hübner)*	Mignot 2002
	Prodenia sp. l	
	Sphingomorpha chlorea Cr.	Silow 1976
	Spodoptera exempta (Walker)	Mbata 1995
	Spodoptera exigua Hübner	Mbata 1995
Notodontidae	*Anaphe panda (Boisduval)*	Harris 1940, Le Clerc *et al.* 1976
	Anaphe reticulata Walker	Steele (in litt.)
	Anaphe venata Butler	Bahuchet 1985, Ashiru 1988
	Antheua insignata Gaede	Malaisse & Parent 1980
	Cerurina cf. marshalli (Hampson)	Malaisse & Roulon-Doko (in prep.)
	Desmeocraera sp.	Silow 1976
	Drapedites uniformis Swinhce	Malaisse & Parent 1980
	Elaphrodes lactea (Gaede)	Seydel 1939
	Ipanaphe carteri Walsingam	Latham in Malaisse & Lognay 2003
	"lusambwa" (chibemba)="nsindi" (ntandu)	Malaisse & Parent 1980, Latham 1999
Nymphalidae	*Cymothoe caenis*	Malaisse (unpubl.)
Papilionidae	*Cymothoe caenis*	Malaisse (unpubl.)
Papilionidae	*cf. Princeps sp.*	Malaisse & Roulon-Doko (in prep.)
Psychidae	*Eumeta cervina Druce*	Steele (in litt.)
	Eumeta rougeoti	Steele (in litt.)
	Eumeta sp.	Pagezy 1975
	"nâà-so-?ini"	Roulon-Doko 1998
Saturniidae	*Argema mimosae (Boisduval)*	Kropf 1899
	Athletes gigas Sonthonnax	Malaisse & Parent 1980
	Athletes semialba Sonthonnax	Malaisse & Parent 1980
	Bunaea alcinoe (Stoll)	Silow 1976
	Bunaeopsis aurantiaca (Rothschild)	Malaisse & Parent 1980
	Bunias aslauga	Harris 1940
	Cinabra hyperbius (Westwood)	Silow 1976, Malaisse & Parent 1980
	Cirina butyrospermi Vuillet	Bergier in Merle 1958
	Cirina forda (Westwood)	Adriaens 1953, Oberprieler 1993
	Epiphora bauhiniae (Guérin-Méneville)	Pagezy 1975
	Gonimbrasia hecate (Rougeot)	Malaisse & Parent 1980
	Gonimbrasia rectilineata (Sonthonnax)	
	Gonimbrasia zambesina (Walker)	Malaisse & Parent 1980
	Goodia kuntzei (Dewitz)	Malaisse & Parent 1980
	Gynanisa ata Strand	Malaisse & Parent 1980
	Gymnanisa maja (Klug)	Oberprieler 1993
	Heniocha dyops (Maassen)	Oberprieler 1993
	Imbrasia anthina (Karsch)	Latham 1999
	Imbrasia belina (Westwood)	Velcich 1963, Oberprieler 1993
	Imbrasia cytherea (Fabricius)	Smit 1964

