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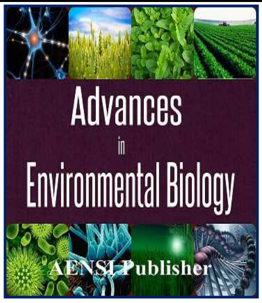

Study of the temporal distribution of oribates in an orchard of apple trees (Variety HANA) in the region of Boufarik (Algeria)

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ABSTRACT

Biodiversity is currently a major challenge for research in ecology, both regarding its role in the ecosystem, its determinism and promoting it field of preservation of the environment .It measures the variability of living organisms in ecological systems. Composition and community activity are affected by interactions climatic factors. Indeed, the richness and complexity of these communities retrace the historical and biogeographical events of the environment and ecological factors available. These communities can however, learn about the integrity or degree of deterioration of the environment and thereby constitute a basis for studies of ecosystems and their evolution. the acarologic currently a very important tool for the characterization of the environments. The results of this study confirm this. Indeed, climate factor considered in this research showed an influence that can be judged very important for the survey staff during the four years of analysis varies from one year to another. There were an average density of 15644 ind / m^2 in 2011, 22933 in 2012 ind./m^2, 17600ind./m^2 in 2013 and 10133ind / m^2 in 2014. The wealth, for its part, has a low variation. It is 16 species for the years 2012 and 2014, 15 species for the year 2011 against, in 2013; the value is only 11 species. The change in the number and wealth are felt even on the scale of months and seasons. Indeed, the monthly values recorded in the years 2011, 2012 and 2013 shows that the development of Oribatida displays an early increase from the month of the spring season and peaked during the months of summer. However, the lowest values were found during the winter months december and January in particular that seem to coincide with the lowest temperature values of the year and an abundant rainfall. This trend seems to be controversial for 2014 where we see that there is the same level of population since January until May when the maximum value is recorded then a population decline to reach the minimum value in the months of August to September and a slight increase until November. This may reflect the effect of climate change that can significantly influence the structure of the oribatida community. The study consists in estimating the population of Oribates in an orchard of apple trees during four years of studies (2011-2014). Monthly statements made during this period we allow to follow the evolution of the wealth and the abundance of the species according to the climatic variations raised at the level of the station.

KEYWORDS: Ecological factors, Density, Oribatida, Climate change, Environments.

INTRODUCTION

The relation between biodiversity and functioning of the ecosystems stood out as a major theme of the sciences of the environment during the last twenty years. According to [4] global climate change (GCC) significantly affects distributional patterns of organisms, and considerable impacts on biodiversity are predicted for the next decades. Inferred effects include large-scale range shifts towards higher altitudes and latitudes, facilitation of biological invasions and species extinctions. During recent climate warming, many insect species have shifted their ranges to higher latitudes and altitudes [17]. According to [12] Climate change is at present considered as one of the gravest threats put in the development, with significant impacts on the economy of developing countries and ways of life of the poorest populations of the planet.

The climate change is probably one of major challenges of the next decades for the biodiversity. The biodiversity is at present a major stake in the research in ecology, at the same time concerning its role in the ecosystems, its determinism and its valuation in the field of the environmental protection [31]

[4] noted that the effects of climate change at the most fundamental level of biodiversity—intraspecific genetic diversity—remain elusive. Here we show that the use of morphospecies-based assessments of GCC effects will result in underestimations of the true scale of biodiversity loss. Species distribution modelling and assessments of mitochondrial DNA variability in nine montane aquatic insect species in Europe indicate that future range contractions will be accompanied by severe losses of cryptic evolutionary lineages and genetic diversity within these lineages. These losses greatly exceed those at the scale of morphospecies. We also document that the extent of range reduction may be a useful proxy when predicting losses of genetic diversity. Our results demonstrate that intraspecific patterns of genetic diversity should be considered when estimating the effects of climate change on biodiversity.

