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Twenty-Three Years of Insect Pollinator-Dependent Crop Studies in Agro-Ecological Zones of Cameroon (2011-2020)

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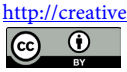

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Abstract

Cultivation of pollinator-dependent crops has expanded globally, increasing our reliance on insect pollination. This essential ecosystem service is provided by a wide range of managed and wild pollinators whose abundance and diversity are thought to be in decline, threatening sustainable food production. In Cameroon, several studies on pollinator-dependent crops carried out in different agro-ecological zones (AEZ) have been published in national and international journals, in order to present the importance and impact of flowering insects on fruit and seed yields of plant species. We proposed to produce a review article highlighting the different flowering insects and their importance for different plants according to AEZ, without however focusing on the quality of the journal (predator or non-predator) and how the different insects were identified (scientific names given in the publications). Thus, from 1997 to 2020, we collected 116 published papers from which only 26 were kept for this review. The results show that Hymenoptera, including the Apidae, followed by Megachilidae, are the most excellent pollinators of plant species in Cameroon, and they are present in different agro-ecological zones. The majority of publications focused on bees, particularly the honeybee *Apis mellifera*.

Keywords

Agro-Ecological Zones, Cameroon, Flowering Insects, Hymenoptera, Pollinators

1. Introduction

Entomophilic pollination is a key component of ecosystem functioning and is therefore an ecosystem service of global importance [1]. For most Angiosperm plant species, reproduction depends on pollination provided by a wide range of animal species, including insects, birds and mammals [2]. This type of pollination is characterised by the transport of pollen grains from the stamens to the stigmas of the pistil of flowering plants by insects. This process is an essential step in plant fertilisation. More than 200,000 species of flowering plants depend on pollination by more than 100,000 species of insects [3]. Pollination by flower-feeding insects is vital for maintaining biodiversity worldwide [4]. Pollinators, including bees, contribute efficiently to food security and nutrition, sustainable agriculture, the health of ecosystems and the environment, the preservation and enrichment of biological diversity and other aspects of sustainable development [5]. Cameroon is subdivided into five (05) major agro-ecological zones due to its geographical position and its diversity of soils and climates [6]. As a result, several studies on plant-insect interactions in different agro-ecological zones (Forest zone with monomodal rainfall, Forest zone bimodal rainfall forest, Western highlands, Guinean high savannah and Sahelo-Sudanian) have been published. This was done with a view to highlighting the importance and impact of flower visiting insects on fruit and seed yields [7] [8] in Cameroon. As the expansion of pollinator-dependent crops in certain regions of the world has been analyzed in the paper [9] [10], where pollination research is well documented with tremendous publications. However, in Africa in general and in Cameroon in particular, the field is still at its infancy with the first works in early 1990s and thereafter has rapidly grown the last 20 years. Thus, research has been carried out in all five agro-ecological zones in the country, with the greatest concentration of work in the High Guinean Savannah. The present work is a synthesis of scientific articles presenting the impact and/or contribution of pollinating insects on fruit and seed yields in agro-ecological zones of Cameroon. The aim of this work is to present the diversity of insect pollinators and the plants benefiting from them, without however focusing on the quality of the journal (predator or not) where the papers were published.

2. Methodology

To shed light on the dynamics of publications related to plant-insect pollinator interactions in Cameroon, various scientific articles were used. Due to the fact that there is no technical report published, our documentation criteria included all articles and books online or published before 25 October 2023. The articles were obtained through Scopus and Google Scholar. Our literature searches were done in English and French as both languages are the national languages in Cameroon, and publications as done in both. We also obtained some publications from the library of the Applied Apidology Unit of the Faculty of Science of

the University of Ngaoundéré in Cameroon.

The methodology adopted is summarised in Figure 1 below.

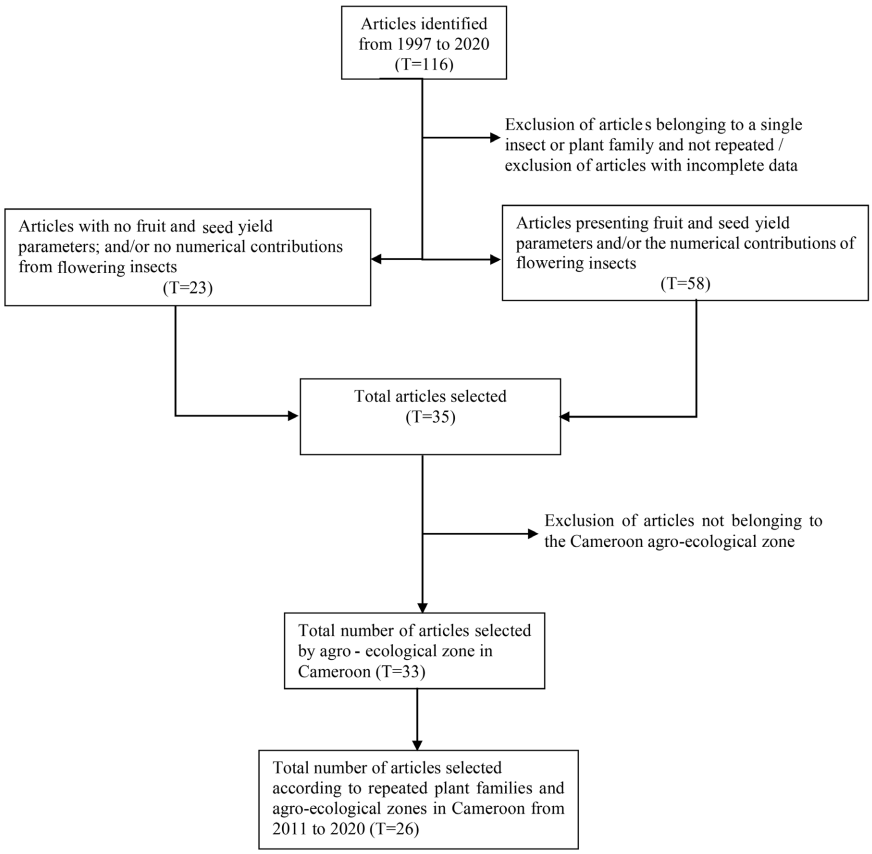

Figure 1. Selection method for scientific publications.

Our selection criteria are as follow: 1) repetition of the study over time (at least 2 years); 2) plant yields; 3) location of the work; 4) plant family repeated over time.

From 1997 to 2020, 116 scientific articles were selected, irrespective of the language of publication and the scientific journal. Subsequently, 33 articles were subtracted from this initial total, in particular those whose data had not been repeated over time. Then 23 articles that did not present parameters related to plant species yields were excluded; followed by 2 articles that did not belong to any agro-ecological zone in Cameroon and finally 7 articles that did not have repeated plant families and agro-ecological zones. In the end, based on the repeated plant families and agro-ecological zones of Cameroon, 26 publications were selected for the period from 2011 to 2020, and used for the present work. Figure 2 below shows a map of Cameroon with the different agro-ecological zones.

The map shows that Cameroon is subdivided into five agro-ecological zones (AEZ): Sudan-Sahelian; Guinean High Savannah; Forest with bimodal rainfall regime; Forest with monomodal rainfall regime; Western High Plateaux.

