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Research Article

VALORIZATION OF THE FLOURS OF THE EDIBLE CATERPILLARS (IMBRASIATRUNCATA) IN THE TECHNOLOGICAL APPLICATION OF MANUFACTURE OF THE LOCAL BREADS AND COOKIES

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A B S T R A C T

To design foodstuffs containing the flour of manioc (ManihotEsculentaCrantz) and that of corn by incorporation with varied percentages of the flour of the caterpillars (ImbrasiaTruncata), to correct some natural imbalances of the proportions in nutrient; at end to obtain food more balanced in cookie factory and panification.

The bought caterpillars are dehydrated to 70 °C then incinerated with the drying oven with 550 °C. The dry matters of these caterpillars obtained were analyzed by using the methods of Kjeldal for proteins, and Folch for the lipids, and spectrophotometry of atomic absorption for the biogenic salts in ashes. The results obtained show important protein rates and respectively evaluated total lipids with 67,50 and 18,42%. They reveal moreover, the presence in considerable quantity of all the essential amino-acids of which the aromatic thréonine, tryptophan and amino-acids. Lipids, rich in polyinsaturés fatty-acids (linoleic acid C18: 2 ω 6 8,67% and acid α-linoleic C18: 3 ω 3 42,63%). Minerals like calcium salts (184 Mg); of phosphorus (621 Mg); of magnesium (383 Mg) or potassium (1533 Mg) in the same way were highlighted. The results obtained show that the caterpillars of Imbrasiatruncata are an important source in micronutriments likely to contribute to the satisfying development of the human organism, of which the energy value estimated at 1804,57 KJ for 100 G of dry matter. For this work, to incorporate in flour of manioc (ManihotEsculentaCrantz), soft variety, cultivar, with values like 5,30% ±1,8 out of protein; 39% ± 0,24 out of calcium (Ca); 270% ± 0,35 out of potassium (K); 0,4% ± 0,15 out of sodium (Na); 40% ± 1,7 out of magnesium (Mg). Without forgetting the water content (15,5% ± 1,8); the lipids (0,15% ± 0,22); ash content (50,66% ± 0,32); reducing sugar (1,92% ± 0,22) and its pH is of 6 ± 0,2. And with the flour of corn, the contents of proteins of the breads are homogeneous, being around 9,3 g/100 G, except for the rye bread (8,3 g/100 G) (it is the same for the flours, the contents being enters and 11 g/100 G and 12 g/100 G, a little less for the rye flour: 9,1 g/100 G). Indeed, according to (Simarre, 2008) Jean-Marie Bourre1, AlexandreBégat *et al*., 2008; some breads can assert the allegation for the vitamins B3 (PP niacine), or B6 (pyridoxin), or, B9 (folates). The other vitamins take part in food balance. Among minerals, is distinguished iron (20%); manganese is completely appreciable, since, all the breads are; phosphorus (34%); zinc (10%), potassium is present in notable quantities. Only the whole wheat bread is source of magnesium.

The union of the caterpillars in the form of powder to local food low in nutritive sources in order to exceed the cultural importances, allows the creation of the various food important source in micronutriments and could contribute in a significant way to the reduction of the hunger, the fight against the food insecurity and malnutrition protéino-energetics in Congo-Brazzaville and even in Africa.

INTRODUCTION

Among the solutions suggested by FAO with the question put the 16 November 18th, 2014 in Rome "How to nourish the world in 2050 to fight against the famine future in countries under developed? ". The answer to this question is the valorization of the various natural resources out of proteins, fatty-acids essence, minerals and others. A world population growth of 9 Billion inhabitant from here 2050 and the agricultural reduction of spaces, is known as the causes. The scientists pay an attention increased to the role of the