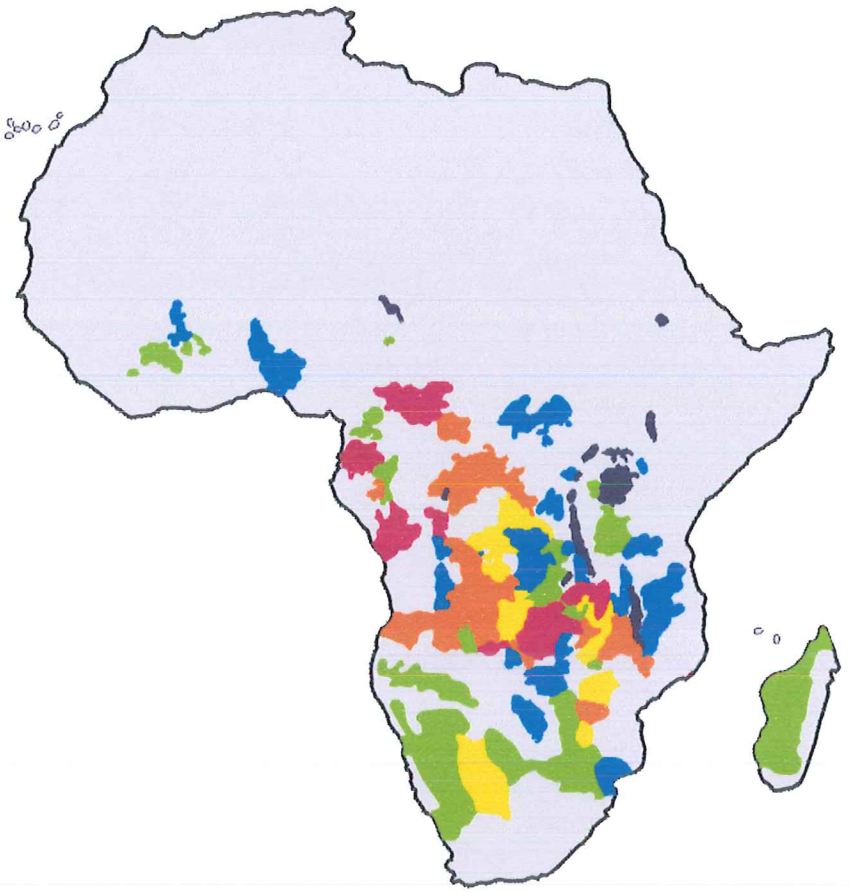


Fig.3.- Ethnolinguistic groups practising campeophagy
Groupes ethnolinguistiques pratiquant la campéophagie

Etnospecies recognized :
Ethnospecies reconnues :

- **> 20**
- **10 - 20**
- **5 - 10**
- **1 - 5**
- Campeophagy but number of ethnospecies unknown
  Campéophagie mais nombre d'espèces inconnu
- Groups never eating caterpillars
  Groupes ne consommant jamais de chenilles
- Lakes - *Lacs*

Families	Species	References
Saturniidae	*Imbrasia epimethea Drury*	Adriaens 1953
	Imbrasia ertli Rebel	Oberprieler 1993
	Imbrasia macrothyris (Rothschild)	Malaisse & Parent 1980
	Imbrasia melanops Bouvier	
	Imbrasia obscura (Butler)	Bahuchet 1985
	Imbrasia petiveri (Guérin-Méneville)	Silow 1976
	Imbrasia rhodina Rothschild	Latham 1999
	Imbrasia rubra (Bouvier)	Malaisse & Parent 1980
	Imbrasia truncata Aurivillius	Bahuchet 1985
	Imbrasia tyrrhea (Cramer)	Oberprieler 1993
	Lobobunaea angasana (Westwood)	Malaisse & Parent 1980
	Lohobunaea christyi (Sharpe)	Seignobos et al. 1996
	Lobobunaea goodü Holland	
	Lobobunaea phaedusa (Drury)	Latham 1999
	Lobobunaea saturnus (Fabricus)	Malaisse & Parent 1980
	Melanocera nereis (Rothschild)	Latham 1999
	alelanocera parva Rothschild	Malaisse & Parent 1980
	Micragone ansorgei (Rothschild)	Malaisse (unpubl.)
	n-licragone cana (Aurivillius)	Malaisse & Parent 1980
	Micragona herilla-(Westwoodl	Ramos Elorduy 1991
	Nudaurelia richelmanni Weymer	Malaisse & Parent 1980
	Pseudantherea discrepans Butler	Malaisse & Lognay 2003
	Tagoropsis flavinata (Walker)	Malaisse & Parent 1980
	Urota sinope (Westwood)	Malaisse & Parent 1980
	Usta terpsichore (Maassen & Weyding)	Malaisse & Parent 1980
	Usta wallengrenii (Felder & Felder)	Gaerdes 1959, Oberprieler 1993
Sphingidae	*Acherontia atropos(Linn)*	Latham 1999
	Coelonia julvinotata-(Butlerl	Malaisse & Roulon-Doko (in prep.)
	Herse convolvuli (Linn.)	McGregor 1995
	Hippotion eson (Cramer)	Malaisse & Lognay 2003
	Hippotion sp. 1	Malaisse & Roulon-Doko (in prep.)
	Lophostethus demolini (Angas)	Malaisse & Roulon-Doko (in prep.)
	Nephele comma Hopffer	Silow 1976
	Platysphinx stigmatica (Mabille)!	Malaisse & Lognay 2003
	Platysphinx sp. 1	Latham 1999
	Platysphinx sp. 2	Latham 1999

In total, some 14 families are concerned, Saturniidae taking the top position with some 39 different species or 51%, followed up by Notodontidae (11 species, 14%) and Sphingidae (10 species, 13%)

Finally it should be noted that other caterpillar families furnish edible species, as indicated in papers dealing with Central America (ALDASORO MAYA, 2003, RAMOS ELORDUY, 1991); for instance consumption of caterpillars of Castniidae, Ceratocampidae, Hepialidae, Megathymidae, Nycteolidae and Pyralidae have been observed!