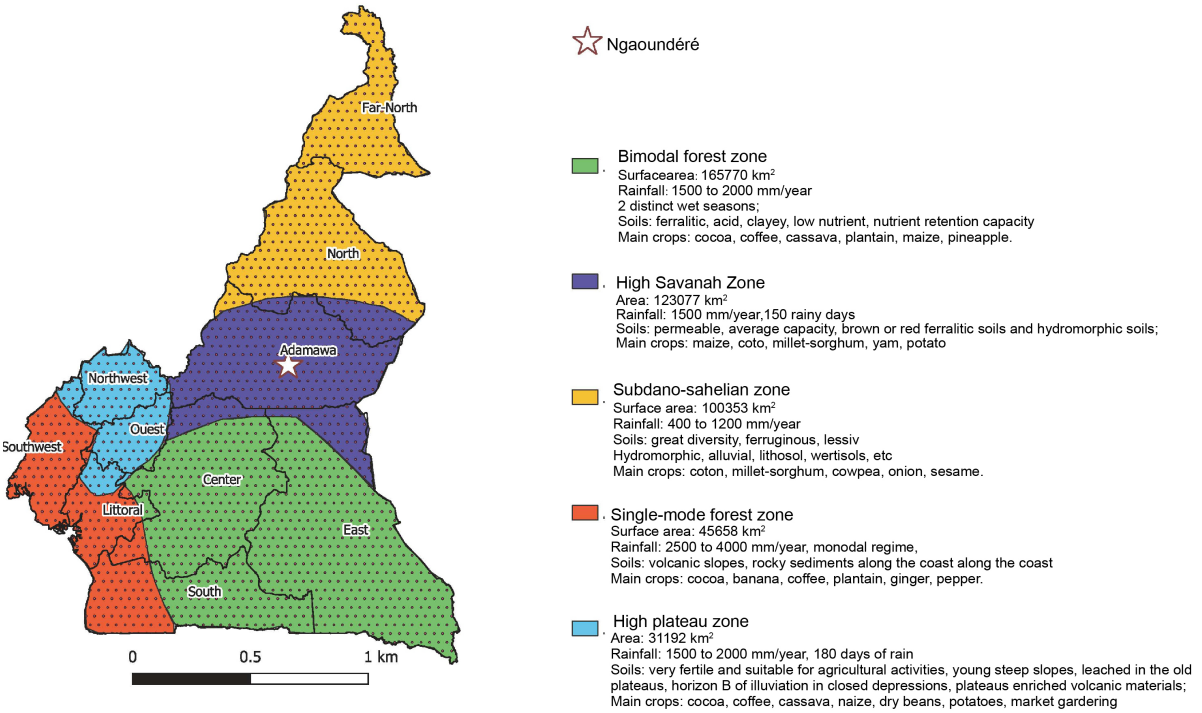

Figure 2. Maps of Cameroon's agro-ecological zones.

3. Results and Discussion

Data from the synthesis of scientific articles are summarised in supplementaries 1 to 5, which show that studies on the impact of pollinating insects on fruit and seed yields of plant species were carried out in the five (05) agro-ecological zones (AEZ) in Cameroon (**Figure 2**).

The following figure (**Figure 3**) shows the number of articles published by agro-ecological zone.

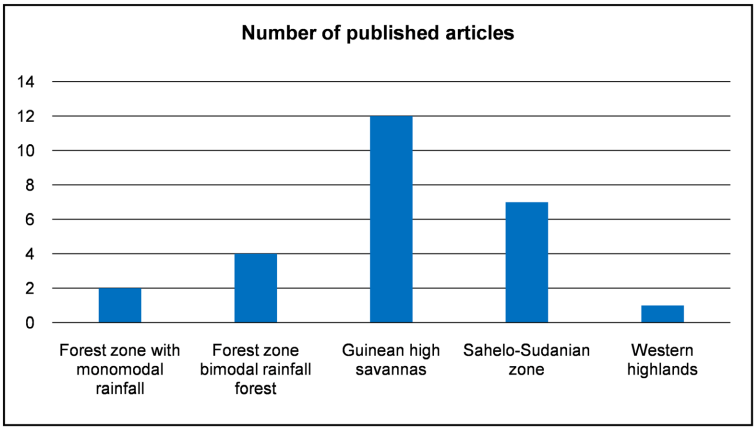

Figure 3. Data synthesis in agro-ecological zones.

Figure 4 presents the data summary in forest zone with the monomodal rainfall.

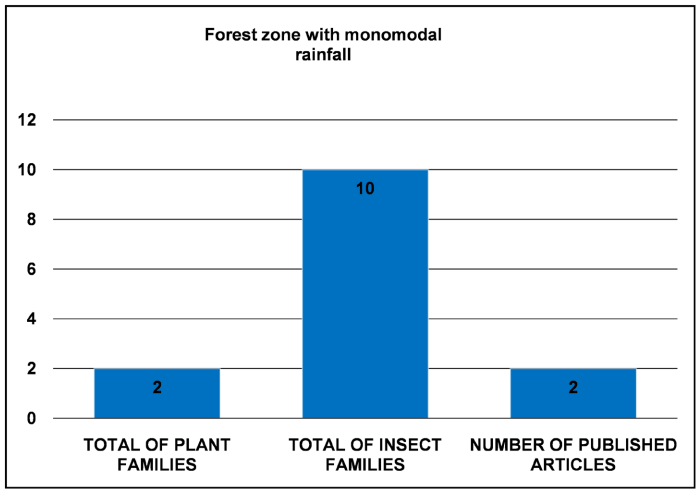

Figure 4. Summary of forest zone with the monomodal rainfall.

In the agro-ecological forest zone with monomodal rainfall (**Supplementary 1**, **Figure 4**), two (02) plant families were studied: Fabaceae and Pedaliaceae. On Fabaceae (*Vigna unguiculata*) plants, Hymenoptera ranked first with pollinator insects belonging to Apidae family which include the following insects: *Apis mellifera*, *Xylocopa olivacea* and *Amegilla* sp., followed by Megachilidae family (*Chalicodoma* sp. and *Megachile* sp.). These insects are the main pollinators of the plant in this AEZ. The same species (*Apis mellifera*, *Xylocopa olivacea*, *Amegilla* sp. (Apidae)) and *Chalicodoma* sp., *Megachile* sp. (Megachilidae) are the main pollinators of Pedaliaceae (*Sesamum indicum*) plant. For the Fabaceae plant, the yield due to flowering insects was 92.22% for the fruiting rate and 91.01% for the percentage of normal seeds. For the Pedaliaceae, the corresponding values were 75.55% and 88.45% respectively. These results show that for both plant families, Apidae and Megachilidae are the main pollinators in that zone. Moreover, the equatorial cameroonian climate would favour the activity of flowering insects. The contribution of bees, particularly honeybees (*Apis mellifera unicolor*), to plant pollination has also been noted by researchers [11] in a humid tropical forest formation in Reunion and Madagascar.

Figure 5 presents the data summary in forest zone with the bimodal rainfall.

In the bimodal rainfall forest zone (**Supplementary 2**, **Figure 5**), only one (01) plant family has been studied: the Fabaceae with three different plants (*Phaseolus coccineus*, *Cajanus cajan* and *Vigna unguiculata*). In this zone, Hymenoptera ranked first, and Apidae (*Xylocopa calens*, *Xylocopa albiceps*, *Apis mellifera adansonii*, *Dactylurina staudingeri*, *Xylocopa torrida*, *Xylocopa nigrita*, (1 sp.), *Meliponula erythra*, *Xylocopa olivacea*, *Allodape* sp. and *Meliponula bocandei*); followed by Megachilidae (*Chalicodoma cinta cinta*, *Megachile bituberculata*, *Chalicodoma rufipennis*, *Chalicodoma rufipes* and *Chalicodoma torrida*), are the most important pollinators. The mean fruiting rate was 85.31% and the mean percentage of normal seeds was 93.56%. Therefore for both plant families, Apidae and Megachilidae are the main. The equatorial Guinean climate

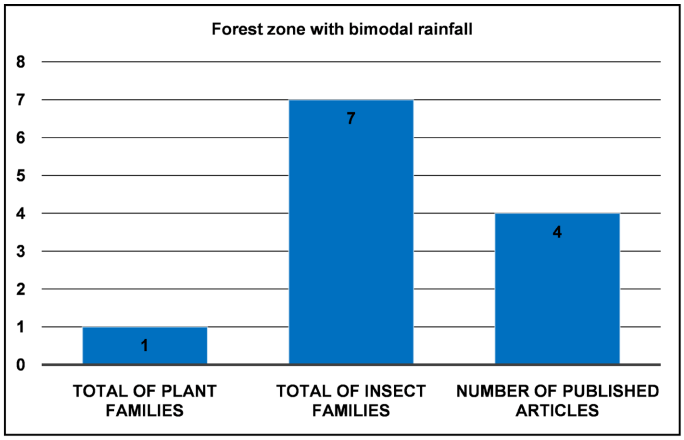

Figure 5. Summary of forest zone with the bimodal rainfall.

would have a positive influence on the activity of flowering insects. Thus, the forest zone is of crucial importance for the pollinator's diversity and improves the pollination of adjacent crops [12].

