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Ecozone biodiversity of selected leaf beetles (Chrysomelidae) on crops and ornamental plants in Southwestern Nigeria

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Abstract
This study investigated the diversity of Leaf Beetles in different ecological zones within southwestern Nigeria. The sampling sites were selected within the mangrove forest, rainforest and the derived savannah ecozones of the region. This study covered the six states of southwestern Nigeria (Lagos, Ogun, Oyo, Osun, Ekiti and Ondo states). Collected specimens were carefully documented and preserved for subsequent mounting and identification in the laboratory. The diagnostic characters of the adults of all the species collected were examined under the dissecting microscope (400x). Palaeontological statistics software package (PAST) was used to analyse the data while Non-parametric t-test was used to interpret the data.
A total of thirty seven species were recorded in the rainforest ecozone. Twenty nine Leaf Beetles species are present in the derived savannah, indicating that this zone is less diverse when compared with the rainforest, in terms of the number of species recorded. There was no species of Donacinae subfamily recorded in derived savannah. Eleven species of Leaf Beetles were recorded in mangrove forest and there was no species of Galerucinae subfamily recorded in the mangrove zone. Distribution of Leaf Beetles is higher in rainforest zone compared to any other zone in the region. This study find out that subfamily Chrosomelinae is the largest in the study area and Galerucinae, Donacinae, and Criocerinae subfamilies are not as large as subfamily Chrysomelinae in the region. The subfamily Chrysomelinae contained 13 species in 10 genera, while Galerucinae had five species in two genera.
The levels of infestation were high for *Callosobruchus maculatus, Bruchidius imbricornis, Lilioceris lilli, Cryptocephalus nitidulus, C. decemmaculatus, Cassida compuncta, Phratora vitellinae, Prasocuris phellandrii and Chrysomela vigintipunctata* in all the ecological zones in the region. This study also documented for the first time, the diversity and host-plant association of Leaf Beetles in the region.

Keywords: Ecozones, diversity, vegetation, host plants, species

Introduction

Ecosystem Biodiversity and its importance Ecosystem diversity relates to the variety of habitats, biotic communities, and ecological processes, as well as the tremendous diversity present within ecosystems in terms of habitat differences and the variety of ecological processes (Biodiversity Unit, 1993) [1]. The attention being paid to the study of biodiversity has led to increasing interest in assessing the diversity of insects and their relatives, because these groups dominate terrestrial and freshwater ecosystems and are valuable indicators of health. Insects are extremely diverse and important to ecosystems (Finnamore 1996) [2]. They have permeated the diverse and essential natural processes that sustain biological systems, making up over 75% of known species of animals. Indeed, our present ecosystems would not function without insects and arachnids (Wiggins *et al.*, 1991) [3]. However, so many species of insects exist that most groups are very inadequately known. For example, only about 34,000 of the 67,000 species of insects and their relatives in Canada have even been described (Danks, 1988) [4], and only some 100,000 of 181,000 in North America as a whole (Kosztarab and Schaefer, 1990) [5]. In some parts of Europe, the state of knowledge is much better: for example, more than 93% of an estimated 24,000 species of British insects are known (Stubbs, 1982) [6]. However in most tropical areas of which Nigeria inclusive, information is very much scanty, and less than 10% of species - perhaps much less - have been described (Stork, 1988) [7].
Invertebrates, and especially insects, are the dominant animals of the rainforest contributing the majority of species, individuals, and biomass, (Corlett and Primack, 2011; Primack, 2014) [8, 9]. Unfortunately, the so-called taxonomic impediment is especially severe in those groups:

Most species cannot be identified and millions are still undescribed due to a shortage of trained taxonomists and curators and a lack of taxonomic knowledge, therefore, an acceleration of biodiversity assessment is necessary.

Scheffers *et al*., (2012) [10] reported that biodiversity study can help to discover and describe species. Their study also reveals patterns of community ecology thorough taxonomic identification which can lead to description of new species. Species identification system is useful in various fields of research and has been used successfully in beetle communities (Baselga *et al*., 2013) [11]. This study made used of gross morphology to investigate the unknown leaf beetle fauna (Coleoptera: Chrysomelidae) in southwestern Nigeria.