CHEMICAL COMPOSITION

Some twenty two papers present original results dealing with chemical composition of edible caterpillars from Africa (CHINN, 1945, TIHON, 1946, ADRIAENS, 1951, DARTEVELLE, 1951, ADRIAENS, 1953, NUNES, 1960, PAULIAN, 1963, MALAISSE *et al.*, 1969, HEYMANS & EVRARD, 1970, LECLERC *et al.*, 1976, SANTOS OLIVEIRA *et al.*, 1976, MALAISSE & PARENT, 1980, DREYER & WEHMEYER, 1982, KODONDI *et al.* 1987a, ASHIRU 1988, SEKHWELA 1989, MBEMBA & REMACHE 1992, MOTSHEGWE *et al.*, 1998, GLEW *et al.*, 1999). One study deals in particular with proteins (LANDRY *et al,*. 1986), two with lipids (LANDRY *et al,*. 1986, ZINGOMBE & GEORGE, 1994) and even one with vitamins (KODONDI *et al.*, 1987b).

Table IV. Composition of edible caterpillars of Tropical Africa (values per 100 g dry matter).
Composition globale de chenilles comestibles d'Afrique tropicale (valeurs pour 100 g de matière sèche).

	Attacidae	Hesperidae	Limacodidae	Notodontidae
	N=20	N= 1	N= 1	N=6
Proteins (g)	(44,1) 63,7 +/- 10,4 (79,6)	51.2	69.6	(45,6) 53,7 +/- 5,4 (61,0)
Fats (g)	(8,1) 13,8 +/- 4,5 (21,5)	12.4	9.2	(10,1) 21,7 +/- 8,3 (26,0)
Carbohydrates (g)	(3,7) 13,8 +/- 9,2 (29,4)	15.6	12.7	(13,1) 18,4 +/- 7,0 (24,1)
Ashes (g)	(3,8) 6,7 +/- 2,6 (14,4)	11.6	8.5	(3,7) 5,3 +t- 1,4 (7,7)
Ca (mg)	(50) 148 +/- 124 (500)	220	1600	(20) 108 +/- 86 (200)
P (mg)	(500) 1099 +/- 680 (2300)	1160	900	(450) 710 +/- 445 (1500)
Fe (mg)	(10) 81 +/- 81 (300)		20	(10) 42 +/- 31 (80)
E.v. (Kcal)	(371) 449 +/- 36 (504)	348	397	(397) 463 +/- 49 (485)

E.v. = energetic value
(After Demesmaecker 1997, Malaisse 1997, 2003, Malaisse and Lognay 2003)

Table V.- Amino-acids composition of tropical African edible caterpillars (in % of proteins).
Composition en acides aminés de chenilles comestibles d'Afrique tropicale (en % des protéines)

amino acids	Attacidae			Notodontidae		
	N=14			N=1 to 3		
aspartic acid	(8.5)	8.8 +/- 0.4	(9.3)		0.6	
glutamic acid	(13.6)	14.5 +/- 0.8	(15.0)		0.4	
alanine	(4.0)	4.4 +/- 0.4	(4.7)		1.8	
arginine	(5.6)	6.2 +/- 0.6	(6.6)		0.3	
cystine	(1.3)	1.6 +/- 0.3	(2.0)			
glycine	(3.7)	3.8 +/- 0.2	(4.1)		1.4	
histidine	(1.7)	2,8 +/- 0.6	(3.4)	(0.8)	2.3 +/- 1.4	(3.4)
isoleucine	(2.4)	4.5 +/- 2.0	(10.9)	(2.2)	3.9 +/- 1.5	(4.9)
leucine	(3.7)	6,6 +/- 1.4	(9.1)	(1.3)	4.7 +/- 3.0	(6.7)
lysine	(3.9)	6.9 +/- 1.2	(9.1)	(0.9)	4.8 +/- 3.4	(6.8)
methionine	(1.1)	1.9 +/- 0.5	(2.4)			
(methionine + cystine)	(0.8)	1.5 +/- 0.5	(2.1)	(1.5)	2.2 +/- 0.9	(2.8)
phenylalanine	(1.7)	5.2 +/- 2.0	(6.5)		2.2	
(phenylalanine + tyrosine)	(8.9)	11.3 +/-2.0	(14.7)	(13.2)	14.2 +/-1.3	(15.1)
proline	(2.0)	2.1 +/- 0.1	(2.2)		1.9	
serine	(4.5)	4.7 +/- 0.2	(4.9)			
threonine	(3.9)	4.4 +/- 0.3	(5.1)	(0.4)	3.1 +/- 2.3	(4.5)
thryptophan	(0.7)	1.3 +/- 0.5	(1.7)			
tyrosine	(1.3)	5.5 +/- 3.0	(7.7)		2.5	
valine	(4.2)	6.6 +/- 2.0	(102)	(1.8)	4.4 +/- 2.2	(5.7)