Figure 6 presents the data summary in the Guinean high savannas zone.

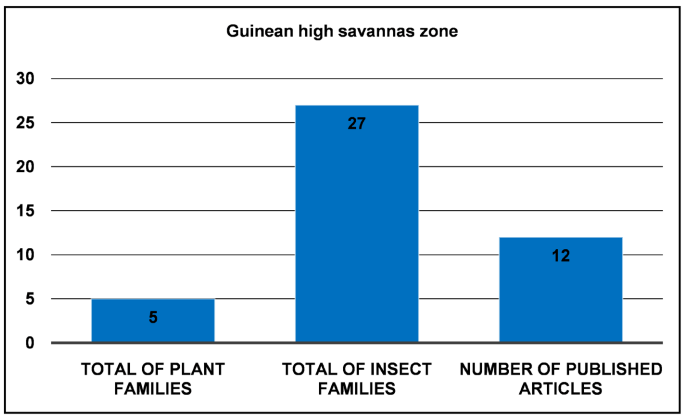

Figure 6. Summary of the Guinean high savannas zone.

Concerning the Guinean high savannas zone (**Supplementary 3**, **Figure 6**), studies were concentrated on five (05) plant species families: Fabaceae (*Phaseolus vulgaris*, *Phaseolus coccineus*, *Glycine max*, *Cajanus cajan* and *Vigna unguiculata*), Malvaceae (*Gossypium hirsutum*), Euphorbiaceae (*Croton macrostachyus*), Solanaceae (*Physalis minima*) and Pedaliaceae (*Sesamum indicum* and *Cerathoteca sesamoides*). Hymenoptera are the main pollinators for Fabaceae, with the Apidae (*Xylocopa olivacea*; *Xylocopa* sp.; *Apis mellifera adansonii*; *Amegila* sp. 1; *Amegila* sp. 2; *Braunsapis* sp.; *Ceratina* sp. 1; *Ceratina* sp. 2), followed by the Megachilidae (*Megachile* sp., *Chalicodoma cinta cinta*, *Chalicodoma rufipes* and *Chalicodoma torrida*). The mean fruiting rate was 85.12% and the mean percentage of normal seeds was 89.45%. For Malvaceae plant species, Apidae (*Apis mellifera adansonii*; *Allodope* sp.; *Amegilla* sp. 1; *Amegilla* sp. 2; *Tetralonia* sp.) are the main pollinators. The mean fruiting rate is

93.54% and the mean percentage of normal seeds is 94.06%. Among Euphorbiaceae plant species recorded, we have the following Apidae: *Apis mellifera adansonii*; *Meliponula furruginea*; *Xylocopa olivacea*. The fruiting rate is 28.76% and the percentage of normal seeds is 64.14%. For Solanaceae *Apis mellifera*; *Amegilla* sp.1; *Amegilla* sp. 2; *Ceratina* sp.1; *Dactylurina staudingeri*; *Lipotriches collaris*; *Lipotriches* sp.1; *Lasioglossum* sp.1; *Meliponula ferruginea* were the main pollinators. The tropical Sudanian climate would favour the activity of flowering insects.

Figure 7 presents the data summary in the Sahelo-Sudanian zone.

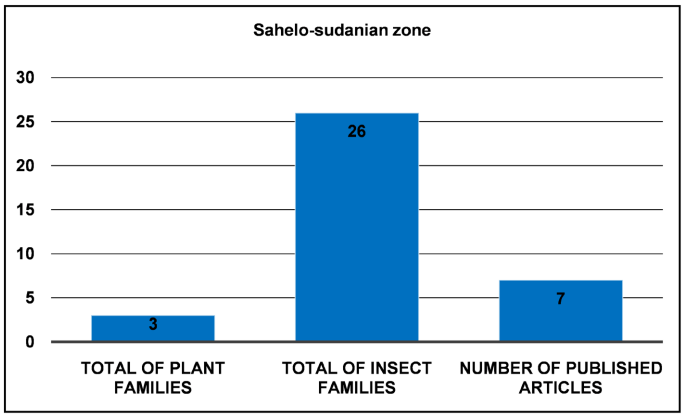

Figure 7. Summary of the Sahelo-Sudanian zone.

With regard to the Sahelo-Sudanian zone (Supplementary 4, Figure 7), three (03) families of plant have been subject to publications: Fabaceae (*Phaseolus vulgaris*, *Glycine max* and *Vigna unguiculata*), with Apidae (*Apis mellifera adansonii*; *Amegilla* sp.; *Thyrus* sp.; *Xylocopa* sp.) and the Megachilidae (*Chalicodoma* sp., *Megachile* sp. and *Megachile eurymera*) as the main pollinators. The mean fruiting rate was 65.89% and the mean percentage of normal seeds was 63.35%. On Malvaceae (*Gossypium hirsutum*) plant largely cultivated as the main cash crop in that AEZ, Apidae (*Apis mellifera adansonii*; *Allodape* sp.; *Amegilla* sp. 1; *Amegilla* sp. 2; *Thyrus* sp.; *Xylocopa* sp. 1; *Xylocopa* sp. 2) and the Megachilidae (*Chalicodoma* sp., *Chalicodoma kamerunensis*, *Megachile* sp. and *Creightonella* sp.) are the main and efficient pollinators. The mean fruiting rate is 92.47% and the mean percentage of normal seeds is 90.84%. Concerning Euphorbiaceae (*Ricinus communis*) plant species, Lepidoptera ranked first with: *Eurema* sp.; *Acraea acerata*; *Catopsilia florella*; and one non determine Lepidoptera species (1 sp.). The fruiting rate was 96.00% and the percentage of normal seeds was 94.13%. These results show that for the three plant families, Apidae and Megachilidae are the main pollinators in the Sahelo-Sudanian agro-ecological zone. The tropical Sudano-Sahelian climate would be beneficial to the activity of flowering insects. Similarly, in Burkina Faso, the work of some researchers [1] has shown that bees have contributed to the production of the main cash crops grown by farmers in the region.

Figure 8 presents the data summary in the western highlands zone.

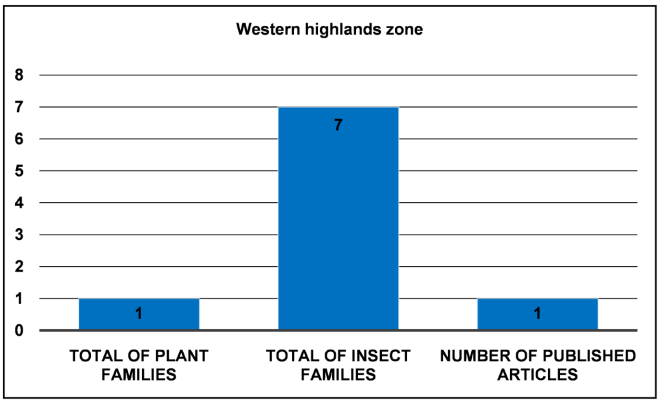

Figure 8. Summary of the western highlands zone.

In the western highlands zone (Supplementary 5, Figure 8), Solanaceae (*Physalis micrantha*) plants were studied. The main pollinators are Apidae with *Amegilla* sp.; *Apis mellifera adansonii*; *Braunsapis* sp.; *Ceratina* sp.; *Dactylurina staudingeri*; *Lasioglossum atricum*; *Melipoluna erythra*, occupying the first places of the Arthropods visiting the plant species. The values corresponding to the fruiting rate and the percentage of normal seeds are 65.40% and 98.64% respectively. These values reveal the positive contribution of entomophilic pollination to flowering plant yields [1]. So the equatorial cameroonian climate would favour the activity of flowering insects. Moreover, the dependence of flowering plants on pollinators has also been highlighted in the Qinghai-Tibet plateau region of China [13].