Materials and Methods

The Ecozones in the Study Area

This study covered all the three Ecozones in southwestern Nigeria and fall between longitudes 002˚49′ E and 006˚20′ E of the Greenwich Meridian, and latitudes 06˚00′ N and 08˚50′ N of the Equator (Figs. 1). The selection of the study area in this research was based on the type of the vegetation in southwestern Nigeria (Mangrove, Rainforest and Derived Savannah).

The mangrove forest ecozone of the southwestern Nigeria forms a western band from about 6.20ºN to 6.70ºN. Mangrove forest is found in silt-rich, saline habitats of Nigeria, generally along large river deltas, estuaries, and coastal areas. The typical mangrove swamp forest develops on the muddy banks of these creeks where the water is brackish and the number of species is limited by their tolerance to specific environmental condition (Olowokudejo, 1975) [12]. Badagry is located in the mangrove forest ecozone of southwestern Nigeria.

The rainforest ecozone is 91,000 km^2 which is 10% of the land surface of Nigeria according to the work of Happold (1987) [13]. The Rainforest ecozone is characterised with moist evergreen forest and is the wettest region. Through out this zone we have moist semi-deciduous forest that share boundary with the savannah.

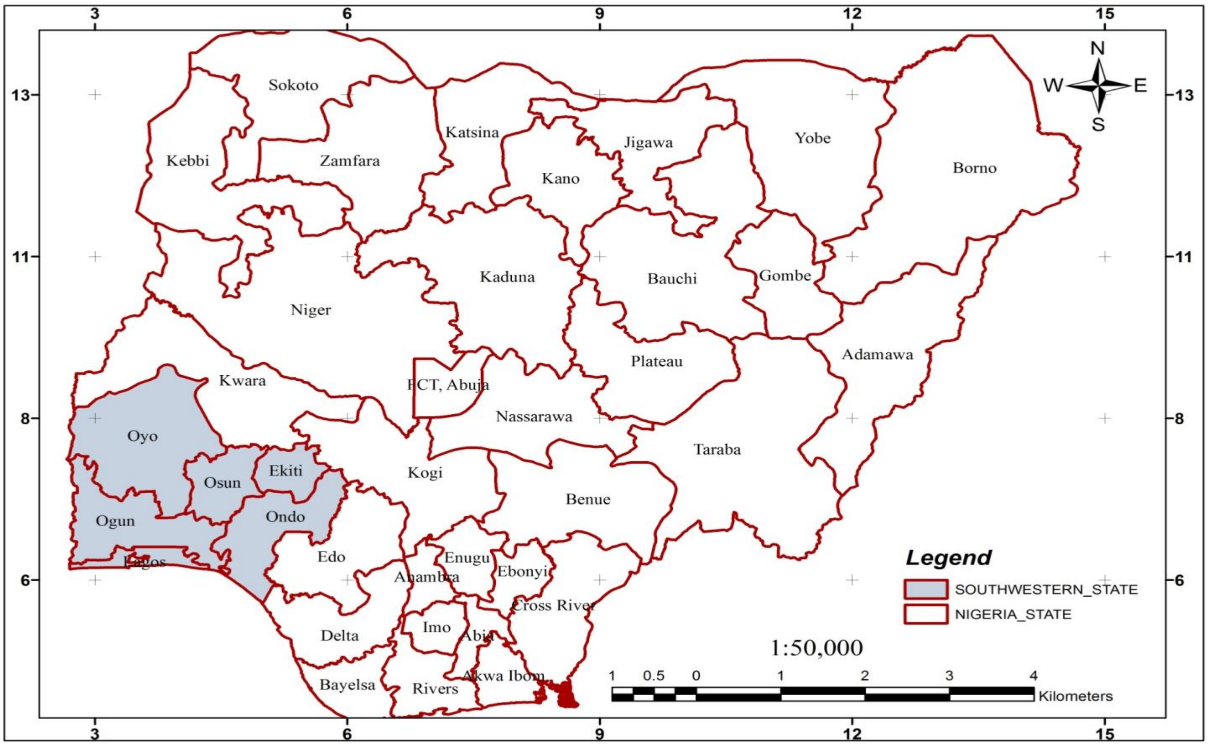

Fig 1: Map of Nigeria showing the study area (Southwestern Nigeria)