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insects in the traditional food of the tropical areas. The insects have an important place in the food tradition of the populations in tropical medium where the climate and the environment support their number and diversity of the species. However certain insects are rich in unsaturated fatty-acids that our organization is unable to synthesize by itself (high percentage of linoleic acid of the African termites) and others still rich in alpha-linoleic acids like various caterpillars (Imbrasiaertli and Gonimbrasiabelina in particular).The insects, rich in proteins and container of iron and the vitamin has, could thus constitute a solution with nutritional deficiencies evoked here before. The recourse to this food behavior should be encouraged and should not constitute an insurmountable obstacle, more especially as more than 2 billion people insects consume traditionally according to FAO (2013). In Republic of Congo, very few studies was devoted to this subject except work Paulian (1963), Nkouka (1987) and MBani (1993, 1995).In Congo, the consumption of caterpillars revêt for a very long time a great seasonal importance as attests it some work (Paulian, 1963; Nkouka, 1987; Outlaw, 1995; Dzono, 2002; Foamed, 2004; Mabossy-Mobouna and Al, 2013. Among the many species of caterpillars sold and consumed in Congo, the species Imbrasiatruncata most important and qualitatively is sold. ImbrasiatruncataAurivillius, of the family of Saturniidae is a lépidoptère which was described in 1908 by Aurivillius the holotype was collected in Republic of Cameroun. Imbrasiapumila (Herdsman, 1926) is a synonym (Bouyer, 1999)). According to work of professor Therese KINKELA and Al. , 2017 in the nutritional valorization of the caterpillars (imbrasia), we seek to break the interdicts on the consumption of the caterpillars, the transforms in other forms (incorporation in the cookie factory, panification, of the faces) to facilitate its consumption and to grind the populations with her consumption to overcome the aforementioned famine of 2050. One is reminded that usually more than two billion people are deprived of minerals or vitamins and that nearly 30% of the natives under development are victims of malnutrition (ROUDART, 2016). Thus in Center and West Africa, 11% of the children of less than five years suffer from acute malnutrition (UNICEF, 2013). To consume caterpillars with the daily newspaper belongs to the objectives of this work, and to suggest approaches of solutions to the various problems of the food insecurity. For this made technological application (panification, the cookie factory) to facilitate its broad consumption. Work of Professor Therese KINKELA *et al*. 2017, called "nutritive Contributions of the caterpillars of Imbrasiatruncata consumed in Congo-Brazzaville" shows the nutritional interest of this caterpillar for the good performance of the human organism and the food safety of the countries of the under-area.

Table 1 Average composition of the samples of caterpillars dried of Imbrasiatruncata Source (Therese KINKELA and Al., 2017)

Composition of dried caterpillars	Content (%MB)
Moisture	9,9
Nitrogenize total	11,3
Proteins	70,63
Total lipids	15,22
Total ashes	2,75
Glucids	1,5
Energy value (raw material KJ/100g)	1804,57

Table 2 Composition in amino-acids of the caterpillars of Imbrasiatruncata

Source (Therese KINKELA *et al*., 2017)

Amino-acids	Imbrasiatruncata	
	g/100g MS	g/16g N
Asp	4,175±0,144	4,76±0,16
Thr	2,634±0,03	3,1±0,03
Ser	2,667±0,06	3,05±0,07
Glu	5,526±0,15	6,32±0,16
Pro	3,055±0,07	3,50±0,08
Gly	2,342±0,05	2,68±0,06
Ala	2,314±0,03	2,65±0,04
Val	2,440±0,06	2,79±0,07
Met	0,871±0,01	1,0±0,014
Ile	2,107±0,002	2,41
Leu	2,875±0,05	3,33±0,06
Tyr	3,793±0,023	4,34±0,02
Phe	2,738	3,13
His	1,839±0,023	2,10±0,03
Lys	2,992±0,124	3,42±0,14
Arg	2,551±0,003	2,92±0,007
Trp	0,962	1,10
Total	45,88±0,8	52,45±0,91

Table 3 Composition in fatty-acids of the samples of caterpillars of Imbrasiatruncata (in % of mass of the fat contents) and iodine indices. Source (Therese KINKELA and Al., 2017)