4. General Discussion

It appears that the Apidae and Megachilidae are excellent pollinators of plant species in the agro-ecological zones of Cameroon. However, the main potential pollinators are distributed differently in AEZ due to environmental conditions [14]. The general factors that influence the activity of pollinating insects include climate (temperature and humidity); the presence of attractive flowering plants; and the availability and accessibility of floral products. Good humidity and temperature conditions are favourable for foraging by Hymenoptera [15]. In addition, the presence of flowering plants that are attractive to flowering insects increases the number of flowers visited, increasing the probability of stigmatic contacts and, consequently, pollination opportunities [16]. Moreover, the presence of flower visiting insects on plants would suggest the availability and accessibility of floral products [17]. Furthermore, researchers [18] noted that the scarcity of visitors and the low efficiency of pollinators reduce the yield success of plant species. In addition, the dependence of a plant species family on insect pollinators may differ from one AEZ to another, notably due to variations in soil nutrients, microclimate and the status of pests and plant diseases [19]. This de-

pendence could also differ between varieties of plant species [20]. This is the case for the dependence of flowering insects on oilseed rape, where researchers [21] recorded a dependence on pollinators of 30%; while other researchers [22] recorded a dependence of 20% for two varieties of the same crop. Furthermore, according to researchers [2], almost 94% of tropical plants depend on animal pollination for fruit/seed production. Pollinators are therefore essential for the reproduction of plant, as they help to preserve biodiversity and increase crop productivity. In addition, work in Kenya [23] has shown that fruit set in *Persea americana* is highly dependent on insect pollination, and that pollinator supplementation reduces pollination deficits in small-scale avocado production systems. Moreover, according to researchers [24], pollination deficit can compromise fruit yield and quality. This is an ample evidence of the important role played by bees in pollinating *Pyrus sinkiangensis* in China [24]. In Egypt, some researchers [25] showed *Apis mellifera* and *Megachile* sp. bees to be the most abundant pollinators of Egyptian clover. Similar studies on the role and importance of pollinators, particularly bees, on the yield and fruit quality of cultivated plants such as watermelon (*Citrullus lanatus*) and okra (*Abelmoschus esculentus*) were also carried out in southern Benin by researchers [26] [27]. Therefore, the presence of Apidae and Megachilidae in the different agro-ecological zones mentioned above would be due to the fact that bees adjust their behaviour to weather conditions in order to survive, and therefore to participate in the pollination of plant species. Thus, meteorological characteristics, vegetation and human activities seem to play an important role in the composition and importance of pollinating insects [14].

5. Conclusions

The results of these published studies provide ample evidence of the significant contribution of pollinating insects, especially Apidae and Megachilidae, in improving the quality of plant yields. However, their decline could have a negative impact on the ecosystem, hence the importance of preserving them.

Based on these finding and according to the research in the field of pollination ecology in Cameroon, there is an urgent need to increase research on pollinator-dependent crops, the abundance of pollinators in agro-ecological zones, as well as to identify the taxonomy of functional pollinators and their richness. Moreover, with regard to pollinators decline, we advise to look into the causes of decline such habitat defragmentation, agricultural intensification and the misuse of agrochemical by farmers, and to find ways for their sustainable management and conservation. Furthermore, given the increasing research in pollination study program in this country, it's time to include policy makers and farmers to inform them about the importance of pollinators, as up to now, there is little public and/or political awareness of the importance of pollinators. Farmers as main actors in close relation to environment, are unaware of the role of pollinators and how to manage for them. So public authorities should set up platforms

to train farmers to understand the role of pollinators and learn how to manage them for agriculture. The use of pesticides should be banned in favour of biological control.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Stein, K., Coulibaly, D., Stenchly, K., Goetze, D., Porembski, S., Lindner, A., *et al*. (2017) Bee Pollination Increases Yield Quantity and Quality of Cash Crops in Burkina Faso, West Africa. *Scientific Reports*, **7**, Article No. 17691. https://doi.org/10.1038/s41598-017-17970-2

[2] Ollerton, J., Winfree, R. and Tarrant, S. (2011) How Many Flowering Plants Are Pollinated by Animals? *OIKOS*, **120**, 321-326. https://doi.org/10.1111/j.1600-0706.2010.18644.x

[3] FAO (2009) Les pollinisateurs: Un élément négligé de la biodiversité, important pour l'alimentation et l'agriculture.

[4] De Elena Fraccaro, S.D. (2023) Pourquoi les insectes pollinisateurs sont-ils importants? https://blog.3bee.com/fr/polinisateurs-role-fondamental/

[5] FAO (2023) L'importance des abeilles dans la biodiversité et leur contribution à la sécurité alimentaire et nutritionnelle. https://www.fao.org/africa/news-stories/news-detail/L-importance-des-abeilles-dans-la-biodiversit%C3%A9-et-leur-contribution-%C3%A0-la-s%C3%A9curit%C3%A9-alimentaire-et-nutritionnelle-/en

[6] IRAD (2008) Deuxième rapport sur l'état des ressources phytogénétiques pour l'alimentation et l'agriculture au Cameroun.

[7] Mazi, S., kingha, T.B.M., Déli, K.P., Faïbawa E. and Brückner, D. (2019) Role of Pollinators in Enhancing Pod and Seed Set of *Arachis hypogaea* Variety 28-206 (Fabaceae) at Tchabal-Mounguel (Ngaoundere, Cameroon). *Journal of Entomology and Zoology Studies*, **7**, 1521-1528.

[8] Wei, W., Wu, H., Li, X., Wei, X., Lu, W. and Zheng, X. (2019) Diversity, Daily Activity Patterns, and Pollination Effectiveness of the Insects Visiting *Camellia osmantha*, *C. vietnamensis*, and *C. oleifera* in South China. *Insects*, **10**, Article 98. https://doi.org/10.3390/insects10040098

[9] Aizen, M.A., Aguiar, S., Biesmeijer, J.C., Garibaldi, L.A., Inouye, D.W., Jung, C., *et al*. (2019) Global Agricultural Productivity Is Threatened by Increasing Pollinator Dependence without a Parallel Increase in Crop Diversification. *Global Change Biology*, **25**, 3516-3527. https://doi.org/10.1111/gcb.14736

[10] Hristov, P., Neov, B., Shumkova, R. and Palova, N. (2020) Significance of Apoidea as Main Pollinators. Ecological and Economic Impact and Implications for Human Nutrition. *Diversity*, **12**, Article 280. https://doi.org/10.3390/d12070280

[11] Rasoloarijao, T.M. (2018) Écologie de l'abeille, *Apis mellifera unicolor* Latreille, dans les écosystèmes forestiers naturels de Ranomafana (Madagascar) et Mare Longue (Réunion): Etude du comportement de butinage et de l'utilisation des ressources florales par approche mélissopalynologique. Thèse de Doctorat, Université de La Réunion et Université d'Antananarivo.

[12] Ulyshen, M., Urban-Mead, K.R., Dorey, J.B. and Rivers, J.W. (2023) Forests Are Critically Important to Global Pollinator Diversity and Enhance Pollination in Adjacent Crops. *Biological Reviews*, **98**, 1118-1141. https://doi.org/10.1111/brv.12947

[13] Yue-Wen, X., Lu, S., Rong, M., Yong-Qian, G., Hang, S. and Bo, S. (2023) Does Pollinator Dependence Decrease along Elevational Gradients? *Plant Diversity*, **45**, 446-455.

[14] Bazie, B.F., Dao, M.C.E., Drabo, F.S., Da, N., Kabre, S. and Gnankine, O. (2021) Influence des facteurs climatiques sur les insectes pollinisateurs potentiels du *Moringa oleifera* lam. au Burkina Faso. *Revue Ramres*, *Science de la vie*, *de la terre et agronomie*, **9**, 47-54.

