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Entomofauna of sweet pepper (*Capsicum annuum* L.) in Menoua division, Western Cameroon

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Abstract
Pepper production in Cameroon faces many constraints, including arthropods, which occupy one of the most important places. This study was conducted with the aim of gathering information on the entomofauna of peppers for better decision-making on control methods. To achieve this, an inventory of arthropods in 4 localities in the Menoua pepper production basins was carried out on the "Simbad, "Tibesti" and "Ylusse" varieties. Insects captured weekly using an entomological net and a mouth aspirator were identified in the Agricultural Zoology Laboratory at the University of Dschang. The results showed that insects associated to peppers varied in number and diversity from one locality to another. A total of 4003 Insecta and Arachnida were captured. The Insecta class has 9 orders (Coleoptera, Diptera, Hemiptera, Hymenoptera, Thysanoptera, Lepidoptera, Odonata, and Orthoptera) of 85 families. The Order of the Hemiptera is the most representative in terms of individuals (1627) and that of the Diptera the most representative in number of families (27). Pearson's X-squared test shows a significant dependence between different orders of arthropods and the 3 varieties of peppers. The "Simbad" variety proved to be the most sensitive with 48.31%. Although most of these insects are pepper pests, there have been some pollinators, predators and parasitoids. The data collected provide a preliminary basis for any biological or integrated pest management against *Capsicum annuum* pests in Menoua-Cameroon.

Keywords: Entomofauna, *Capsicum annuum*, insecta, pest, auxiliary

Introduction
Market gardening is one of the most productive agricultural systems in Africa (FAO, 2012) [11]. It plays a key role in most nutrition and anti-poverty programmes. They contribute significantly to family incomes (Yolou, 2015) [28]. Pepper among vegetable crops is one of the most widely consumed vegetables in the world and in Africa. It is a vegetable fruit widely consumed throughout the world mainly as a spice. Pepper fruits are a source of vitamins (A, D, E, C, K, B2), protein, fat, carbohydrates, fibre and minerals (Ca, P, Fe). They are rich in potassium, flavonoids and cardiovascular antioxidants. This wealth helps in the prevention of many diseases such as cancer and cardiovascular disease (Wilcox *et al*., 2004) [26].

The increase in the urban population and the onset of the economic crisis have led to an unprecedented boom in market gardening activity in urban and periurban areas in Cameroon (Bopda, 2003) [2]. In the west region of the country, a predominantly agricultural region, there have been profound changes in recent decades as a result of the consequences of coffee sales (Fouepe, 2008) [13]. As part of the conversion of this coffee economy, the former producers of Arabica coffee have gradually converted into vegetable growers (Kaffo, 2005) [19]. For this purpose, crops such as potatoes, tomatoes, carrots, peppers have emerged (Tchékoté *et al*., 2018) [23]. The intensification of this activity goes hand in hand with a diversification of pests (Albert *et al*., 2003) [1], resistance to pesticides and formerly specialized insect species, have passed over several crops (Djiéto and Aléné, 2006) [9]. Pest arthropods often pose real problems for producers with damage (Diatte *et al*., 2016) [7]. In an effective control program, the preliminary step to successfully protecting this culture is knowledge of enemies (Chougourou *et al*., 2012) [4]. It is for this reason that this study proposes to invent the entomofauna of the sweet pepper fields in order to consider an effective and sustainable plant protection of this crop in Cameroon.

Materials and Methods

Collecting locations and history

The collections took place in 3 localities in the Nkong-Ni district (Tetop: 2050 m^2, 3 varieties, 10°11'70.2"E and 5°42'32.1"N; Zaah Seeh: 1244 m^2, 3 varieties, 10°10'76.5"E and 5°44'78.11'"N; Lepeh: 600 m^2, "Simbad" variety under cover, 10°05'08.9"E and 5°31'59.8"N) and a locality in the district of Dschang (Municipal Lake: 30 m^2, "Simbad" variety, 10°06'46.3"E and 5°44'96.8"N), Menoua Division, 1385 m. Amendments and Chemical were made indiscriminately to peppers by producers, except in Municipal Lake where the crop was organic.