Clearing of the rainforest for timbers and farms, and the burning of grasses which have colonized the former forest, have resulted in the formation of an ecozone of ‘derived savannah’ which was formerly part of the rainforest ecozone. The derived savannah ecozone in southwestern is located between 7.50°N and 8.50°N and is towards the southern-most part of the Guinea savannah of Nigeria according to Happold (1987) [13]. The derived savannah ecozone can be also reffered to as transitional forest-savannah ecozone according to the Nigerian Environmental Study/Action Team (NEST, 1991) [14]. It occurs immediately north of the lowland rainforest belt. The derived savannah ecozone covers part of Ogun, Oyo, and Osun States. It covers 75,707 sq km area of land which is 8% of Nigeria (NEST, 1991) [14]. It is the widest ecozone with the value of 240 km.

Sites representing various ecological zones and habitat types (Figure 3) were sampled around Ibadan, Oyo, Ondo, Akure, Ile Oluji, Ado Ekiti, Osogbo, Ikirun, Abeokuta, Ijebu Ode, Ile-Ife, Modakeke, Iwo, Ejigbo, Ikere Ekiti, Ikire, Eruwa, Idanre (rain forest); Ogbomoso, Igbo Ora and Ila Orangun (derived savannah) and Badagry (Mangrove forest). Part of these various localities showing their peculiar features are displayed in Plates 1, 2 and 3.

(A) (B)

Plate 1: A and B are different localities within Rainforest zone

(A) (B)

Plate 3: A and B are different localities within Derived Savannah zone

Collected Leaf Beetles were killed in glass bottles by chloroform or ethyl acetate and stored as dry preparations on entomological pins or glue on sample cards. After collection, the adult specimens were gently transferred into the killing jars containing chloroform ($CHCL_3$) or ethyl acetate as the killing agent. Small sized adult Leaf Beetles collected were mounted on points. Points were made with a point punch which created triangular shaped pieces of card stock. The insect pins went through the wide end of the point and the small insect was glued to the narrow point so that they might be handled and examined with the greatest convenience and with the least possible damage. Driedspecimens were relaxed before pinning, they were remoistened enough to soften so that it will not break when the pin is inserted or so that parts of the specimen may be rearranged or repositioned. The specimens were just relaxed for few hours in the relaxing chamber. The specimens were later transferred into the oven and dried for few weeks under regulated temperature of 35 ºC. Well dried specimens were placed in insect boxes and naphthalene flakes (Camphor) were used to preserve them from pests.

The small sized Leaf Beetles were examined under a dissecting microscope at high magnification so as to reveal minute details of their parts. Specimen identification was performed using the keys Kimoto and Gressit of 1979 [15], Gressitt and Kimoto of 1961 [16] and Warchalowski of 2003 [17]. The collected, preservedmaterials were deposited in the insectariums of Natural History Museum, Obafemi Awolowo University, Ile-Ife, Nigeria. The data was analysed by using Paleontological statistics software package (PAST).

The data generated during this study was subjected to non-parametric t-test and interpreted. Relationships between Chrysomelidae and their host plants were identified on the basis of damages to vegetative and floral parts and the presence of numerous specimens of larvae and other instars. Only host plants from which the insects were collected were presented in this study. Economically important species of Chrysomelidae were particularly identified. Identification of plants was done using herbaria of the Natural History Museum (UNIFEM) and Department of Botany (IFE) in Obafemi Awolowo University and Forestry Research Institute of Nigeria (FHI), Ibadan.

Results and Discussion

Diversity and distribution of Leaf Beetles in southwestern Nigeria

The occurrence of Leaf Beetles in the three ecological zones is presented in Table 1. Rainforest had the highest number of Leaf Beetles species with 37 species belonging to all the six subfamilies recorded in the region. Twenty nine Leaf Beetles species were present in the Derived Savannah and eleven were recorded in the mangrove forest.