The highlighting of possible relations between the biodiversity and the functioning of the ecosystems can be made only if there is beforehand a standardization of the methods of measure which are multiple according to the type of indications and the groups taxinomics used [11]. Furthermore, the information brought by its various measures of the biodiversity is variable and if numerous works indicated the diagnostic value or the description of the structures, very few authors tried to measure the value forecast regarding consequences for the ecosystem. The recent scientific experiences attribute to the ground of numerous functions in the biosphere, the lithosphere, the hydrosphere and the atmosphere. These functions allow including the stakes which grounds represent for the individuals and the human societies through their activities. The ground allows the production of biomass which maintains the life, supplies with the renewable energy and contributes, consequently in the smooth running of the food chain and the cycle of the water as well as the recycling of the organic matter via an outfit of species of which are a part arthropods and particularly oribates. The latter are the most frequent in the ground as show it the works of [25], [37,7], They are observed in diverse housing environments tree-dwelling as in barks and tree trunks [21,28,29], in leaves and stalks [30,37], in mosses, lichen and other covers epiphytic corticols [30, 1] and in accumulations of organic compounds [24,42,5,41] The abundance, the composition and the activity of the community are affected by the interactions between the climatic factors, the nutritional support and the community of decomposers. These factors are the important regulators of the decomposition and the liberation of nutriments [35,27] . The specific wealth and the complexity of these communities redraw the historic and biogeographical events of the environment as well as the available ecological factors [14]. They can however inform about the integrity or the degree of change of the environment and establish of this fact a base for the studies of the ecosystems and their evolution. They can supply indications and presence or absence of certain species inform about the quality of the environment [21,14 ,13] notes that the group of oribates presents fundamental characteristics which allow to indicate the various environmental changes. Its characteristics are widely mentioned in the works of [20,6, 16]. According to the aforesaid authors, the behavior of oribates can be used to indicate the effects of a chemical pollution or heavy metals and disturbances in the process of decomposition. [13] thinks that oribates constitutes a very promising group because he can be used for purposes of indication diverse.

The objective of the present study is to see the evolution of the temporal populations of Oribates according to the climatic variations of the region , it aims at studying the impact of the annual and seasonal variations of the climate on the structure of the populations of oribates on plan wealth and abundance. She also handles the behavior of the species towards these climatic variations.

Presentation of the region of study:

The present study was realized at the level of the region of Boufarik which situated in the center of the plain of Mitidja and has about 5000 Ha. it is bounded in the North by the sahel, in the East by the municipality of Birtouta and Chebli, in the southeast by the municipality of Oued El Alleug, in the South by the municipality of Somaa and in the southeast by Blida. it is situated in 25 km of Algiers and is at a height of 49m and its geographical address and phone coordinates is: 36°28 ' in 36°40'N and 2°43 ' in 3°09 ' E. This region is situated in the bioclimatic floor subhumide in soft winter.

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Fig. 1: presentation of the regions of study

Methodology:

Our study was realized in the region of Boufarik at the level of an orchard of Apple tree of variety Hana, a surface of 2 ha, crashed in 1990. The orchard is left with the plentiful only a size of formation and addition of some organic and mineral amendments are applied .Il is to indicate that no phytosanitary treatment is applied.

The takings are made at the level of the station during every month since January, 2011 until December, 2014. The plot of land is divided into 14 equal blocks. Every block consists of 25 trees of apple tree. The tree of the middle of every block is retained to make the sampling. Every taking is made on a square of 15 cm aside and from 10 to 15 cm deep. The extraction of the acarologica fauna is realized by to the technique of Berlese [9].

Results:

The results obtained during the present study during four years 2011-2014 are treated in this party. The analysis of the variation of the density according to the years as well as the various indications will be the object of the first part.