Fatty-acids	Mass molecular ions (EMAG)	Imbrasiatruncata
C14 : 0	242	0,31
C15 : 0	256	Nd
C15 :1	254	0,3
C16 : 0	270	20,63± 0,71
C16 :1	268	0,33±0,014
C17 : 0	284	1,17±0,0056
C17 : 1	282	Nd
C18 :0	298	16,44±0,13
C18 : 1 n-9	296	7,68±0,03
C18 : 2 n-6	294	8,67±0,1
C18 : 3 n-3	292	42,63±0,33
C20 : 0	326	0,33
C20 : 1	324	Nd
C20 : 4 n-6	318	0,32±0,007
Saturated		38,72±0,2
Monounsaturates		8,31±0,014
Polyunsaturates		51,63±0,24
Total		98,66±0,035
Others (not identified)		1,36±0,035
Report/ratio GƆ 6/GƆ 3		0,21
Ratio GƆ3/GƆ 6		4,91
Iodine index (calculated)		134,453

Nd =non detected; EMAG= methyl esters of fatty-acids

Table 4 Content of rock salt and nitrogen. Source (Therese KINKELA *et al*.…, 2017)

Rock salt and nitrogenizes	Unit	Caterpillars of Imbrasiatruncata
CaO	%MB	0,184±0,0056
P_2O_5	%MB	0,621±0,0014
MgO	%MB	0,383±0,0021
Nkgel	%MB	11,289±0,015
K_2O	%MB	1,538±0,055
Na_2O	%MB	0,028±0,0014
Cd	mg/kg MB	< 0,01
Cu	mg/kg MB	12,8±0,42
Ni	mg/kg MB	1,22±0,2
Pb	mg/kg MB	< 0,01
Zn	mg/kg MB	135,65±12,37
Hg	mg/kg MB	0,005±0,002
Cr	mg/kg MB	0,28±0,014
As	mg/kg MB	< 0,04±0,04

The caterpillars of Imbrasiatruncata constitutes an important source of proteins of animal origin (70,63%). The comparison between this rate and that of other consumed caterpillars, the fish or the meat show that the caterpillars of Imbrasiatruncata have a content of proteins similar to that of the caterpillars of Imbrasia will obscura (Saturniidae), of Imbrasiaepimethea (Saturniidae) and Hadrapheethiopica (Limacodidae). They are richer in proteins than the caterpillars of Bunaeopsisaurantiaca (Saturniidae) (49%), of Antheuainsignata (Notodontidae) (61%) and of Imbrasiaoyemensis (Saturniidae) (57,77%), beef (18,2%) and the fish fresh (18,3%) or dried and salted (47,3%). In the same way, contents of proteins of the larvae of Rhynchophorusphoenicis (Curculionidae) (21,21%) and Oryctes rhinoceros (Scarabeidae) (42,66%) obtained by Lenga and Al (2012) like that of caterpillars of Cirinaforda (Saturniidae) (51,43 to 52,39%) obtained by Badanaro and Al (2014) are lower than that of the caterpillars of Imbrasiatruncata. This protein rate is in agreement with that of the FAO (2004) which had noted a strong proteinic content at the caterpillars thus supporting their incorporation in the flours low in proteins in order to fight against infantile malnutrition. Ashes resulting from the incineration of the caterpillars of Imbrasiatruncata made it possible to quantify by order ascending Potassium (K), Magnesium (Mg), Phosphorus (P), Calcium (Ca) and Sodium (Na). These results are different from those obtained by APkossan and Al (2014) on the caterpillars of Imbrasiaoyemensis. On the other hand, the Ca/P report/ratio is much lower than 1 and involves a weak absorption of calcium. The sodium ratio/potassium lower than 1 is favorable to the good performance of the organization.

MATERIAL AND METHODOLOGY

Biological Material

Cater$pillars of Imbrasiatruncata bought in the department of Likouala in the North of Congo, with dated August 3rd, 2017 brought back by plane to Brazzaville.

Photograph 1 Caterpillars of Imbrasiatruncata collected at Impfondo, August 2017

FINKE (2004) announces many results of analysis of chemical composition of insects.

It does not specify the source of the taken again results. Among those appear of the results of analysis concerning the caterpillar of Imbrasiatruncata.