Figure 2 shows percentile distribution of Leaf Beetles in Southwestern Nigeria. Eleven species were distributed within 24 percentile in Mangrove zone of southwestern Nigeria. Twenty nine species in derived savannah were distributed with 28 percentile. Thirty seven species in rainforest were distributed with 32 percentile in the region. In Figure 2, C represents Rainforest zone that has the highest percentile of the Leaf Beetles in southwestern Nigeria, B represents Derived Savannah and A represents Mangrove Forest. Figure 3 shows the diversity of Leaf Beetles species in southwestern Nigeria. Rainforest has the highest diversity index of 1 with distribution range of 1. Derived savannah has distribution range of 0.2 with diversity index of 0.8. Mangrove forest has diversity index of 0.3 and distribution range of 0.2. Figure 4 shows the spindle distribution diagram of Leaf Beetles species in southwestern Nigeria. Rainforest has the highest distribution and covered the whole region while mangrove zone has the least.

Table 1: Leaf Beetles in different Ecological zones of southwestern Nigeria

Species of Bruchinae	Ecological Zones		
	A	B	C
Acanthoscelides obtectus		X	X
Callosobruchus maculatus	X	X	X
Bruchidius olivaceus		X	X
Bruchidius imbricornis	X	X	X
Bruchus loti		X	X
Bruchus rufimanus		X	X
Sub Total	2	6	6
Species of Donaciinae			
Plateumaris sericea	X	X	
Macroplea mutica	X	X	
Sub Total	2	2	0
Species of Criocerinae			
Crioceris asparagi		X	X
Lilioceris lilli	X	X	X
Lema cyanella		X	
Oulema melanopus		X	
Sub Total	1	4	2
Species of Cryptocephalinae			
Labidostomis tridentate		X	X
Clytra laeviuscula		X	
Cryptocephalus punctiger		X	
Cryptocephalus nitidulus	X	X	X
Cryptocephalus bipunctatus		X	X
Cryptocephalus decemmaculatus	X	X	X
Cryptocephalus frontalis		X	
Sub Total	2	7	4
Species of Chrysomelinae			
Aspidimorpha westwoodi		X	X
Cassida compuncta	X	X	X
Dicranosterna circle		X	
Gonioctena decemnotata		X	X
Gonioctena olivacea		X	X
Gastrophysa polygoni		X	X
Phratora vitellinae	X	X	X
Prasocuris phellandrii	X	X	X
Phaedon concinnus		X	X
Chrysolina polita		X	X
Chrysolina cerealis		X	X
Chrysomela populi		X	X
Chrysomela vigintipunctata	X	X	X
Sub Total	4	13	12
Species of Galerucinae			
Calomicrus circumfusus		X	X
Longitarsus nigerrimus		X	X
Longitarsus quadriguttatus		X	X
Longitarsus dorsalis		X	X
Longitarsus brunneus		X	X
Sub Total	0	5	5
Total	11	37	29