Density:

The values of the density registered during the years of studies are represented in the present graph

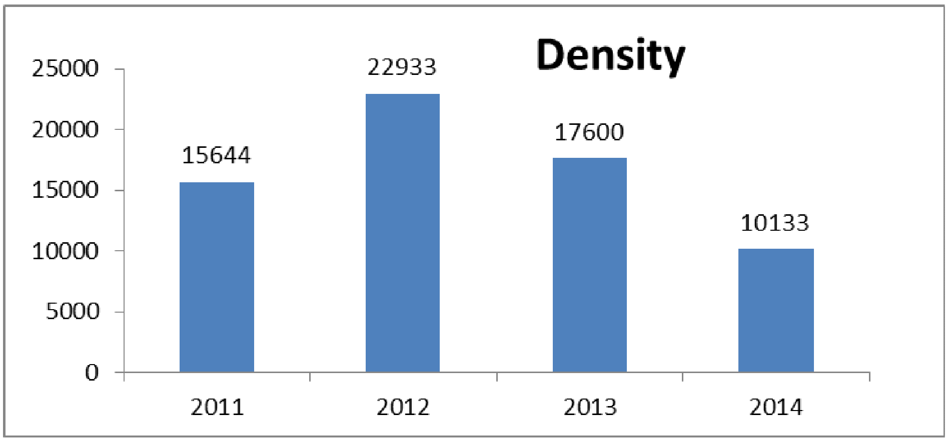
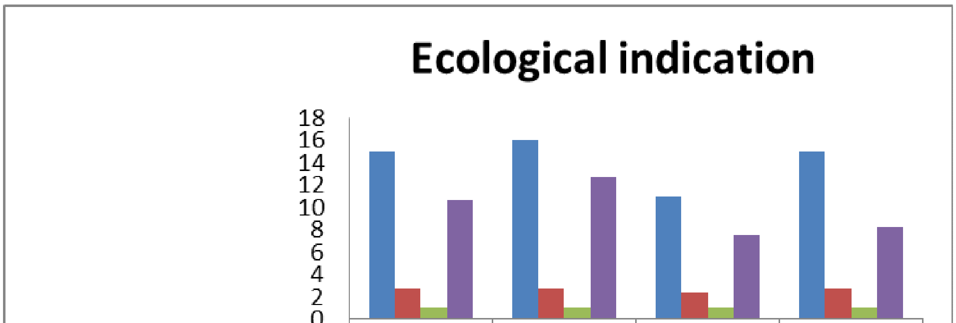


Fig. 2: The annual evolution of the density of the species of Oribates collected at the level of the station of study during the period 2011-2014.

The values of the density registered during this period 2011-2014 show a big variation and this seems in perfect correlation with the climatic variations. The pluviometry seems the factor determining in the spatiotemporal distribution of oribates at ground level. Indeed, this last year, the pluviometry knew many variations what influenced considerably the development of oribates. According to the graph above, year 2012, seem the most convenient with a density of 22933 ind / m^2 then we find year 2013 with 17600 ind / m^2. In the third position we find year 2011 with 15644 ind / m^{2}et in denier we have year 2014 with 10133 ind / m^2. We have to , however, note that the value of the density noted during year 2012 is more than the double of that noted in 2014.



	2011	2012	2013	2014
Richesse totale	15	16	11	15
Indice de Shannon (Bits)	2,7	2,77	2,39	2,7
Equitabilité	1	1	1	1
Richesse moyenne	10,58	12,66	7,58	8,25

Fig. 3: Values of the total wealth, the indication of Shannon-Weaver and the equitability registered in the station of study during period 2011-2014

-Total wealth:

The ecological conditions which reign in the station having been the object of this study show themselves little different. Indeed the number of meditative species shows very important differences. Indeed the spicy values are practically the same during the years 2011, 2012 and 2014et are respectively 15, 16 and 15 species. However during year 2013 this wealth showed a clear regression and the spicy value is 11 species.

- Average wealth:

The registered average wealth presents a variability regarding value. Year 2012 shows the strongest value with 12.66 followed by year 2011. 2013s and 2014 show most values with respectively 7.58 and 8.25.

-Indication of diversity of Shannon:

The values of the indication of diversity of Shannon-Weaver (Fig.3) obtained are lower for the greater part than 3. This means that the middle which was the object of this present study a low wealth. Years 2011,2012 and 2014 present practically the same value while year 2013 is characterized by the weakest wealth. According to [10] a community will be diversified all the more as the indication H' will be greater. We can note, however, that the wealth is important in the stations where the ecological conditions are better. The seasonal variation of the values of the indication of diversity of Shannon - Weaver is practically the same that the global values. They are lower for the greater part than the value 3. But between the various seasons, the most removed values are registered during the spring season.