[15] Tuell, J.K. and Isaacs, R. (2010) Weather during Bloom Affects Pollination and Yield of Highbush Blueberry. *Journal of Economic Entomology*, **103**, 557-562. https://doi.org/10.1603/ec09387

[16] Tchuenguem, F.F.-N. and Népidé, N.C. (2018) Pollination Efficiency of *Apis mellifera* L. (Hymenoptera: Apidae) on *Sesamum indicum* (Pedaliaceae) White and Smooth Seed Variety Flowers at Dang (Ngaoundéré, Cameroon). *International Journal of Biological and Chemical Sciences*, **12**, 446-461.

[17] Basga, E., Tope, S.F., Atibita, E.N.O. and Tchuenguem Fohouo, F. (2019) Efficacité pollinisatrice de Apis mellifera Linné (Hymenoptera: Apidae) sur les fleurs de Gossypium hirsutum (Malvaceae) à Djamboutou (Garoua, Cameroun). *Journal of Applied Biosciences*, **138**, Article 14123. https://doi.org/10.4314/jab.v138i1.11

[18] Reyes, H.C., Draper, D. and Marques, I. (2021) Pollination in the Rainforest: Scarce Visitors and Low Effective Pollinators Limit the Fruiting Success of Tropical Orchids. *Insects*, **12**, Article 856. https://doi.org/10.3390/insects12100856

[19] Klein, A., Vaissière, B.E., Cane, J.H., Steffan-Dewenter, I., Cunningham, S.A., Kremen, C., *et al*. (2006) Importance of Pollinators in Changing Landscapes for World Crops. *Proceedings of the Royal Society B*: *Biological Sciences*, **274**, 303-313. https://doi.org/10.1098/rspb.2006.3721

[20] Breeze, T.D., Gallai, N., Garibaldi, L.A. and Li, X.S. (2016) Economic Measures of Pollination Services: Shortcomings and Future Directions. *Trends in Ecology & Evolution*, **31**, 927-939. https://doi.org/10.1016/j.tree.2016.09.002

[21] Stanley, D.A., Gunning, D. and Stout, J.C. (2013) Pollinators and Pollination of Oilseed Rape Crops (brassica Napus L.) in Ireland: Ecological and Economic Incentives for Pollinator Conservation. *Journal of Insect Conservation*, **17**, 1181-1189. https://doi.org/10.1007/s10841-013-9599-z

[22] Bartomeus, I., Potts, S.G., Steffan-Dewenter, I., Vaissière, B.E., Woyciechowski, M., Krewenka, K.M., *et al*. (2014) Contribution of Insect Pollinators to Crop Yield and Quality Varies with Agricultural Intensification. *Peer J*, **2**, e328. https://doi.org/10.7717/peerj.328

[23] Sagwe, R.N., Peters, M.K., Dubois, T., Steffan-Dewenter, I. and Lattorff, H.M.G. (2021) Pollinator Supplementation Mitigates Pollination Deficits in Smallholder Avocado (*Persea americana* Mill.) Production Systems in Kenya. *Basic and Applied Ecology*, **56**, 392-400. https://doi.org/10.1016/j.baae.2021.08.013

[24] Li, Q., Sun, M., Liu, Y., Liu, B., Bianchi, F.J.J.A., van der Werf, W., *et al*. (2022) High Pollination Deficit and Strong Dependence on Honeybees in Pollination of Korla Fragrant Pear, *Pyrus sinkiangensis*. *Plants*, **11**, Article 1734. https://doi.org/10.3390/plants11131734

[25] Mazeed, A., Zidan, E. and Abd El-latif, A. (2019) Role of Pollinators on Egyptian Clover Pollination with Special Reference to Honeybee at Sohag Governorate, Egypt. *Arab Universities Journal of Agricultural Sciences*, **27**, 853-860. https://doi.org/10.21608/ajs.2019.43835

[26] Toni, H., Djossa, A.B., Teka, O. and Yédomonhan, H. (2020). Abeilles pollinisatrices et production de la pastèque (*Citrullus lanatus*) dans la Commune de Kétou au Sud Bénin. *Afrique Science*, **16**, 63-77.

[27] Toni, H., Djossa, A.B., Teka, O. and Yédomonhan, H. (2020). Rôle des insectes pollinisateurs dans qualité des fruits et le rendement du gombo (*Abelmoschus esculentus*) dans la Commune de Kétou au Sud Bénin. *Afrique Science*, **17**, 102-114.

Supplementary Materials

Supplementary 1. Yields as a function of plant families in the forest agro-ecological zone with monomodal rainfall in Cameroon.

Plants	Years and references	Months	Flora Entomofauna			Impact of flower-feeding insects on the fruit and seed yields of the plants studied					
						Yields			Numerical contributions (%)		
						FR (%)	MNS/F	PNS (%)	FR	MNS/F	PNS
Fabaceae family											
			Order	**Family**	**Genus, species, sub-species**						
Vigna unguiculata	Pharaon *et al*., 2019	April - July	Diptera	Calliphoridae	(1 sp.)	92.22	8.00	91.01	7.20	18.81	3.10
				Muscidae	*Musca domestica*						
			Hymenoptera	Apidae	*Apis mellifera*						
					Xylocopa olivacea						
					Amegilla sp.						
				Formicidae	(1 sp.)						
				Megachilidae	*Chalicodoma* sp.						
					Megachile sp.						
				Vespidae	*Synagris cornuta*						
			Lepidoptera	Acraeidae	*Acraea acerata*						
				Pieridae	*Catopsilia flerella*						
			Orthoptera		(1 sp.)						
			Nevroptera		(1 sp.)						
Pedaliaceae Family											
			Order	**Family**	**Genus, species, sub-species**						
Sesamum indicum	Pharaon *et al*., 2018	March - June	Diptera	Calliphoridae	(1 sp.)	75.55	58	88.45	21.08	14.70	5.02
				Muscidae	*Musca domestica*						
			Hymenoptera	Apidae	*Apis mellifera*						
					Xylocopa olivacea						
					Amegilla sp.						
				Eumenidae	*Delta* sp.						
				Formicidae	(1 sp.)						
				Halictidae	*Lasioglossum* sp.						

Continued

	Megachilidae	*Chalicodoma* sp.
		Megachile sp.
	Vespidae	*Synagris cornuta*
Lepidoptera	Acraeidae	*Acraea acerata*
	Pieridae	*Catopsilia flerella*
	Nymphalidae	(1 sp.)
Orthoptera		(1 sp.)
Nevroptera		(1 sp.)

FR: Fruiting Rate; MNS/F: Mean Number of Seeds per Fruit; PNS (%): Percentage of Normal Seeds; sp: undetermined species.

Supplementary 2. Yields as a function of repeated plant families in the forest agro-ecological zone with bimodal rainfall in Cameroon.