We mention these data below. They relate to the total composition of fume and dried caterpillars, namely dry weight in % of the fresh weight: 7,0; proteins (value in G for 100 G of dry weight = NR X 6,25): 61,1; lipids (value in G for 100 G of dry weight): 16,4; ashes (value in G for 100 G of dry weight): 4,0. For rock salt (out of Mg per kg), the author announces Ca: 1.320, P: 8.420, Mg: 1.920, K: 13.490, Cl: 1.830, Zn: 87, Cu: 111, mn: 14: 32; for the vitamins, vitamin has (µgrétinol/kg): 330; ß-carotene (µg/kg): 71; thiamin (mg/kg): 2,9; riboflavin (mg/kg): 55,0; niacine (mg/kg): 118; pyridoxin (mg/kg): 0,4; folate (mg/kg): 0,4; biotine (mg/kg): 0,5; vitamin B12 (µg/kg): 0,3; finally for the lipidic contents and the major fatty-acids, a percentage of lipids of 16,4, namely myristic acid (14: 0): 0,03; palmitic acid (16: 0): 4,03; palmitoleic acid (16: 1): 0,03; stearic acid (18: 0): 3,56; acid oleic (18: 1): 1,21; linoleic acid (18: 2): 1,25; linolenic acid (18: 3): 6,04.

METHODS

Water and the ash contents of the flour of caterpillar were given according to method AOAC (1995).

Calcium was proportioned according to the colorimetric method of Gindler and King (1972) using the thymol blue.

Sodium and potassium were proportioned by the method of the Photometry of flame according to the technique of Pinta (1954). The phosphates were proportioned according to the method of Briggs (1922).

Total sugars were extracted according to the method of Martinez and Al (2000) and were proportioned according to the method of Dubois and Al (1956) using phenol and of the concentrated sulphuric acid.

Reducing sugars were proportioned according to the method of Bernfeld (1955) using the salicylic acid -3,5-dinitro (DNS). The rough proteins were proportioned according to the method of BIPEA (1976) using Kjeldhal. The water content was given according to the method described by the International union of Pure Chemistry Applied (UICPA, 1979). The content glucids was obtained by the following relation: % Glucids =100 - (% moisture + % lipids + % proteins + % total ashes). The acid value and acidity were given according to method AOCS Ca 5-40 normalizes ISO 9001. The iodine index was estimated according to method NF ISO 3961 (February 1990) with the standard ISO 9001. The index of saponification was given according to the Method AOCS-Ca-2b-38 T60-2 with standard ISO-9001. The peroxide index was given according to Method AOCS Cd-8-53/1960 with the standard ISO 9001. (AOAC, 1995).

Selection of the Sites

The choice of the sites to carry out the investigations with Brazzaville was carried out by taking account of the sociological reality of the city. Brazzaville extends on more than 15 km and account nine districts:

- Southern Brazzaville (districts I, II and VII) gathering the populations resulting as a majority from the south of the country.
- Brazzaville centers (districts III and IV) with cosmopolitan populations.
- Northern Brazzaville (districts V and VI) whose populations emanate as a northern majority of the areas.

The sites selected were the coach station of the Total market for Southern Brazzaville, the coach station of Nkombo and the river port of Yoro for the populations of Northern Brazzaville. The main markets, by district, are:

- District I: Sachet, Bifouiti, km No, Bouro
- District II: Total,

- District III: market of yoro, Station statement, Plate.
- District IV: market of Moungali, 10 franc
- District V: market of Ouénzé, Texaco, Soukissa.
- District VI: Market of Talang

RESULTS AND DISCUSSION

Inquire of consumption

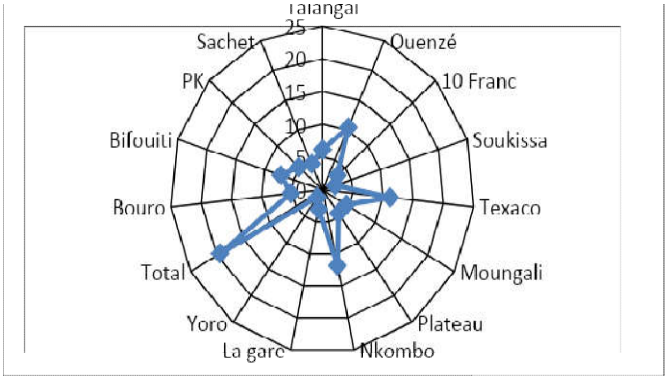

Figure 1 Rate of consumption of the caterpillars of Imbrasiatruncata by markets of Brazzaville. (normalized Radar-stud of the markets)