- Equitability:

The values of the equitability registered during the various years are equal to 1 what means that the species during the years of studies are balanced between them.

- Monthly and seasonal variation of the species of Oribates:

The monthly results raised during this study during period 2011-2014 are presented in the following graph.

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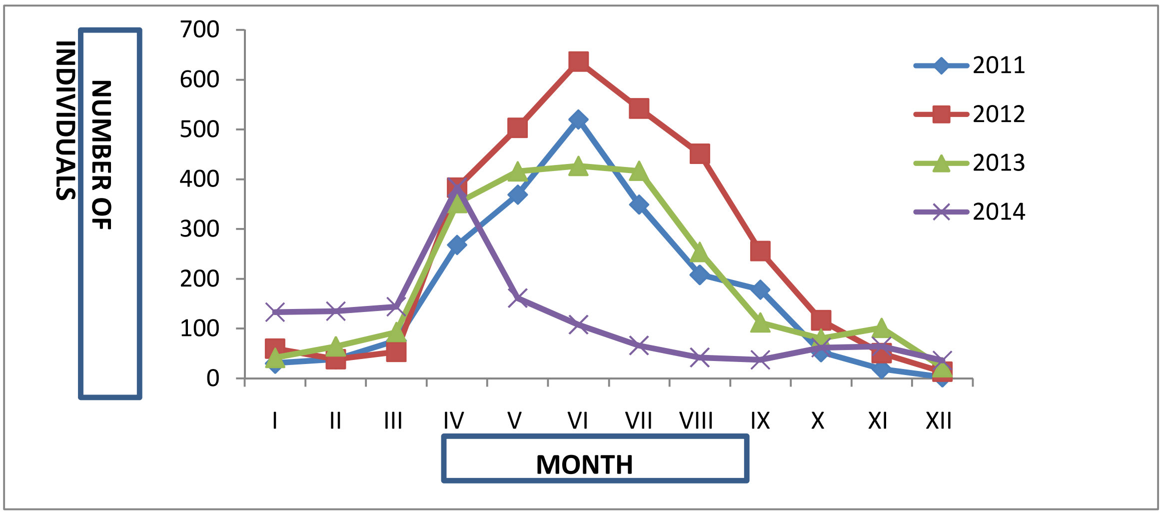

Fig. 4: Monthly evolution of the species of Oribates collected during four years (2011-2014) in the region of Boufarik

It is to notice that the weakest effectives are raised during the months of autumnal and wintry period then the most important effectives is noted during the months of the spring and summery season. However, this evolution of staff differs from one year to the next. 2011s and 2012 present the same tendency. Indeed we notice that effectives registered during these two years are very weak during the months when the temperatures are very low and the maximum is raised during June when the values of the temperature are the most clement. 2013 and 2014, present differences.

Year 2013, presents practically the same tendency as on the previous two years except that the effectives of the meditative oribates show a development since half of March until in the middle of August and this is probably due to weather conditions raised during this year.

Year 2014 posts values relatively more important during the months of wintry period and a maximal effective during April then we note a fall of this value until October. The evolution of the effectives of Oribates posts a tendency totally different from that raised during the first three years

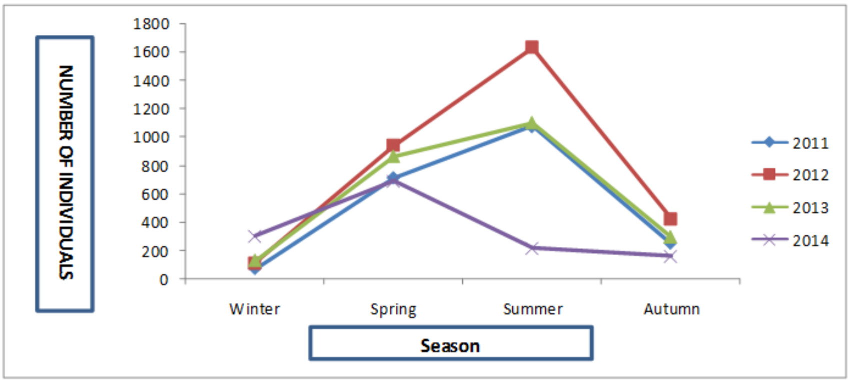

Fig. 5: Seasonal evolution of oribates collected at the level of the station of Boufarik during the years 2011-2014