Capture and conservation of arthropods

These activities took place over a period from February to March 2019. Arthropods associated to the cultivation of peppers were captured using an entomological net. Arthropods were randomly mowed on pepper plants in all plots. The arthropods that had fallen into the net were recovered using the mouth aspirator. The soft-bodied, unmoved individuals found on the plant's organs were recovered with the brush so as not to damage them. The larger ones were directly introduced into the 70% alcohol containing pillboxes. Catches were made in each plot once a week between 9 a.m. and 10 a.m. when the dew completely disappeared. The collected specimens were kept in 70% alcohol and taken to the laboratory for counting and identification.

Sorting and identifying arthropods

This stage took place from April to June 2019. The specimens captured and stored in 70% ethanol were taken to the Agricultural Zoology Laboratory at the University of Dschang. The arthropods were spread out for better observation on Motic brand binocular magnifying glass. The specimens were initially separated in order according to their morphological characteristics and counted. Using the identification keys of Delvare and Aberleng (1989) [5], Wolfgang and Werner (1992) [27] and the entomological collection of the Agricultural Zoology Laboratory at the University of Dschang, the families were determined. These specimens are kept in 70% ethanol at the Laboratory of Agricultural Zoology at the University of Dschang (LAZUDs).

Statistical analysis

All data collected was stored in Microsoft's Excel 2010 software. The Pearson's Chi-squared
Test was used to analyse the data.

Results

The arthropods caught between February and April 2019 in the pepper fields are numerous and diverse. A total of 4.003 arthropods were collected from the different pepper plots in the 4 localities surveyed. These arthropods belong to the Arachnida and the Insecta class. The "Simbad" variety proved to be the most sensitive with 48.31% (Table 1). Indeed, in Lepeh, only the “Simbad” variety is cultivated. In the localities of Zaah Seeh and Tetop, the 3 varieties of sweet pepper were cultivated. The Arachnida class is represented by one family. The insect class is made up of 9 orders, namely, Diptera, Coleoptera, Hemiptera, Lepidoptera, Orthoptera, Hymenoptera, Thysanoptera, Mantoptera and Odonata.

Table 1 shows that Hemiptera order is the most represented in individuals followed by the Order of Diptera. Pearson's X-squared test shows a very significant dependence between the different orders of arthropods and the different locations where the collections took place (p-value < $2.2e^{-16}$). Similarly, Pearson's X-squared test shows a very significant dependence between different orders of arthropods and the 3 varieties of sweet peppers (Table 2).

Table 1: Percentage of specimens of the various orders according to the 4 localities of collection

Localities	Nkong-Ni						Dschang		Total	
	Zaah Seeh		Tetop		Lepeh		Municipal Lake			
Orders	NI	%	NI	%	NI	%	NI	%	NI	%
Coleoptera	145	0.14	44	1.13	156	0.01	30	1.38	375	2.66
Diptera	668	10.26	275	2.55	437	14.76	73	0.09	1453	27.66
Hemiptera	450	9.99	240	0.33	856	11.68	81	0.13	1627	22.13
Hymenoptera	33	2.68	24	0.00	80	1.03	16	2.11	153	5.82
Lepidoptera	52	0.74	17	0.02	42	0.23	3	0.46	114	1.45
Orthoptera	1	1.35	4	0.13	11	0.43	2	0.32	18	2.23
Thysanoptera	0	6.80	0	2.94	65	14.64	0	1.00	65	25.38
Mantoptera	0	0.21	0	0.09	2	0.45	0	0.03	2	0.78
Odonata	1	0.03	0	0.09	1	0.01	0	0.03	2	0.16
Arachnida	111	6.55	29	0.03	44	5.07	10	0.00	194	11.65
Total	1 461	38.75	633	7.31	1 694	48.31	215	5.55	4 003	99.92

Pearson's Chi-squared test: X-squared = 348.58, df = 27, p-value < $2.2e^{-16}$;
NI=Number of Individuals

The nine orders include 85 families. The number of families varied in the different orders of insects. The order of the Diptera counts the largest number (27 families) followed by the order of Hymenoptera (19 families) and Hemiptera (15 families). The least represented orders are the Orthoptera (5 families), Mantoptera and the Odonata, who each have one family.