Figure 1 shows the highest rates of consumption which one respectively finds on the markets of: total (arr 1); Nkombo (arr 7); Texaco (arr 5); Ouenzé (arr 5); bifouiti (arr 1) and Talangai (arr 6). The rates low are observed on the markets of: Yoro (arr 5); Soukissa (5); 10 franc (arr 4); and parks it (arr 3). The studies of DZONO (2002) and of FOAMED (2002, 2004) showed that the caterpillars are consumed by Lari, Téké and Mbochi. This explains the Southern markets of Brazzaville reiterated. The rate of consumption not being too high compared to the other countries of central Africa, it thus appears recommended to carry out the popularization of the nutritive virtues of these caterpillars by the organization of the broadcasts broadcast and television in order to lead most of the population to consume these caterpillars.

Analyzes Physicochemical

Physicochemical characterization: Table 7 represents the average composition of the samples of dried caterpillars. It is deduced from this table that the caterpillars of Imbrasiatruncata are very rich in proteins with an average content 67,50%. They are also rich in fat contents (18,42%) and fairly low in carbohydrates (5,86%). These caterpillars contain rock salt 2,83%. The energy value of the caterpillars of Imbrasiatruncata obtained is of 1804,57 kJ for 100 G of matter dries is 431,7 kcal. These results are close to the results of the publication of Therese KINKELA *et al*…., 2017 . The fat contents extracted the flour of the caterpillar ImbrasiaTruncata are of very dark brown color, semi solid with the room temperature and fluid with 70 °C. This grease presents an acid value of 57,23 ± 0,11 Mg of fat contents KOH/g. The index of saponification is of 151,79 ± 1,28 Mg of KOH/g of fat contents and the rate of insaponifiables of 0,93% ± 0,001. The indices of peroxide of the fat contents of the caterpillar ImbrasiaTruncata is and 11 ± 0,03meq of fat contents oxygène/kg.

Table 5 Composition of the samples of caterpillars dried of Imbrasia truncate

Parameters	Content of chemical elements of the flour of the caterpillar (%)
Moisture	5,39
Nitrogenize total	10,8
Proteins	67,50
Total lipids	18,42
Total ashes	2,83
Calcium	1,92
Iron	2,61
Phosphorus	40,13
Glucids	5,86
Energy value (raw material KJ/100g)	1804,57

The caterpillars of Imbrasiatruncuta contain very low contents of heavy metals, except for copper and of zinc. They are thus not toxic. These caterpillars are very rich in zinc (content higher than 100 mg/kg MB). The content of copper is approximately 13 mg/kg MB. Analyzed ashes have a nutritional positive ratio potassium/sodium and very weak a calcium ratio/phosphorus. Cadmium, lead and arsenic are present at the state of traces (< 0,04), not poisons for the human organism according to Table 4: Content of rock salt and nitrogen (Therese KINKELA *et al*…., 2017).

Table 6 Output of extraction (matter g/100g) and water content of the fat contents

Parameters	Content of extracted elements
Fat contents rate (g/1 00g of matter)	18,42
Water content (%)	0,09
Degreased dry matter rate (%)	81,49

Table 7 Physicochemical characteristics of the fat contents resulting from the flour of the caterpillar ImbrasiaTruncata

Physicochemical characteristics	Values of the parameters
Color	brown very dark
Aspect	semi solid
Temperature of solubility (°C)	70°C
Acid value (Mg of KOH/G of fat contents)	57,23
Index of saponification (Mg of fat contents KOH/g)	151
Rate of insaponifiables (%)	0,93
Peroxide index (meq of fat contents oxygène/kg)	11