The seasonal evolution of oribates been during these four years of studies shows that the acarologique fauna at ground level present a regressive tendency and it perfect correlation with weather conditions (Fig.5). Their development is convenient between the temperatures 17 and 26°C and a very weak pluviometry. However year 2014 shows itself different as for the dispersal of oribates. It tends to be almost identical during the year in particular the year and this in correlation with the values of the pluviometry and the temperature registered during this year.

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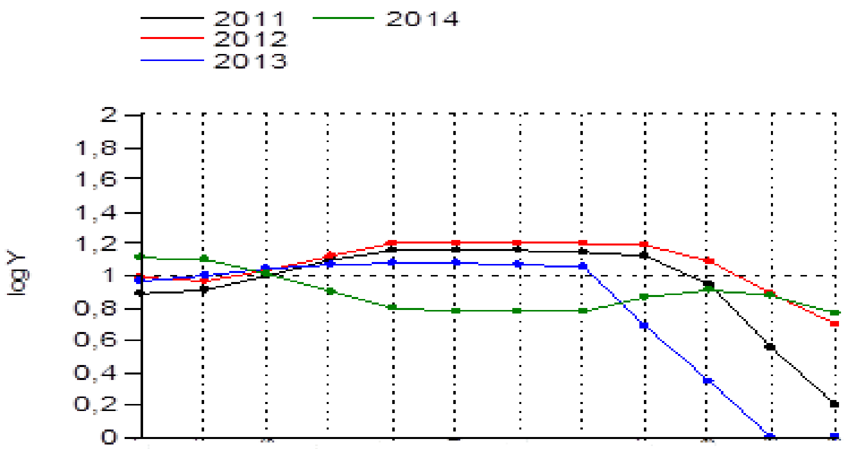

Fig. 6: Monthly evolution of the size of the species collected taken in at the level of the station during period 2011-2014 (EXCEL STAT TEST)

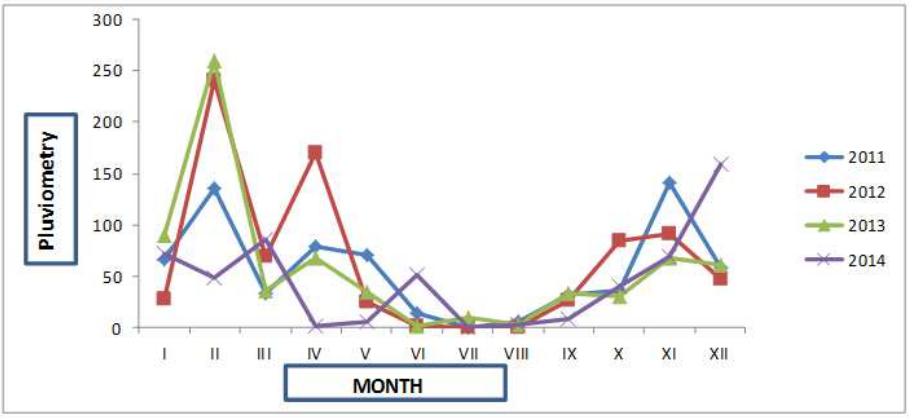

Fig. 7: Pluviometry of the region of study during the period 2011-2014

The comparative analysis of the monthly evolution of oribates and that of the pluviometry shows the impact of the latter on the temporal dispersal of acarids at ground level. We notice that the pluviometry affects considerably the presence of Oribates. We note that in the presence of heavy rain, oribates tend to disappear, then they reappear with rather important values but during year 2014 the situation appears differently. Indeed, during this year, the pluviometry registered during the months seems less important, what influenced considerably the monthly distribution of oribates. The availability of the humidity at ground level seems a determining factor.

We can also note that year 2014 is a hot year because the spicy values are higher for the greater part compared with the other years. This stressed the low rate of humidity at ground level.