Plants	Years and references	Months	Flora Entomofauna			Impact of flower-feeding insects on the fruit and seed yields of the plants studied					
						Yields			Numerical contributions (%)		
						FR (%)	MNS/F	PNS (%)	FR	MNS/F	PNS
			Fabaceae family								
			Order	**Family**	**Genus, species, sub-species**						
Phaseolus coccineus	Pando *et al*., 2011a	May - July (2008) April - June (2009)	Hymenoptera	Apidae	*Xylocopa calens*	82.29	6.47	90.08	19.09	8.10	18.09
			-	-	*Xylocopa albiceps*						
			-	-	*Apis mellifera adansonii*						
			-	-	*Dactylurina staudingeri*						
			-	-	*Xylocopa torrida*						
			-	-	*Xylocopa nigrita*						
			-	-	(1 sp.)						
			-	Megachilidae	*Chalicodoma cincta cincta*						
			-	-	*Megachile bituberculata*						

Continued

			-	-	*Chalicodoma rufipennis*						
			-	Halictidae	*Crocisaspidia chandleri*						
			-	-	*Thrinchostoma wissmanni*						
			-	-	*Lasioglossum* sp.						
			-	Vespidae	*Synagris cornuta*						
			-	Sphecidae	*Philanthus triangulum*						
			-	Formicidae	*Camponotus flavomarginatus*						
Cajanus cajan	Pando *et al*., 2011b	September - October (2008) July - August (2009)	Hymenoptera	Apidae	*Xylocopa calens*	89.52	5.96	94.96	11.82	18.53	8.84
				-	*Xylocopa torrida*						
				-	*Xylocopa albiceps*						
				-	*Xylocopa nigrita*						
				-	*Apis mellifera adansonii*						
				-	*Dactylurina staudingeri*						
				-	*Meliponula erythra*						
				-	(1 sp.)						
				Megachilidae	*Chalicodoma cincta cincta*						
				-	*Chalicodoma rufipes*						
				-	*Chalicodoma torrida*						
				-	*Chalicodoma rufipennis*						
				-	*Megachile bituberculata*						
				Halictidae	*Crocisaspidia chandlerie*						

Continued

				Formicidae	*Camponotus flavomarginatus*						
				Sphecidae	*Philanthus Triangulum*						
				Xymonidae	*Synagris cornuta*						
				Vespidae	*Belonogaster juncea juncea*						
			Hymenoptera	Apidae	*Xylocopa olivacea*						
					Xylocopa torrida						
					Xylocopa nigrita						
					Xylocopa albiceps						
					Apis mellifera adansonii						
					Allodape sp.						
					Dactylurina staudingeri						
					Meliponula erythra						
Vigna unguiculata	Pando *et al.*, 2013	April - July		Megachilidae	*Chalicodoma cincta cincta*	80.69	17.83	93.67	22.48	20.08	14.84
					Chalicodoma rufipennis						
					Megachile bituberculata						
				Halictidae	*Crocisaspidia chandleri*						
					1sp.						
				Sphecidae	*Philanthus triangulum*						
				Vespidae	*Synagris cornuta*						
					Belonogaster juncea juncea						
					sp.1						
					sp.2						
					sp.3						
					Polistes sp.						

Continued

				Formicidae	*Camponotus flavomarginatus*						
Cajanus cajan	Tchuenguem *et al*., 2014a	July 2008 - January 2009 June - Décember (2009)	Hymenoptera	Apidae	*Xylocopa olivacea*	88.76	5.96	95.55	14.64	23.48	9.43
					Xylocopa torrida						
					Xylocopa albiceps						
					Apis mellifera adansonii						
					Meliponula erythra						
					Meliponula bocandei						
					Dactylurina staudingeri						
				Megachilidae	*Chalicodoma cincta cincta*						
					Chalicodoma rufipennis						
					Chalicodoma rufipes						
					Chalicodoma torrida						
					Megachile bituberculata						
				Halictidae	*Crocisaspidia chandleri*						
					(sp. 1)						
				Formicidae	*Camponotus flavomarginatus*						
				Sphecidae	*Philanthus triangulum*						
				Xymonidae	*Synagris cornuta*						
				Vespidae	*Belonogaster juncea juncea*						
					(sp. 2)						

FR: Fruiting Rate; MNS/F: Mean Number of Seeds per Fruit; PNS (%): Percentage of Normal Seeds; sp: undetermined species.

Supplementary 3. Yields as a function of plant families in the high Guinean savannah agro-ecological zone of Cameroon.

Plants	Years and references	Months	Flora Entomofauna			Impact of flower-feeding and seed yields of the plants studied					
						Yields			Numerical contributions (%)		
						FR (%)	MNS/F	PNS (%)	FR	MNS/F	PNS
Fabaceae family											
			Order	**Family**	**Genus, species, sub-species**						
Phaseolus vulgaris	Kingha *et al.*, 2012	June - July	Hymenoptera	Apidae	*Xylocopa olivacea*	88.75	6.36	92.18	73.31	18.79	26.85
					Xylocopa sp.						
					Apis mellifera adansonii						
					Amegila sp. 1						
					Amegila sp. 2						
					Braunsapis sp.						
					Ceratina sp. 1						
					Ceratina sp. 2						
				Halictidae	*Lasioglossum* sp.						
				Megachilidae	*Chalicodoma rufipes*						
					Megachile sp. 1						
					Megachile sp. 2						
					Megachile sp. 3						
					Megachile sp. 4						
					Megachile sp. 5						
				Formicidae	*Camponotus flavomarginatus*						
					Camponotus sp.						
			Lepidoptera	Pieridae	*Eurema* sp. 1						

Continued

					Eurema sp. 2						
				Lycaenidae	(sp. 1)						
					(sp. 2)						
				Hesperiidae	*Lambrix* sp.						
				Syrphidae	*Episyrphus* sp.						
				Meloidae	*Coryna* sp.						
			Hymenoptera	Apidae	*Xylocopa olivacea*						
					Ameglia sp. 1						
					Ameglia sp. 2						
					Ceratina sp.						
				Megachilidae	*Megachile* sp. 1						
					Megachile sp. 2						
Phaseolus coccineus	Tchuenguem *et al*., 2014b	June - July (2010) July - August (2011)			*Megachile* sp. 3	96.25	5.17	90.62	53.52	64.29	76.62
				Vespidae	*Belonogaster juncea*						
					Polistes sp.						
			Lepidoptera	Pieridae	*Eurema* sp.						
				Lycaenidae	Espèce 1						
					Espèce 2						
					Espèce 3						
			Coleoptera	Meloidae	*Coryna* sp.						
				Lagriidae	*Lagria villosa*						
			Coleoptera	Meloidae	*Coryna* sp.						
			Diptera	Muscidae	*Musca domestica*						
				Syrphidae	*Epysyrphus balteatus*						
Glycine max	Kengni *et al*., 2015a	March - September	Hymenoptera	Apidae	*Apis mellifera adansonii*	85.75	2.01	92.26	23.78	55.36	25.90
					Ceratina sp.						
				Formicidae	*Camponotus acvapimensis*						
				Halictidae	*Lasioglossum* sp.						

Continued

			Coleoptera	Pentatomidae	(1 sp.)						
				Meloidae	*Coryna* sp.						
			Diptera	Muscidae	*Musca autumnalis*						
					Musca domestica						
				Syrphidae	*Episyrphus* sp.						
			Hymenoptera	Apidae	*Apis mellifera adansonii*						
					Xylocopa olivacea						
Vigna unguiculata	Kengni *et al*., 2015b	April - August (2011) March - September (2012)		Formicidae	*Camponotus acvapimensis*	57.49	14.68	96.35	60.77	52.39	11.41
					Myrmicaria opaciventris						
				Megachilidae	*Chalicodoma cinta cinta*						
					Crocisaspidia chandleri						
			Lepidoptera	Pieridae	*Eurema* sp.1						
				Hespiridae	*Pelopidas mathias*						
			Hymenoptera	Apidae	*Apis mellifera*						
					Amegilla acraensis						
					Amegilla sp.						
					Ceratina sp.						
					Tyreus sp.						
Phaseolus vulgaris variété Bigarrée	Déli *et al.,* 2020	June			*Xylocopa inconstans*	86.66	2.76	72.96	36.01	23.42	42.24
					Xylocopa olivacea						
				Halictidae	*Lasioglossum* sp.						
				Megachilidae	*Chalicodoma rufipes*						
					Megachile torrida						
				Pieridae	*Eurema* sp.						