Table 2: Percentage of specimens of the various orders according to the 3 varieties of sweet peppers

Orders	Varieties			Total
	Simbad	Ylusse	Tibesti	
Coleoptera	0.18	0.24	0.22	0.64
Diptera	7.15	10.13	8.64	25.93
Hemiptera	6.44	6.23	11.06	23.73
Hymenoptera	0.27	2.92	0.29	3.48
Lepidoptera	1.61	1.65	18.07	21.32
Orthoptera	0.02	0.39	0.10	0.51
Thysanoptera	3.28	4.39	4.20	11.87
Mantoptera	0.10	0.14	0.13	0.37
Odonata	0.07	0.88	0.13	1.07
Arachnidae	1.52	9.47	0.08	11.08
Total	20.62	36.44	42.92	99.98

Pearson's Chi-squared test: X-squared = 208.63, df = 18, p-value < $2.2e^{-16}$

Order Hemiptera

The Order of the Hemiptera comprises 15 families (Table 3) present on the pepper in Dschang. The locality of Lepeh and Zaah seeh have the same number of families represented (12 families). The Miridae and Cydnidae families are present in Zaah seeh and are absent Lepeh and Lake. In addition, the Miridae, Psyllidae and Nepidae are absent only at the lake. The Issidae family is only seen at Lepeh. The largest family is the Aphididae followed by ciccadellidae and Aleyrodidae. The least represented families are those of the Issidae and the Cydnidae. There is a significant difference between the Aleyrodidae, Aphididae, Ciccadellidae and Pyrrochoridae families in Tetop.

Table 3: Percentage of specimens of the different families of Hemiptera order according to the 3 varieties of sweet peppers

Hemiptera	Varieties			Total
	Simbad	Ylusse	Tibesti	
Aleyrodidae	1.04	2.28	2.01	5.33
Aphididae	0.12	0.69	0.02	0.83
Beytilidae	0.65	7.34	0.28	8.27
Ciccadellidae	2.83	9.62	2.81	15.26
Ciccadidae	1.39	3.95	1.89	7.23
Cydnidae	0.53	0.93	1.27	2.73
Dinidoridae	0.47	2.21	0.19	2.87
Issidae	0.03	0.07	0.06	0.16
Miridae	0.32	2.21	0.01	2.54
Nepidae	0.12	0.80	0.00	0.92
Pentatomidae	1.65	3.69	3.12	8.46
Psyllidae	2.42	15.58	0.14	18.14
Pyrrochoridae	0.60	5.26	0.03	5.89
Tingidae	1.93	19.10	0.34	21.37
Total	14.1	73.73	12.17	100

Pearson's Chi-squared test: X-squared = 157.54, df = 26, p-value < $2.2e^{-16}$

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Order Diptera

The Diptera order consists of 27 families listed on the pepper in the Menoua (Table 4), not all families have been represented in the four localities. In the Nkong-Ni district, the towns of Zaah seeh and Lepeh have the same number of families (22). The families of Ulididae, Chloropidae, Dolichopotidae and Sciaridae are present only in Lepeh. The Athericidae family is only found in Zaah Seeh and the Otidae family is only in Tetop. The borough of Dschang has only 14 families. The most represented families are the Dosophilidae and the Hybotidae. There is a significant difference between the Cecidomyiidae, Drosophilidae and other families in Lepeh. There is a significant difference between the Drosophilidae family and all the families of the Diptera order in Zaah Seeh.

Table 4: Percentage of specimens of the different families of Diptera order according to the 3 varieties of sweet peppers

Diptera	Varieties	Ylusse	Tibesti	Total
	Simbad			
Agromyzidae	1.31	0.56	1.96	3.83
Athericidae	4.25	5.67	2.13	12.00
Apomyzidae	0.94	0.85	0.80	2.60
Asilidae	0.20	2.90	0.79	3.89
Bombyiidae	0.002	0.36	0.27	0.63
Calliphoridae	0.02	0.01	0.14	0.17
Cecidomyiidae	3.22	3.67	2.05	8.93
Chloropidae	1.35	1.21	1.15	3.71
Diopsidae	0.60	1.36	0.08	2.04