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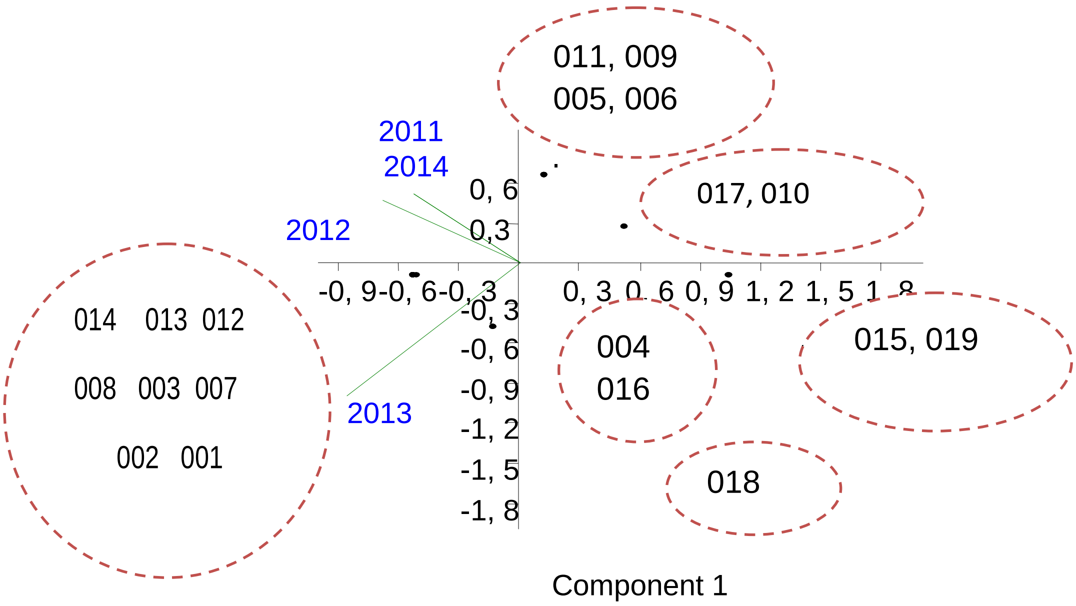

Fig. 8: Distribution of the species of Oribates according to the years

According to the AFC, the temporal distribution of the species of Oribates allowed to distinguish two periods. The first one is constituted by years 2011, 2012 and 2014 which seem to present a big affinity as for the distribution of the acarids of the ground. The second is constituted by year 2013. However the distribution spread out by oribates in the time shows that year 2013 is the richest.