Continued

			Diptera	Syrphidae	*Episyrphus* sp.						
			Hymenoptera	Apidae	*Amegilla* sp.						
					Apis mellifera						
					Ceratina sp.						
					Dactylurina staudingeri						
					Meliponula ferruginea						
					Tyreus sp.						
					Xylocopa inconstans						
					Xylocopa olivacea						
					Xylocopa sp.						
				Formicidae	*Polyrhachis* sp.						
				Halictidae	*Crocisaspidia chandleri*						
					Lasioglusum sp.						
Cajanus cajan	Zra *et al*., 2020b	April - Décember			*Macronomia vulpina*	95.83	4.45	92.31	23.56	41.95	26.41
				Megachilidae	*Chalicodoma cincta*						
					Chalicodoma sp.						
					Megachile acraensis						
					Megachile torrida						
					Megachile sp. 1						
					Megachile sp. 2						
					Megachile sp. 3						
					Megachile sp. 4						
					Megachile sp. 5						
					Megachile sp. 6						

Continued

				Megachile sp. 7						
				Megachile sp. 8						
				Pachyanthidium bouyssoui						
			Crabronidae	*Philanthus triangulum*						
				(1 sp.)						
			Vespidae	*Belonogaster juncea*						
				(sp. 1)						
				(sp. 2)						
			Lepidoptera	Lycaenidae	(1 sp.)						
Malvaceae Family										
			Order	**Family**	**Genus, species, sub-species**						
			Hymenoptera	Apidae	*Apis mellifera adansonii*						
					Allodope sp.						
					Amegilla sp. 1						
					Amegilla sp. 2						
					Tetralonia sp.						
				Halictidae	*Lasioglossum* sp.						
Gossypium hirsutum	Mazi *et al.*, 2013	August - September (2009) August - October (2010)			*Lipotriches blandula*	90.41	26.70	94.82	55.74	22.04	51.20
					Halictus sp.						
					Leuconomia granulate						
				Formicidae	*Myrmicaria opaciventris*						
					Camponotus sp.						
					Paratrechina longicornis						
					(1 sp.)						

Continued

				Vespidae	*Belonogaster juncea*						
			Coleoptera	Coccinellidae	*Cheilomenes lunata*						
				Curculionidae	(sp.1)						
					(sp.2)						
				Scarabeidae	(sp.1)						
			Diptera		(sp.1)						
			Hemiptera	Pentatomidae	*Nezara viridula*						
				Coreidae	*Anoplocnemis curvipes*						
			Lepidoptera	Pieridae	*Eurema* sp.						
					Catopsilia florella						
				Nymphalidae	*Neptis* sp.						
					(1 sp.)						
			Hymenoptera	Apidae	*Amegilla* sp.						
					Amegilla calens						
Gossypium hirsutum	Mazi *et al*., 2020a	September - October			*Apis mellifera*	96.67	25.39	93.30	8.63	16.15	10.21
					Ceratina sp.						
				Halictidae	*Lasioglusum* sp.						
					Lipotriches sp.						
Euphorbiaceae Family											
			Order	**Family**	**Genus, species, sub-species**						
			Coleoptera	Chrysomelidae	(1 sp.)						
				Lycidae	*Lycus latissimus*						
Croton macrostachyus	Népidé & Tchuenguem, 2016	May - June		Scarabeidae	(1 sp.) (ne)	28.76	01.33	64.14	26.85	15.24	43.49
			Diptera	Calliphoridae	*Calliphora* sp. 1						
					Calliphora sp. 2						

Continued

				Syrphidae	(1 sp.)						
					(1 sp.)						
			Hemiptera	Pyrrhocoridae	*Dysdercus voelkeri*						
			Hymenoptera	Apidae	*Apis mellifera adansonii*						
					Meliponula furruginea						
					Xylocopa olivacea						
				Formicidae	*Camponotus brutus*						
					Polyrachis sp.						
					(1 sp.)						
				Sphecidae	*Philanthus triangulum*						
				Vespidae	*Belonogaster juncea*						
				Zygenidae	(1 sp.)						
Solanaceae Family											
			Order	**Family**	**Genus, species, sub-species**						
			Diptera	Calliphoridae	(1 sp.)						
			Hemiptera	Pentamidae	(1 sp.)						
			Hymenoptera	Apidae	*Apis mellifera*						
					Amegilla sp.1						
					Amegilla sp. 2						
					Ceratina sp.1						
Physalis minima	Djakbé *et al.*, 2017	April – August			*Dactylurina staudingeri*	94.44	140.97	98.33	7.06	11.91	1.61
					Lipotriches collaris						
					Lipotriches sp.1						
					Lasioglossum sp.1						
					Meliponula ferruginea						

Continued

				Formicidae	*Camponotus flavomarginatus*						
				Halictidae	*Halictus* sp.1						
					Halictus sp. 2						
				Vespidae	*Belonogaster juncea*						
					(1 sp.)						
Pedaliaceae Family											
			Order	**Family**	**Genus, species, sub-species**						
			Hymenoptera	Apidae	*Apis mellifera*						
					Ceratina sp.						
					Xylocopa olivacea						
				Formicidae	*Polyrachis* sp.						
			Hymenoptera	Apidae	*Apis mellifera*						
					Amegilla acraensis						
					Amegilla sp.1						
					Amegilla sp.2						
					Amegilla sp.3						
Sesamum indicum	Tchuenguem & Népidé, 2018	September (2013) & July (2014)			*Braunsapis foveata*	81.66	45.34	62.40	30.33	29.65	9.34
					Ceratina sp.1						
					Crossisaspidia chandleri						
					Dactylurina staudingerii						
					Meliponula ferruginea						
					Xylocopa inconstans						
					Xylocopa olivacea						
				Halictidae	*Lasioglossum nairobicum*						
					Lipotriches notabilis						

Continued

	Megachilidae	*Thrinchostoma sjostedti*	
		Chalicodoma cinta cinta	
		Chalicodoma rufipes	
		Megachile torrida	
	Formicidae	*Camponotus flavomarginatus*	
	Vespidae	*Belonogaster juncea*	
		(sp.)	

FR: Fruiting Rate; MNS/F: Mean Number of Seeds per Fruit; PNS (%): Percentage of Normal Seeds; sp: undetermined species.

Supplementary 4. Yields according to plant families repeated in the Sahelo-Sudanian agro-ecological zone of Cameroon.

Plants	Years and references	Months	Flora Entomofauna			Impact of flower-feeding insects on the fruit and seed yields of the plants studied					
						Yields			Numerical contributions (%)		
						FR (%)	MNS/F	PNS (%)	FR	MNS/F	PNS
Fabaceae family											
			Order	**Family**	**Genus, species, sub-species**						
Phaseolus vulgaris	Douka & Tchuenguem, 2013	June - August	Hymenoptera	Apidae	*Apis mellifera adansonii*	52.31	5.10	94.19	35.57	20.32	7.72
					Amegilla sp.						
					Thyrus sp.						
					Xylocopa sp.						
				Formicidae	*Polyrachis* sp.						
				Halictidae	*Lipotriches collaris*						
					Macronomia vulpina						
				Megachilidae	*Chalicodoma* sp.						
					Megachile sp.						
				Sphecidae	*Philanthus triangulum*						
				Vespidae	*Synagris cornuta*						
			Diptera	Calliphoridae	(sp. 1)						
					(sp. 2)						

Continued

			Coleoptera	Scarabeidae	(sp. 1)						
					(sp. 2)						
			Hemiptera	Coreidae	*Anoplocnemis curvipes*						
			Lepidoptera	Acraeidae	*Acraea acerata*						
				Pieridae	*Catopsilia florella*						
				Pieridae	(sp. 1)						
			Orthoptera		(1 sp.)						
					(2 sp.)						
			Dictyoptera	Mantodae	(sp. 1)						
			Nevroptera		(sp. 1)						
					(sp. 2)						
Glycine max	Tchuengue m & Dounia, 2014	August - September	Hymenoptera	Apidae	*Apis mellifera adansonii*	92.37	3.53	86.88	5.86	31.29	22.85
					Amegilla sp. 1						
					Xylocopa sp. 1						
				Halictidae	*Macronomia vulpina*						
					Lipotriches collaris						
				Megachilidae	*Chalicodoma* sp.1						
					Megachile sp. 1						
					Megachile sp. 2						
				Formicidae	*Polyrachis* sp. 1						
				Vespidae	*Synagris cornuta*						
					(1 sp.)						
				Sphecidae	*Philanthus triangulum*						
					(1 sp.)						
			Lepidoptera	Pieridae	*Catopsilia florella*						
					(sp. 1)						
					(sp. 2)						
				Nymphalidae	(1 sp.)						
				Acraeidae	*Acraea acerata*						
			Diptera	Muscidae	*Musca domestica*						
				Drosophilidae	*Drosophila* sp. 1						