Legend
A= Mangrove Forest
B=Rrainforest
C= Derived Savannah

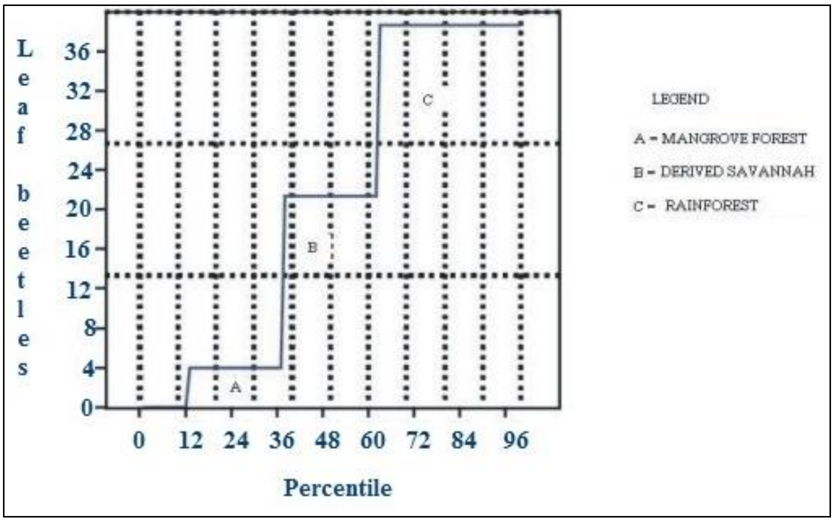

Fig 2: Percentile Distribution of Leaf Beetle species in southwestern Nigeria

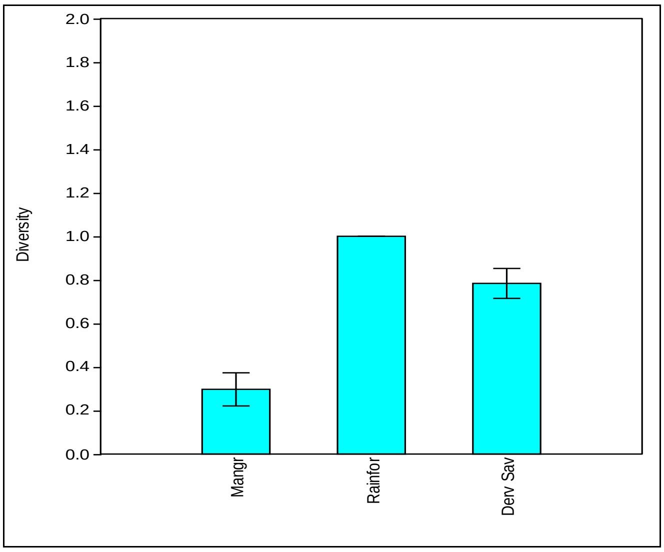

Fig 3: Diversity of Leaf Beetle Species in southwestern Nigeria

Legend
Mangr- Mangrove Forest
Rainfor- Rainforest
Derv Sav- Derived Savannah
X axis- Southwestern Nigeria Ecozones
Y axis- Diversity across the Ecozones

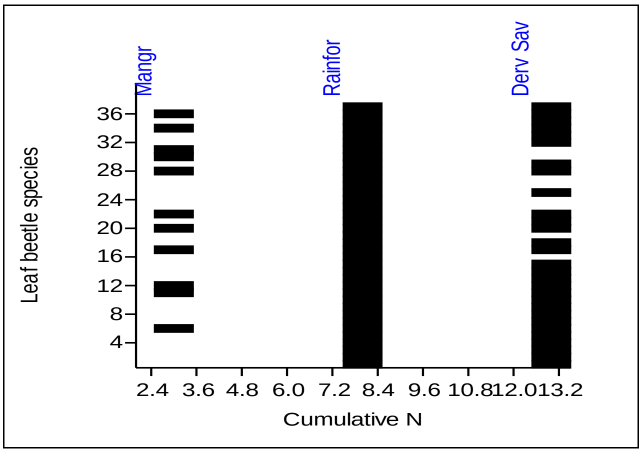

Fig 4: Spindle distribution diagram of Leaf Beetle Species in southwestern Nigeria

Legend
Mangr- Mangrove Forest
Rainfor- Rainforest
Derv Sav- Derived Savannah

The result of paired comparison of subfamily Bruchinae using non-parametric t-test is presented in Table 2. The comparisons between the various ecological zones were not significantly different (P>0.05). Table 3 shows the result of paired comparison of subfamily Donacinae using non-parametric t-test. There were significant differences (P<0.05) between derived savannah versus mangrove and rainforest versus derived Savannah. The comparison between rainforest and mangrove were not statistically different. Table 4 shows the result of paired comparison of subfamily Criocerinae using non-parametric t-test. There were significant differences (P<0.05) between derived savannah versus rainforest and rainforest versus mangrove forest. Only the comparison between mangrove and derived savannah were not statistically different.