Some local names

Table 8 Some names

Scientific names	Physical characteristics	Local names		
		Isongo (Likouala)	Lari (Pool)	Bomitaba (Likouala)
ImbrasiaOyemensis	Carry prickles red color on a mosaic body of yellow black	Mboyo	Bikélé	Mbandjéndjé
Imbrasiatruncata	Carry small white spots on its black body	Mbambanga	Bimbami	Mpaka
Imbrasiaertli Rebel (epimethea)	Carry a white train on the dorsal column and some hairs	Koulouka	Mihouka	Mbolé

Inquire of identification with Impfondo, Brazzaville/ Bintsangou Roger Mr. in 2017

Incorporation

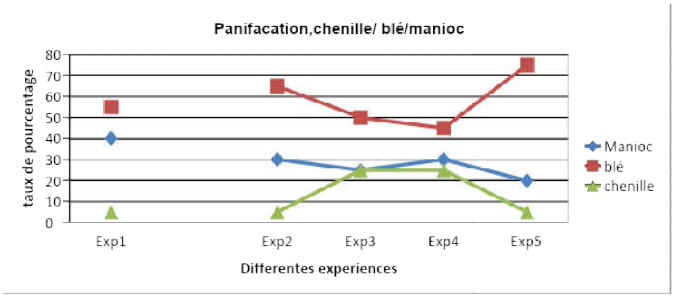

Figure 2 % of incorporation of flour of Imbrasiatruncata in panification

Experiment 3 and 4, show the rate of incorporation to 25% and bring to the end product a value raised out of minerals (0,71%), out of protein (16,875%), in fatty-acids (4,605%), out of Iron (0,6525%), out of Calcium (0,48%), out of Phosphorus (10,0325%), Glucid (1,465%) and energy (451,1425 KJ). The contribution of the flour of the caterpillars ImbrasiaTruncata in the various components of panification changes the report/ratio into nutrient and nutritional value that the practice. The contents of proteins of the breads are homogeneous, being around 9,3 g/100 G, except for the rye bread (8,3 g/100 G) (it is the same for the flours, the contents being enters and 11 g/100 G and 12 g/100 G, a little less for the rye flour: 9,1 g/100 G). According to the legislation in force, many breads can be quali fi are "without greases" (less than 0,5 g/100 G; breads: currents T55, T65, T65 tradition, with the flour T80), others are low in greases (less than 3 g/100 G; breads: with the leaven, biological, of countryside, of rye, with the sound). Among the vitamins of the group B, and taking into account the recommendations of consumption for the man, are distinguished some of them. Indeed, some breads can assert the allegation "source of", for the vitamins B3 (PP niacine), or B6 (pyridoxin), or, B9 (folates). The other vitamins take part in food balance. Among minerals, is distinguished iron (20%); manganese is completely appreciable, since, all the breads are "source"; phosphorus (34%); zinc (10%), potassium is present in notable quantities. Only the wholewheat bread is source of magnesium. (Simarre, 2008) Jean-Marie Bourre1, AlexandreBégat *et al*., 2008.

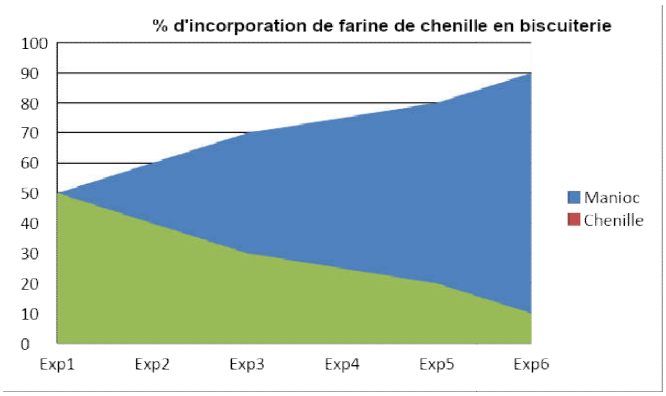

Figure 3 % of incorporation of flour of Imbrasiatruncata in cookie factory

Experiment 1, watch a rate of incorporation to 50% of flour of ImbrasiaTruncata in cookie factory; that is to say an important contribution: rock salt (1,415%), out of protein (33,75%), fatty-acid (9,21%), Calcium (0,96%), Iron (1,305%), Phosphorus (20,065%), Glucid (2,93%) and energy (902,285%). The cookies are rich in nutrient and readjust the nutritional values for a good contribution in the organization. The flour of the caterpillars mixed with the flour of manioc, gives a compound balanced for the human ration.