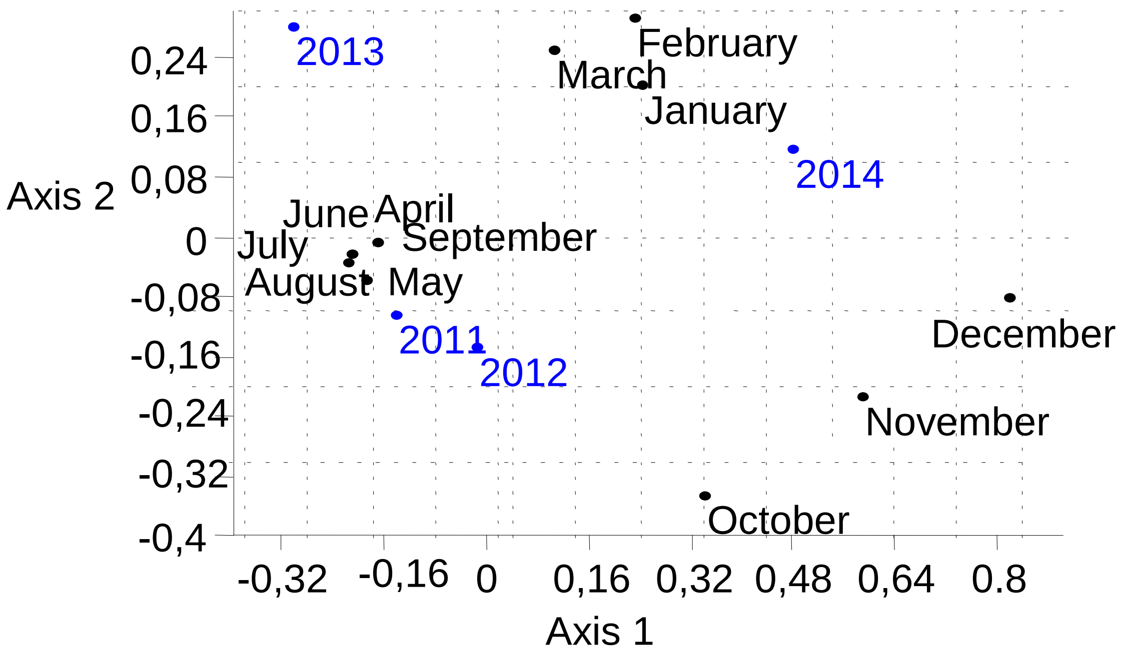

Fig. 9: Monthly distribution of the acarids of the ground according to the months during period 2011-2014

According to the graph above, we note that oribates posts a different monthly distribution according to the years. Year 2013 posts a uniform distribution during all year with the exception of October, November and December when the conditions are unfavorable.

2011 and 2012 show that the wealth of oribates is much more refined during the months when the temperatures are relatively more important in particular the months of the spring and summery season with a light appearance of acarids during the months of the autumnal season.

Year 2014, however posts a tendency against that presented during the other years. Indeed, the effective of oribates seems more important during the months of the winter season. This tendency posts, it seems the beginnings of a climate change.

Discussion:

The temperature of the ground acts on the physical phenomena such as the retention and the circulation of the fluids (water, gas), but also on the chemical transformations (the speed of the reactions is a function of the temperature) [25]. At the biological level, she acts on the distribution of the species, in the time and in the space, according to their ecologies. It also influences the general activity occurring in the interspecific relations (ex: competition).

The effects of the temperature are dominating in the first centimeters where are gathered the majority of the representatives of the pédofaune [25]. During "extreme" temperatures (high or low), which can be fatal it, the fauna arranges several means of adaptation: thermal regulation (relatively limited to invertebrates hétérothermes), a passage lives on it slow (diapause, hibernation) or still the migration towards a favorable middle (often in depth).

During this study, the number of collected Oribates differs from one year to the next. We listed an average density of 15644 ind / m^2 en 2011, 22933 ind. / m^2 in 2012, 17600 ind. / m^2 in 2013 and 10133 ind / m^2 in 2014. The wealth, as for it, posts a low variation. It is 16 species for 2012 and 2014, 15 species for year 2011 on the other hand, in 2013, the posted value is only 11 species.

We can note that the values of the density raised during this study are relatively very high and are comparable to those obtained by [33] who notes that the current values of the density of oribates at the level of the litter vary from 7875 to 17 875 ind / m^2. However, it is necessary to note that the wealth registered in the present work is relatively very low compared with that noted by [33] whose posted value is 55 species.

[39] noted that plant species vary in palatability to consumers as well as quality and quantity of litter they produce. In the present study, the quality notion of the litter presents no effect of the fact that we realized our sampling at the level of the same site during four years.

The density and the specific wealth of oribates evolve in an middle under the influence of two important factors in particular the climatic variations and the support nutritional as it was demonstrated by [34] who noted that the presence of these soil organisms, particularly acarofaune depends directly on the nutritional substratum and [15,40,13] show that The temperature can induce a change in the structure of the community of Oribatida.

The monthly evolution posted by the results obtained during the years 2011,2012 and 2013 shows that the development of oribates posts the beginning of increase from the months of the spring season and reaches their maximum during the months of the summer season. However, the weakest values are raised during the winter months in particular in December and January which seem to coincide with the lowest values of temperature of the year and a very plentiful pluviometry. This period seems to be unfavorable for the development of acarids. It is then about a stage of rest which is useful for the seasonal control of the life cycles where a shape of quiescence which arthropods adopt for their survival in environmental conditions unfavorable as it was underlined by [8] who notes that the type of quiescence, who arises as a direct answer to the environmental conditions unfavorable to any stage of the life cycle and the respite just after the elimination of the unfavorable factors. The control of the seasonality of life cycles is activated not only by the diapause, but also by certain forms of quiescence, in particular by quiescences post--diapause noticed by the entomologists [18,19], is underlined by the acarologie [36]. According to [8] the combination of diapause and rest post--diapause, characteristic of numerous acarid existing acariformes, corresponds to the ancestral initial state of dormancy in the adaptations (in particular Oribatides) to environmental changes.