The result of paired comparison of subfamily Cryptocephalinae using non-parametric t-test was presented in Table 5. The comparisons between the various ecological zones were not significantly different (P>0.05). Table 6 shows the result of paired comparison of subfamily Chrysomelinae using non-parametric t-test. The comparisons between the various ecological zones were not significantly different (P>0.05). Table 7 shows the result of paired comparison of subfamily Galerucinae using non-parametric t-test. There were significant differences (P<0.05) between derived savannah versus Mangrove and rainforest versus Mangrove forest. Only the comparison between rainforest and derived savannah were not statistically different.

Table 2: Paired comparisons of subfamily Bruchinae in different Ecological Zones of Southwestern Nigeria.

Paired comparisons	Derived savanah	Rainforest	Mangrove
Derived savannah	--	1.0	1.0
Rainforest	0.5	--	
Mangrove	0.56	1.0	--

Table 3: Paired comparisons of subfamily Donacinae in different Ecological Zones of Southwestern Nigeria

Paired comparisons	Mangrove	Rainforest	Derived savanah
Mangrove	--	8.940	0.00024*
Rainforest	2.16	--	.0016*
Derived savannah	0.00031*	0.0023*	--

* indicates probabilities that are significantly different (P ≤ 0.05)

Table 4: Paired comparisons of subfamily Criocerinae in different Ecological Zones of Southwestern Nigeria

Paired comparisons	Derived savanah	Rainforest	Mangrove
Derived savannah	--	0.00020*	7.982
Rainforest	0.00029*	--	.0013*
Mangrove	4.09	0.0032*	--

* indicates probabilities that are significantly different (P ≤ 0.05)

Table 5: Paired comparisons of subfamily Cryptocephalinae in different Ecological Zones of Southwestern Nigeria.

Paired comparisons	Derived savanah	Rainforest	Mangrove
Derived savannah	--	2.0	7.0
Rainforest	0.47	--	
Mangrove	0.83	3.0	--

Table 6: Paired comparisons of subfamily Chrysomelinae in different Ecological Zones of Southwestern Nigeria

Paired comparisons	Derived savanah	Rainforest	Mangrove
Derived savannah	--	3.0	1.3
Rainforest	0.65	--	
Mangrove	0.34	2.0	--

Table 7: Paired comparisons of subfamily Galerucinae in different Ecological Zones of Southwestern Nigeria

Paired comparisons	Derived savanah	Rainforest	Mangrove
Derived savannah	--	7.93	0.00071*
Rainforest	5.13	--	.0052*
Mangrove	0.00023*	0.0041*	--

* indicates probabilities that are significantly different (P≤ 0.05)

A total of thirty-seven species in twenty-five genera of Leaf Beetles belonging to six subfamilies were recorded in southwestern Nigeria as shown in the checklist. The genera of Leaf Beetles collected did not tally totally with the work of Medler (1980) [18]. *Callosobruchus maculatus* was put under Bruchidae family and was not recognised as chrysomelidae in Medler checklist. The present study in the checklist provided has put *Callosobruchus maculatus* in the subfamily Bruchinae of chrysomelidae family. This follows after the findings of Warchalowski (2003) [17]; Borowiec (2006) [19]; and Delobel and Delobel (2007) [20].

Medler (1980) [18] did not classify the Leaf Beetles of Nigeria into different subfamilies but this work has classified the Leaf Beetles recorded in southwestern Nigeria into six different subfamilies. These subfamilies are Bruchinae, Donacinae, Criocerinae, Cryptocephalinae, Chrysomelinae and Galerucinae as shown in Table 1. This study added eight new genera into the existing checklist. The new genera are *Plateumaris*, *Macroplea*, *Labidostomis*, *Dicranosterna*, *Gonioctena*, *Gastrophysa*, *Phratora* and *Chrysolina*. Twenty species that are not in the old checklist were now added to the newly generated checklist produced through this study. The newly added species are *Acanthoscelides obtectus*, *Callosobruchus maculatus*, *Bruchidius olivaceus*, *B. imbricornis*, *Bruchus loti*, *B. rufimanus*, *Plateumaris sericea*, *Macroplea mutica*, *Labidostomis tridentata*, *Clytra laeviuscula*, *Cryptocephalus punctiger*, *Dicranosterna circle*, *Gonioctena olivacea*, *G. decemnotata*, *Gastrophysa polygoni*, *Phratora vitellinae*, *Chrysolina polita*, *C. cerealis* and *Longitarsus quadrguttatus* as shown in the checklist.