Dolichopidae	0.13	0.12	0.11	0.37
Drosophilidae	3.27	0.21	8.75	12.20
Hybotidae	0.02	1.08	0.64	1.75
Lauxaniidae	2.95^{-03}	2.91	3.44	6.35
Michiidae	1.22	0.65	1.61	3.47
Muscidae	1.48^{-05}	0.43	0.46	0.88
Mycetophilae	0.31	0.24	0.30	0.84
Otidae	3.77^{-02}	0.24	0.76	1.04
Phoridae	4.37	8.86	0.82	14.10
Psyllidae	5.93^{-02}	0.67	0.14	0.87
Scatophagidae	0.21	0.12	0.27	0.59
Sciaridae	0.27	0.24	0.23	0.74
Sciomyzidae	5.08	5.81	3.22	14.10
Syrphidae	3.75^{-04}	0.38	0.36	0.74
Tachninaire	2.88^{-03}	0.36	0.27	0.63
Tephritidae	0.17	0.11	0.20	0.49
Tilupidae	9.87^{-02}	0.01	0.25	0.35
Ulididae	0.94	0.85	0.80	2.60
Total	26.42	39.88	33.61	99.91

Pearson's Chi-squared test: X-squared = 154.37, df = 52, p-value = $4.397e^{-12}$

Order Lepidoptera

Seven families of the Order Lepidoptera are recorded on pepper in the Menoua (Table 5). The largest number of families is recorded in the Nkong-Ni district. The most represented family is that of the Gelichiidae followed by the Tineidae and the Tortricidae. The individuals of the Gelichiidae family are more numerous in Zaah Seeh and those of the Tineidae family are the most represented in Lepeh and absent in the other two localities. The town of Zaah Seeh has more individuals followed by Lepeh. In all localities there is no significant difference between families of the Lepidoptera order.

Table 5: Percentage of specimens of the different families of Lepidoptera order according to the 3 varieties of sweet peppers

Lepidoptera	Varieties	Ylusse	Tibesti	Total
	Simbad			
Gelichiidae	16.89	0.99	32.56	50.44
Noctuidae	2.55	0.39	3.08	6.02
Tortricidae	0.19	0.18	0.13	0.50
Pieridae	3.13	0.73	3.48	7.34
Tineidae	7.51	1.76	8.36	17.63
Saturniidae	3.41	5.39	1.67	10.47
Larves	0.89	2.82	3.89	7.59
Total	34.56	12.26	53.17	99.99

Pearson's Chi-squared test: X-squared = 50.514, df = 12, p-value = $1.135e^{-06}$

Order Hymenoptera

The Hymenoptera Order consists of 19 families (Table 6). The district of Nkong-Ni is home to the most insects. Lepeh is in first place with 17 families followed by Tetop with 10 families and Zaah seeh with 7 families. Apart from the family of Elasmidae and Tenthredinidae which can only be seen in Tetop, all the other families of the Hymenoptera inventoried are found in Lepeh. Cimbicidae, Chalcidae, Diprionidae and Beythilidae are present only in the locality of Lepeh. Of the 4 families found in the Municipal lake, the Formicidae has the highest number of individuals followed by Apidae and Braconidae. Apidae are more numerous in Zaah Seeh and Megalodontidae is much more numerous in Tetop. The town of municipal lake has the largest number of individuals with the smallest number of families. There was a significant difference between the Formicidae family and the other hymenoptera families in Lepeh. In Tetop, there was a significant difference between the Ichneumoida family and other families. There was no significant difference between the arthropod families identified in Zaah Seeh.

In sum, in the localities of Zaah Seeh and Tetop, the 3 varieties of sweet peppers were grown. The average percentage suggests that arthropods are more sensitive to the "Ylusse" variety. But these percentages would be strongly influenced by the coexistence in the same plot areas of different varieties. This is confirmed by the percentages obtained by localities where Lepeh, of "Simbad" variety was the highest. In addition, the pepper plots in our study area were dotted with banana, cassava and fruit trees.

Table 6: Percentage of specimens of the different families of Hymenoptera order according to the 3 varieties of sweet peppers

Hymenoptera	Varieties	Ylusse	Tibesti	Total
	Simbad			
Apidae	1.98	1.33	14.94	18.25
Braconidae	5.73	35.99	2.06	43.79
Beythilidae	0.16	0.17	0.40	0.73
Celiopidae	0.65	0.66	1.59	2.90
Chalcidae	0.49	0.50	1.19	2.18
Cimbicidae	0.08	0.08	0.20	0.36
Diaspriidae	0.08	0.08	0.20	0.36
Diprionidae	0.24	0.25	0.60	1.09
Eucharitidae	0.16	0.17	0.40	0.73
Elasmidae	0.07	0.58	0.01	0.67
Evaniidae	0.19	0.75	0.16	1.09
Formicidae	3.41	3.48	8.36	15.25
Ichneumoïdae	0.26	3.09	0.00	3.35
Megalodontidae	0.71	0.75	5.90	7.36
Phecidae	0.08	0.08	0.20	0.36
Sceliomidae	0.06	0.25	0.74	1.04
Vespidae	0.00	0.41	0.07	0.49
Total	14.35	48.62	37.02	99.99