Continued

				Syrphidae	(1 sp.)						
				Calliphoridae	(1 sp.)						
			Hemiptera	Coreidae	*Anoplocnemis curvipes*						
				Pyrrhocoridae	*Dysdercus voelkeri*						
			Orthroptera		(sp. 1)						
					(sp. 2)						
			Nevroptera		(sp. 1)						
					(sp. 2)						
			Hymenoptera	Megachilidae	*Megachile eurymera*						
				Apidae	*Xylocopa inconstans*						
					Xylocopa olivacea						
				Vespidae	(1 sp.)						
			Lepidoptera	Hesperiidae	*Pelopidas mathias*						
				Pieridae	*Hemiargus hanno*						
Vigna unguiculata	Djonwangwé *et al.*, 2017	August - November			*Eurema senegalensis*	53	9.99	8.99	16.98	10.71	13.35
					Vanessa cardui						
					Danaus chrysippus						
					(1 sp.)						
				Erebidae	*Utetheisa pulchella*						
			Hemiptera	Lygaeidae	(1 sp.)						
			Diptera	Muscidae	(1 sp.)						
			Coleoptera	Meloidae	*Hycleus senegalensis*						
Malvaceae Family											
			Order	**Family**	**Genus, species, sub-species**						
			Hymenoptera	Apidae	*Apis mellifera adansonii*						
					Allodape sp.						
Gossypium hirsutum	Dounia & Tchuenguem, 2013	August - October			*Amegilla* sp. 1	92.5	31.92	91.45	30.29	40.83	22.58
					Amegilla sp. 2						
					Thyrus sp.						
					Xylocopa sp. 1						

Continued

		Xylocopa sp. 2
	Formicidae	*Polyrachis* sp. 1
	Halictidae	*Lipotriches collaris*
	Megachilidae	*Macronomia vulpina*
		Chalicodoma sp. 1
		Chalicodoma sp. 2
		Creightonella sp.
		Megachile sp. 1
		Megachile sp. 2
		Megachile sp. 3
	Sphecidae	*Philanthus triangulum*
		(1 sp.)
	Vespidae	*Synagris cornuta*
		(1 sp.)
	Eumenidae	*Delta* sp.
Diptera	Calliphoridae	(1 sp.)
		(2 sp.)
	Stratiomyiidae	*Hermetia sp.*
	Syrphidae	(1 sp.)
Coleoptera	Scarabeidae	(1 sp.)
		(2 sp.)
	Meloidae	*Coryna* sp.
Hemiptera	Coreidae	*Anoplocnemis curvipes*
	Pyrrhocoridae	*Dysdercus voelkeri*
Lepidoptera	Acraeidae	*Acraea acerata*
	Nymphalidae	(1 sp.)
	Pieridae	*Catopsilia florella*
	Pieridae	(1 sp)
	Pieridae	(2 sp)
Orthroptera		(1 sp.)

Continued

					(2 sp.)						
			Dythioptera	Mantodae	(sp)						
			Nevroptera		(1 sp)						
					(2 sp)						
			Coleoptera	Meloidae	*Coryna* sp.						
				Coccinelidae	*Cheilomenes lunata*						
			Diptera	Muscidae	*Musca domestica*						
				Syrphidae	1 sp.						
			Heteroptera	Pentatomidae	1 sp.						
			Hymenoptera	Apidae	*Apis mellifera*						
				Formicidae	*Camponotus* sp.						
					Myrmicaria opaciventris						
				Halictidae	*Macronomia vulpina*						
					Lasioglossum sp.						
Gossypium hirsutum	Basga *et al*., 2019	June - November			*Crocisaspidia chandleri*	94.50	27.99	88.79	27.54	36.47	25.37
					1 sp.						
				Megachilidae	*Chalicodoma kamerunensis*						
					1 sp.						
				Sphecidae	*Philanthus triangulum*						
					Sceliphron spirifex						
				Vespidae	*Belonogaster juncea*						
					(1 sp.)						
			Lepidoptera	Nymphalidae	*Charaxes jasius*						
			Orthoptera	Acridae	1 sp.						
					Tettigonia viridissima						
			Coleoptera	Coccinellidae	*Cheilomenes lunata*						
Gossypium hirsutum	Adamou *et al.,* 2020a	June - October (2018) & July - October (2019)		Meloidae	*Coryna* sp.	90.41	24.65	92.28	14.12	21.65	11.33
			Diptera	Calliphoridae	(1 sp.)						
				Muscidae	*Musca domestica*						

Continued

				Syrphidae	*Episyrphus sp.*						
					(1 sp.)						
			Heteroptera	Pentatomidae	(1 sp.)						
			Hymenoptera	Apidae	*Amegilla* sp.						
					Apis mellifera						
				Formicidae	*Camponotus* sp.						
					Myrmicaria opaciventris						
				Halictidae	*Macronomia vulpina*						
				Vespidae	*Belonogaster juncea*						
					(1 sp. 1)						
					(1 sp. 2)						
			Lepidoptera	Nymphalidae	(1 sp.)						
				Pieridae	*Eurema sp.*						
					Papilio demodocus						
					(1 sp.)						
			Orthoptera	Acrididae	*Tettigonia viridissima*						
					(1 sp.)						
Euphorbiaceae Family											
			Order	**Family**	**Genus, species, sub-species**						
			Diptera	Muscidae	*Musca domestica*						
				Calliphoridae	(1 sp.)						
			Hymenoptera	Formicidae	*Polyrachis* sp.						
				Vespidae	*Synagris cornuta*						
Ricinus communis	Douka & Tchuenguem, 2014	September - November	Hemiptera	Coreidae	*Delta* sp.	96	2.81	94.13	90.63	94.66	85.05
					Anoplocnemis curvipes						
			Lepidoptera	Lycaenidae	(1 sp.)						
				Pieridae	*Eurema sp.*						
				Acraeidae	*Acraea acerata*						
				Pieridae	*Catopsilia florella*						
			Orthoptera		(sp. 1)						

Continued

			(sp. 2)
	Odonate	Zygoptera	(1 sp.)

FR: Fruiting Rate; MNS/F: Mean Number of Seeds per Fruit; PNS (%): Percentage of Normal Seeds; sp: undetermined species.

Supplementary 5. Yields according to repeated plant families in the West Highlands agro-ecological zone of Cameroon.

Plants	Years and references	Months	Flora Entomofauna			Impact of flower-feeding insects on the fruit and seed yields of the plants studied					
						Yields			Numerical contributions (%)		
						FR (%)	MNS/F	PNS (%)	FR	MNS/F	PNS
Solanaceae Family											
			Order	**Family**	**Genus, species, sub-species**						
Physalis micrantha	Otiobo *et al.*, 2015b	June - July	Diptera	Drosophilidae	*Drosophila* sp.	65.40	367	98.64	6.63	6.38	0.69
				Muscidae	*Musca domestica*						
				Syrphidae	*Paragus borbonicus*						
			Hymenoptera	Apidae	*Amegilla* sp.						
					Apis mellifera adansonii						
					Braunsapis sp.						
					Ceratina sp.						
					Dactylurina staudingeri						
					Lasioglossum atricum						
					Melipoluna erythra						
				Formicidae	*Camponotus flavomarginatus*						
				Megachilidae	*Megachile* sp.						
			Lepidoptera	Acraeidae	*Acraea acerata*						

FR: Fruiting Rate; MNS/F: Mean Number of Seeds per Fruit; PNS (%): Percentage of Normal Seeds; sp: undetermined species.