The division of southwestern Nigerian Leaf Beetles into six different families (Table 1) was in accord with the work of Kimoto and Gressit (1979) [15], Gressitt and Kimoto (1961) [16] and Warchalowski (2003) [17]. A total of thirty seven species were recorded in the rainforest (Table 1). Twenty-nine Leaf Beetles species are present in the derived savannah, indicating that this zone is less diverse when compared with the rainforest; in terms of the number of species recorded. The reason could be that there are more host plants in rainforest than in derived savannah. There was no species of Donacinae subfamily recorded in derived savannah. Eleven species of Leaf Beetles were recorded in mangrove forest and there was no species of Galerucinae subfamily recorded in the mangrove zone. Rainforest and derived savannah ecological zones were characterized with high number of Leaf Beetles (Table 1) while mangrove forest was characterized by low species number. High temperature in rainforest and derived savannah may contribute to the success of the pests in the zones (Bale *et al*., 2002) [21]. High population of Leaf Beetles recorded in rainforest and derived savannah (Table 1) was as a result of good nutritional quality of the leaves favoured by the climatic factors in the region. For instance, Pedigo and Rice (2008) [22] opined that agronomic practices and climatic factors have contributed significantly to the occurrence of Leaf Beetles as a major pest.

Jolivet *et al.* (1994) [23] showed that high temperatures favour Leaf Beetles development up to a maximum of 33 ºC but the study of Bale *et al*. (2002) [21] proofed that high temperatures alone could not cause the increase in Leaf Beetles population and synergetic effect of high temperatures and rainfall were likely to be responsible. Previous studies by Jaworski and Hilszczanski (2013) [24] and Nahrung and Allen (2004) [25] observed high population of Leaf Beetles during high rainfall months.

The result shown in Table 1 revealed that the levels of infestation were high for *Callosobruchus maculatus, Bruchidius imbricornis, Lilioceris lilli, Cryptocephalus nitidulus, C. decemmaculatus, Cassida compuncta, Phratora vitellinae, Prasocuris phellandrii and Chrysomela vigintipunctata* in all the ecological zones in the region. This agrees with the work of Jones and Withers (2003) [26]. It was observed that Leaf Beetles attacked major crops and ornamental plants in both rainforest and derived savannah ecozones in the region. At the same time, these results indicate that the Leaf Beetles infestation is influenced by the characteristics of each geographical area.

The rainforest has the highest diversity index of 1 (Figure 3) with distribution range of 0 that is relatively lower to the distribution range of 0.6 found in derived savannah ecozone. Higher temperature and vegetation type in derived savannah zone favours wide dispersal of Leaf Beetles (Jaworski and Hilszczanski, 2013) [24]. This ecozone is characterised by forest and grasses, the people in the area are majorly into mixed farming involving crop production and animal rearing. The activities of the farmers combine with the effect of global warming in this area, also contributing to vast dispersal of Leaf Beetles (Menéndez, 2007) [27]. Therefore, further studies are necessary to properly determine the dispersal potential of each Leaf Beetles species in derived savannah ecozone. Leaf age may be another factor responsible for the wide distribution range of Leaf Beetles in rainforest and derived savannah in southwestern Nigeria. Most plants in these zones produce young shoots especially in dry season and new leaves emerge in the following wet season. This assertion is supported by the works of Wagner (1998) [28]; Flowers and Hanson (2003) [29]; and Charles and Basset (2005) [30] who noticed decline in egg production with leaf age in many Leaf Beetles species.

The spread of some Leaf Beetles species like *Callosobruchus maculatus* are connected with human and the risk of spread increases with frequency of movement. This is in accord with what was hypothesized by Beck and Blumer (2011) [31] that when Leaf Beetlesare introduced via human activity, they are clumped where their most preferred host plant in that area is located. Menendez (2007) [27] also pointed out that the spread of Leaf Beetles have been found to be connected to human traffics.