For year 2014, the populations of Oribates post another evolution indeed one notice that there is the same level of population since January until May when the maximal value is then recorded a decline of population to reach the minimal value during August-September then a light increase until November.

The seasonal variation of the populations of Oribates observed during this study seems to post a new tendency with a maximal growth during the summer season during the years 2011, 2012 and 2013 on the other hand in 2014 the registered value shows a change as for the development of oribates in the course of which this study was led and the minimum is raised during the autumnal and wintry seasons.

These two observed forms of seasonal variation seem to be contradictory. The first shape of year 2014 seems to be confirmed by numerous works. Indeed, according to [13] , soil moisture is one of the most decisive factors affecting the life of Oribatid communitie. [3] showed that the density of Oridates in samples of ground was much bigger in the rainy season than during the dry season. [23] noted that the moisture content was a key factor affecting the wealth of oribates, but its effect to vary between the seasons. [2] Mite populations were very low in all plots during the dry season (500–3000 m^2), compared to those during the wet season (10 000–30 000 m^2). The highest mite population was observed in Gliricidia plots (3 044 m^2) for the dry season and Leucaena plots (30 240 m^2) for the wet season. However, 2011, 2012, and on 2013, post a contradictory tendency compared with the works brought back above.

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The incidence of the climatic variations seems to have a relatively important effect. Indeed, the climatic data registered during these four years (2011-2014) show a different evolution and we can notice that there is a sign of drought which announces. The values of the pluviometry and the temperature posted during 2013 and 2014 show differences with those registered during 2011 and 2012. During these last two years, the pluviometry seems important during winter, spring seasons and autumnal and almost nobody in summer. On the contrary, during 2013 and 2014, the pluviometry seems relatively less important during the seasons wintry spring and autumnal and we notice for the year 2014 that the seasonal effect appears hardly because the curve relative to the pluviometric given posts almost a tray with a light increase in winter the same plan is observed for the evolution of the temperature.

According to [8] ; the main function of quiescence to arthropods concerns their survival in unfavorable environmental conditions, because of the high general and specific tolerance obtained in this state, whereas the stages of rest are hardly capable of being useful for the seasonal control of life cycles. However, such an opinion concerns only the most current typical of quiescence, which arises as a direct answer to the environmental conditions unfavorable to any stage of the life cycle and the respite just after the elimination of the unfavorable factors.

These conclusions are completed by the declaration today that the control of the seasonality of life cycles is activated not only by the diapause, but also by certain forms of quiescence, in particular by quiescences post--diapause noticed by the entomologists[18,19] and underlined by an acarologist [36]. The most important conclusion is that the combination of diapause and rest post--diapause, characteristic of numerous acarids acariforme existing, corresponds the ancestral initial state of dormancy in the adaptations (in particular oribates) to environmental changes.

Conclusion:

We note that the presence of oribates in the studied station is variable from one year to the next. This difference is sometimes very pronounced and that the factor temperature is determining as for this temporal distribution.

The wealth which posted big differences shows that the ground where this study was led is less convenient as for the development of oribates. This can give some explanation, probably by a poverty of the nutritional support. We can however note that year 2013 shows itself even more unfavorable. However, we can conclude that the duration in the course of which this study was realized is far from informing us about the effect of climate change and its impact on the development of oribates in middle. We can note still that the climate is not the only factor which influences the presence or the absence of oribates in middle but there is good reason raised, in particular in an agricultural middle, the effect of the cultural works which influence the structure of the ground and the phytosanitary products the impact of which is underestimated until now.

In prospect, we wish that similar studies are realized by taking into account particularly the factor time which has to be as prolonged as possible and also environmental factors.

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