Pearson's Chi-squared test: X-squared = 79.359, df = 32, p-value = $6.702e^{-06}$

Order Coleoptera

Carabeidae, Cerambycidae, Chrysomelidae, Cicimdellidae, Coccinelidae, Curculionidae, Grinidae, Lycidiidae, Passolidae, Tenebrionidae and Tineidae families were colleted belonging to Coleoptera order. Tenebrionidae family is the most abundant followed by Coccinelidae. Lycidiidae and Tineidae are the least represented. The locality of Dschang lodged more insects of the Coleoptera

order. Pearson X-squared test shows no dependence between different beetle families and the 3 varieties of sweet pepper (X-squared = 18.006, df = 20, p-value = 0.587).

Other orders present

Three families of the Orthoptera were collected during this study. These three families are present in Lepeh. The Acrididae are absent in Zaah Seeh and the Tettigoniidae also at the Municipal Lake. The Gryllidae are only present in Lepeh. 65 individuals of the Thysanoptera were captured in Lepeh. Identifications are still being made in the determination of the families to which they belong. Two individuals from the Dictyoptera-Mantidae were collected in Lepeh during our investigations. Two Odonata individuals were captured: one in Lepeh and another in Zaah Seeh. 194 individuals of the Arachnida were collected and are mainly nonspecific predators.

Discussion

1. Inventory of arthropods

The study of sweet pepper entomofauna in the Menoua Division revealed the presence of 85 families of nine orders of the Insecta class. The work of Djiéto *et al*. (2014) [10] indicates the same orders of the Insecta class in pepper plots in Yaounde. This diversity could be explained by the ecological conditions offered by peppers. Indeed, with its dense canopy, the pepper would create a microclimate that would be favorable to the swarming of many insects. The same findings were made by Kouonon *et al*. (2009) [21] on *Cucumis melo* in Cameroon and by Koné *et al*. (2018) [20] on zucchini in Côte d'Ivoire who found that the wider the leaves of the plant, the more numerous and varied the insects present. From the analyses of this study, it appears that the entomofauna of sweet pepper is largely dominated by the order of Hemiptera (Aphididae). Aphididae are low-moving sucking stingers that attach to the organs of plants in colonies to feed on sap. These results corroborate those of Chougourou *et al*. (2012) [4] in the Municipality of Djakotomey in Benin, Ghelamallah (2016) [16] in the Mostaganem region of northwestern Algeria and Fournier (2010) [14]. They argue that Aphididae are major plant pests worldwide with negative economic consequences for agriculture. The order of Diptera is the most represented in family number. This result is similar to those of Djiéto and Aléné (2002) [8] on the inventory of insects from market garden crops in Yaounde, Djiéto *et al*. (2014) [10] on insect pests of *C. annuum* in Yaounde and those of Dial *et al*. (2015) [6] on the incidence of fruit flies in Senegal. *Prodiplosis longifila* (Diptera-Cecidomyiidae) has been reported in pepper (*C. frutenscens*), sweet pepper (*C. annum*) and other companion plants in Colombia (Gagné and Jaschhof, 2014) [15]. This abundance could be explained by the need for fruit from Diptera larvae to complete their developmental cycle. Indeed, the period of this study corresponded to the flowering and fruiting phase of the pepper. *P. longifila* larvae consume leaf buds, flowers (ovaries and stamens) and small fruits of tomato plants, fruits of sweet pepper and flower buds of Tahiti lime (Hernandez *et al.*, 2015) [18]. In this study, the Gellichiidae family is the most represented of the Lepidoptera order. At the present state of our knowledge, this family has not yet been reported on pepper in Cameroon, it is found on tomato. It has also been reported in Senegal on the updating of the entomofauna of vegetable crops in Lower Casamance by Tendeng *et al*. (2017) [25]. This result would suggest that individuals in this family became polyphagous or would make pepper their secondary host. This is consistent with the results of Brévault *et al*. (2014) [3] which suggests that Gelichiidae are microlepidoptera with a preferred host to tomato, but also found on peppers.