DISCUSSION

The flour of the caterpillar ImbrasiaTruncata constitutes an important source of proteins (67,50%), fat contents (18,42%) and rock salt. This result is in agreement with that of the FAO (2004) which had noted a strong proteinic content at the caterpillars, thus supporting their incorporation in the flours low in protein in order to fight against infantile malnutrition. However, this quantity of proteins of the caterpillar ImbrasiaTruncata dried is higher than that of the caterpillar Cyri-butyrospermivuillet (63%) consumed in Burkina Faso (Anonymous, 2004)). It is higher than that of salted dried ox (55,4%) and of dried fish (47%) (Anonymous, 2004). Ashes resulting from the incineration of the flour of caterpillar made it possible to quantify some mineral substances (calcium, phosphates, sodium and potassium) essential to the organization. These contents make it possible to confirm that the caterpillars bring to the populations which consume them a sufficient quantity of rock salt (2,83%). Calcium, the phosphates, sodium and potassium intervene in the organization by strengthening the bones of the adults, playing the part of bioactivator and osmotic balance in the cellular metabolism. They support also the growth of the children (Schapira, 1981). The rates of rock salt given in this study are similar to those found by Ramos-Elorduy (1998) at various caterpillars of the Euschistus species. The content of fat contents of the caterpillar ImbrasiaTruncata (18,42%) represents approximately 3 times the content of that of the caterpillar of Hadrapheethiopica (Malayan & Parent, 1980). The chemical properties of the grease of the caterpillar ImbrasiaTruncata analyzed, reveals that the acid value which makes it possible to appreciate the degree of deterioration of the fat contents is high (57,23 Mg of fat contents KOH/g). What makes it possible to affirm that these fat contents contain enough free fatty-acids. It would be thus in process of deterioration (Audigié and Al 1986). Consequently, this grease would be likely with rancidity. Indeed, the free fatty-acids under the effect of atmospheric oxygen cause the rancidity of the fat contents. Moreover, this value is higher than the limiting value recommended for food fat contents by the Alimentarius Codex, (1992) which is of 4. The fat contents of the caterpillar would thus have started its deterioration.

This result could be explained by the fact why the hydrolysis of the bonds esters would be already started. That could be due to the conditions of harvest, conservation, manuring and sale of the caterpillars. Indeed, these caterpillars dried exposed on the stalls without protection no or are locked up in jute bags. The index of saponification obtained (151 Mg of fat contents KOH/g) is lower than that of the oil of Macrotermessubhyalinus (193,40 ± 0,31) observed by Ekpo and Onigbinde, 2007).The grease of the caterpillar ImbrasiaTruncata could be used in the manufacture of the soap like certain animal greasy substances such as the Herring fat contents (FAO, 1975). The insaponifiables (0,93%), composed of bio-active substances including/understanding carbohydrates, tocopherols, sterols, and terpenic alcohols are present in negligible quantities in this grease. The peroxide index of the fat contents of this caterpillar (11 meq of oxygène/kg) is high, which justifies a possible oxidation of this

one. Consequently, it would not be nutritional good quality because the oxidation of the essential fatty-acids causes a reduction in the nutritional value of the fat contents (Asiedu, 1991).

CONCLUSION

It comes out from this work that, with collective efforts we will reduce the rate of famine in our countries and the world. By the valorization of our local products several solutions will be born concerning the food crisis announced by the researchers and FAO from here 2050, which had by world overpopulation to 9 billion inhabitant. The caterpillars of Imbrasiatruncata thus constitute an important source in micronutriments and could contribute in a significant way to the reduction of the hunger, the fight against the food insecurity and malnutrition protéino-energetics in Congo-Brazzaville even in Africa.

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