(After Ashiru 1988, Demesmaecker 1997, Kodondi *et al.* 1987b, Santos Oliveira *et al.* 1976)

Table VI- Lipids composition of tropical African edible caterpillars (in % of total fatty acids).
Composition en lipides de chenilles comestibles d'Afrique tropicale (en % des acides gras totaux).

fatty acids		Attacidae	Notodontidae
		N=12	N=1 to 2
lauric acid	C12:0	(0.10) 0.17 +/- 0.06 (0.20)	
myristic acid	C14:0	(0.10) 0.56 +/- 0.61 (2.30)	0.90
pentadecanoic acid	C15:0	(0.10) 0.23 +/- 0.12 (0.50)	0.20
palmitic acid	C16:0	(8.74) 21.47 +/-5.53 (28.45)	(11.61) 20.86 (30.10)
palmitoleic acid	C16:1	(0.10) 0.39 +/- 0.21 (0.87)	1.00
margaric acid	C17:0	(0.11) 3.70 +/- 9.14 (29.70)	(1.37) 1.44 (1.50)
stearic acid	C18:0	(1.00) 18.99 +/- 7.46 (33.42)	(5.40) 12.42 (19.44)
oleic acid	C18:1	(1.70) 5.83 +/- 3.61 (8.40)	
	C18:1 cis-9	(4.85) 9.36 +/- 2.63 (12.90)	(8.37) 9.14 (9.90)
	C18:1 isom.*	(0.23) 0.32 +/- 0.07 (0.42)	0.10
linoleic acid	C18:2	(4.40) 9.15 +/- 6.11 (27.20)	(6.10) 8.71 (11.31)
linolenic acid	C18-3	(2.80) 34.14 +/-10.78 (45.12)	(41.70) 41.72 (41.73)
arachidic acid	C20:0	(0.20) 1.51 +/- 2.43 (7.50)	(0.12) 0.79 (1.46)
eicosadienoic acid	C20:2	(0.10) 0.25 +/- 0.21 (0.40)	
other fatty acids		(1.15) 2.43 +/- 1.15 (4.35)	(4.08) 4.40 (4.71)

* position isomere of dubble link

Table VII- Vitamins composition of tropical African edible caterpillars (values for 100 g of caterp i l l ar)
Composition en vitamines de chenilles comestibles d'Afrique tropicale (valeurs pour 100 g de chenille).

vitamine		Attacidae	Hesperidae
		N=3	N=1
folic acid	pg	(6.3) 21.1 +/- 15.4 (37.0)	
nicotonic acid	mg		22.7
pantothenic acid	mg	(7.3) 8.8 +/- 1.5 (10.2)	3.8
biotin	ltg	(23.0) 32.7 +/- 11.2 (45.0)	92.0
cholecalciferol	pg	22.2 (N=1)	
cyanocobalamin	pg		6.0
niacin	mg	(9.4) 10.4 +/- 0.9 (11.0)	
pyridoxin	pg	(50.0) 90.0 +/- 45.8 (140.0)	252.0
Retinol	ltg	(30.0) 35.0 +/- 7.8 (44.0)	
Beta-carotene	ltg	(6.3) 6.8 +/- 0.7 (7.6)	
Riboflavin	mg	(3.2) 4.1 +/- 1.0 (5.1)	3.4
thiamin	mg	(0.2) 0.2 +/- 0.1 (0.3)	0.6
alpha-tocopherol	mg		51.0

Surprisingly, a recent synthesis (VANDYCK, 2000) is unaware of those results, whilst dealing with nutritional values of insects! Tables 4 to 7 present syntheses, according to families involved, of the main data published. Some noticeable différences sometimes appear according to families.

In conclusion, for several tropical African peoples, campeophagy, namely the supply of caterpillar's food, is crucial; it should be encouraged and even included and developed in sustainable management projects.

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