In Hymenoptera order, the most represented family is that of the Formicidae. The work of Djiéto and Aléné (2006) [9] and Djiéto *et al*. (2014) [10] points to the strong presence of Formicidae on peppers, a presence correlated with the high number of Aphididae providing honeydew as food. The study of pepper entomofauna in various localities revealed that Lepeh was lodged to the most arthropods. Hemiptera order was the most represented in number of individuals. The Aphididae family has the highest number in the same locality. This result could be explained by the low mobility of the Aphididae that live attached to the organs of the plant. The cultivation in Lepeh being under cover, the slightly higher temperature inside the shelter, combined with the absence of precipitation and winds that would detach these insects from the organs of the host plant, would start from the explanations of this abundance. These results can also be explained by the fact that under shelter, this culture is continuous and fallow-free. Also, crop rotation does not take into account plant families, which would result in the permanence of host plants for these insect pests. The locality of Zaah Seeh was the second largest in terms of abundance of individuals. The Drosophilidae (Diptera) family was the most represented. This could be explained by the fact that Zaah Seeh producers harvested their peppers at a very advanced ripening stage. The presence of the Tephritidae in this locality could be justified by the fact that Zaah Seeh has been a market gardening perimeter for several years and is located in a swampy area. These elements would promote adaptation to new host plants known as relay host plants. But in Lepeh, agriculture is under cover and Tetop is farming for the first time. Heumou *et al*. (2015) [17] recorded Pyrallidae and Thephritidae in Cameroon on *C. annuum*. The Municipal Lake where there has been no application of chemicals is lodged to fewer families of insect pests and has more auxiliary families (Coccinelidae, Braconidae and Apidae), compared to Zaah Seeh and Lepeh where chemicals have been applied. Chemical destroy harmful and useful insects. Also, *Cymbopocom citratus* present around the plots would have an insect repellent effect on certain insects. The presence of Coccinellidae, natural enemies of the most important aphids, would reduce the populations of the latter. This last result corroborates Ferron's (1999) [12] work in Algeria, which argues that Coccinellidae are often present where aphids are found. Overall, the presence of useful insects shows that biological control is possible and promising in Cameroon.

2. Sensitivity of the 3 varieties of sweet pepper to the different arthropods

The "Simbad" variety was the most frequented by the various arthropods. This variety would be the most appetizing and attractive than the other two varieties. Indeed, the darker green variety 'Simbad' has larger and meatier fruits than 'Tibesti' and 'Ylusse', which would provide more desired foods. The fruits of "Simbad" are harvested red unlike the others that are harvested green. This would give arthropods more time to develop. This idea is consistent with the work of Mannan *et al*. (2003) [29]

which argues that the resistance or susceptibility of a plant may be due to biochemical characteristics such as chlorophyll, phenols and sugars. These results also show that, in addition to pests, many beneficial insects (pollinators, predators and parasitoids) coexist in pepper cultivation. Pollinating insects play a key role in productivity (Tchuenguem Fohouo *et al*., 2007) [24]. Auxiliary (predators and parasitoids) contribute to the decline in pest populations, reducing the need to intervene to control their development (Heumou *et al*., 2015) [17]. Insect pests cause several types of damage to leaves (perforations) and fruits (perforations, spots, premature fall and rot). Some insects are vectors of disease (Hemiptera). However, there are useful insects such as parasitoids, predators and pollinators.

Conclusion

This study provided an update on the biodiversity of arthropods associated to peppers in Dschang-Cameroon. The arthropods inventoried belong to two classes Insecta and Arachnida. The insect orders identified are Diptera, Hemiptera, Hymenoptera, Lepidoptera, Beetles, Orthoptera, Thysanoptera and Odonata. The "Simbad" variety proved to be the most attractive with 2829 individuals out of a total of 3907 individuals of the Insecta class. Nevertheless, in-depth studies are needed on the main species in order to adapt crop protection patterns to suit the pests and auxiliaries actually present during cultivation. The results obtained constitute a database in the knowledge of the various pests of pepper cultivation in the locality of Dschang in Cameroon.

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