High percentage of Leaf Beetles that was observed in derived savannah and rainforest ecozones (Figures 3 and 4) could be as a product of human activities, rainfall, high temperature and flush of new leaves. This was attested to with the highest value of diversity index 1 with distribution range of 0 for the rainforest ecozone; derived savannah have diversity index of 0.8 with distribution range of 0.6 and mangrove forest zone have diversity index of 0.3 with distribution range of 0.6 (Figure 3). Higher temperature in derived savannah favoured its wide range but less rainfall in this same ecozone is responsible for the fall in the diversity index when compared with the rainforest (Figure 3).

The comparisons of subfamily Bruchinae within the three different Ecological Zones in the study area were not statically different (P<0.05) as shown in Table 2. This could be as a result of the fact that Bruchids are mostly invasive species and can quickly spread out to cover all the ecological zones (Anton, 2010; György and Germann, 2012) [32, 33]. The comparisons of subfamily Donacinae between derived savannah versus mangrove and rainforest versus derived savannah were significantly different (P<0.05). The comparison between rainforest and mangrove were not statistically different (Table 3). Human activities like bush burning and over grazing that are predominant in the derived savannah could contribute to reason why subfamily Donacinae are not found in the zone because this subfamily have been reported by Odum and Herald (1975) [34] to be water loving beetles that will like to be in cool humid environment. The comparisons of subfamily Criocerinae between derived savannah versus rainforest and rainforest versus mangrove were significantly different (P<0.05). However, the comparison between derived savannah and mangrove were not statistically different (Table 4). The comparisons of subfamilies Cryptocephalinae and Chysomelinae within the three different Ecological Zones in the study area were not statically different (P<0.05) as shown in Table 5 and 6 respectively. This study finds out that both Cryptocephalinae and Chrysomelinae subfamilies were indifferent to all the ecological zones in the study area. This could be as a result of the fact that most of the members of these subfamilies are invasive species (Wittenberg *et al*., 2006) [35]. The comparisons of subfamily Galerucinae between derived savannah versus mangrove and rainforest versus mangrove were significantly different (P<0.05). Only the comparison between rainforest and derived savannah were not statistically different (Table 7). The significant variation that was observed could be genetic. Genotype is likely to play a major role in Galerucinae distribution in the region. Some species of Leaf Beetles can adapt very well in derived savannah and rainforest whereas no species of subfamily Galerucinae can cope with high salt content combined with low temperature of the mangrove environment. This was in accordance with the findings of Jackson *et al.* (2003) [36].

This study find out that subfamily Chrosomelinae is the largest in the study area; Galerucinae, Donacinae, and Criocerinae subfamilies are not as large as subfamily Chrysomelinae in the region. The subfamily Chrysomelinae contained 13 species in 10 genera, while Galerucinae had 5 species in 2 genera. This trend is similar to what occured in other part of the world (Flowers and Hanson, 2003; Gressitt and Kimoto, 1961) [29, 16].

Conclusion

This study revealed that six different subfamilies of Leaf Beetles were present in southwestern Nigeria (Bruchinae, Donacinae, Criocerinae, Cryptocephalinae, Chrysomelinae and Galerucinae). A total of thirty seven species were recorded in the rainforest. Twenty nine Leaf Beetles species are present in the derived savannah, indicating that this zone is less diverse when compared with the rainforest, in terms of the number of species recorded. There was no species of Donacinae subfamily recorded in derived savannah. Eleven species of Leaf Beetles were recorded in mangrove forest and there was no species of Galerucinae subfamily recorded in the mangrove zone. Distribution of Leaf Beetles is higher in rainforest zone compared to any other zone in the region.This study find out that subfamily Chrosomelinae is the largest in the study area and Galerucinae, Donacinae, and Criocerinae subfamilies are not as large as subfamily Chrysomelinae in the region. The subfamily Chrysomelinae contained 13 species in 10 genera, while Galerucinae had five species in two genera.

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