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Article

Weed plants diversity under Ziban palm groves' ecosystem. Algerian Sahara

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Abstract : The current study highlights some knowledge on the importance of weeds plants in Ziban oasis ecosystem in Biskra region. In total, 300 species were sampled with dominance of dicots (250 species) where Asteraceae (40 species) were dominants. Monocots include 50 species, mainly represented by Poaceae (30 species). The biological spectrum was dominated by annual species (75%) in comparison to the biannual and perennial species. Their distribution varied according to seasons and sampling sites from palm groves, it was greatest at El Kantara palm grove (170 species) and Ain Ben Noui palm groves (130 species) followed by far by Sidi Okba (98 species) palm groves. Their distribution according to seasons was marked by the significant average richness during spring (4.3) and summer time (2.7), while it was lowest during autumn (0.8) and winter period. Results of ecological analysis indicate that the most abundant species was from Caryophyllaceae, Brassicaceae and Fabaceae families.

Keywords : Biodiversity; weeds plants; Ziban palm groves; Distribution; Diversity.

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1. Introduction

In Algeria, the three main components of biological diversity that are flora, fauna and natural habitats are threatened, despite the existence of abundant legislation of Environmental Protection Compliance [1,2]. Each habitat has its own fauna and flora [3]. Because agricultural ecosystems are common habitats for biodiversity [4], an oasis is a typical agro-ecosystem that provides a microclimate "oasis effect" for plant and animal biodiversity [5,6,7], the presence of spontaneous vegetation which plays an important biological and ecological roles include a natural heritage of annual plants, biannial or perennial. They have been forced over the time to develop techniques and mechanisms to survive in the most hostile conditions and to compensate for their immobility [8].

Due to the ignorance of spontaneous plants state under oasis ecosystem conjugated to the climate change effect in recent years, knowledge, classification, characterization and conservation of weeds plants in the oasis of Ziban constitute a scientific priority.

For this purpose, our study has objective to know the current state of weeds plants, to highlight their ecological importance, their biological diversity and distribution under oases seasonal conditions.

2. Materials and Methods

2.1. Description of sampling area

Due to its geographical position and its climate, the Biskra region groups together diverse geomorphological elements: mountains, plains and depressions. At the southeast of Algeria, Biskra region (34°, 48' N and 5°, 44' E) is limited by Batna to the north, M'Sila to the North-West, Khenchela to the North east, El Oued and Ouargla to the south and Ouled Djellal to the Southwest (Figure 1). The relief is divided into four large groups:

at the north, a small mountainous area; plateau in the West; the plains to the east, depressions characterized by the presence of saline lakes in the southeast [9]. During our study, the region was characterized by 80.27 mm of total precipitation and a medium of temperature between 5, 5°C (December) and 40,5°C (July). In order to study the characteristic flora in the region, program of survey was performed at three choosing palm groves (Table 1).

Table 1. Palm groves' geographical situation

Palm groves	Geographical coordinates	Situation
Ain Ben Noui	34°48'28.37"N, 5°39'12.91"E	8 km to the west of Biskra city
El Kantara	34°13'28,83"N, 5°42'12,84" E	20 km to the North of Biskra city
Sidi Okba	34°45'33,69"N, 5°53' 14,74" E,	30 km to the Est of Biskra city

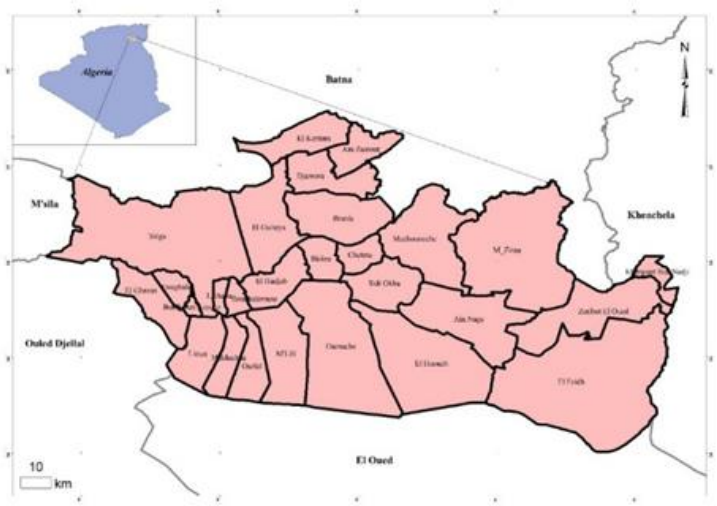

Figure 1. Geographic location of the region and study site [10]

The observation of plant species is often linked to the concept of minimum area [11, 12]. In cultivated area, several authors [13,14], consider that, outside of discontinuities of edaphic order, a plot not too large represents relatively homogeneous unit that may affect the development of species. In our study, a homogenous floristic sampling on representative surface of minimum 100 m² [11,15] was performed with taking into account the variability of ecological factors and agronomic traits [16,17]. In each palm groves, monitoring, sampling and counting of weed species were carried out in a plot of 1ha where it was placed quadrats of 1m2 randomly distributed on 5 transects 10m spaced (Figure 2).

Figure 2. Sampling weeds plants' Method under palm trees

2.2. Data analyses

The identification of collected weed species during flowering (presence of flowers or inflorescences), was done based on dichotomous determination keys for families and species of [18], [19] and [20]. The nomenclature has been updated using Tela-Botanica, available at URL http://www.tela-botanica.org. For data entry and interpretation, species were coded according to BAYER's international 5-letter mnemonic indicator published in 1992 [21].

2.3. Sampling methods

To characterize spontaneous flora under palm groves, environmental indices; total richness S= + sp1 sp2 + sp3 + sp4 ..... + spn [17], average richness (Sm = ΣS/N), the relative abundance =AR ou F = ni x 100 / N [22] and density; D = N/P [3] were used. Statistical analyses were also applied using Principal Components Analysis (PCA), Cluster analysis and hierarchical classification using R program version (i386 3.1.0.) [23].

3. Results

3.1 Species richness

During collecting period between 2014-2015, 300 weeds plants were collected and identified under the climate conditions of the three palm groves. Dicots class was largely dominant with 250 species (84%) versus 50 species (16%) of monocots. A half of this flora were composed of major botanical families; Asteraceae (40species), Poaceae (30species), Brassicaceae (28species), Fabaceae (20species) and Amaranthaceae (25species) families.

3.1.1. Biological spectrum

Weeds flora sampled during our survey were characterized by a high rate of annual species (75%), perennial species represents 20% of the total flora sampled, while the biannual represents only 5% of the total flora sampled.

3.1.2. Weeds species distribution

Total richness observed and identified in each palm grove show a significant diversity of weeds plants, it varies from 93 to 170 species/palm grove. The Ain Ben Noui palm grove was the most diversified with 170 species (56%), followed by the El Kantara palm

grove with 130 species (43%). In the 3rd position Sidi Okba palm grove were represented with 98 (32%) species of total identified weeds (Figure 3).

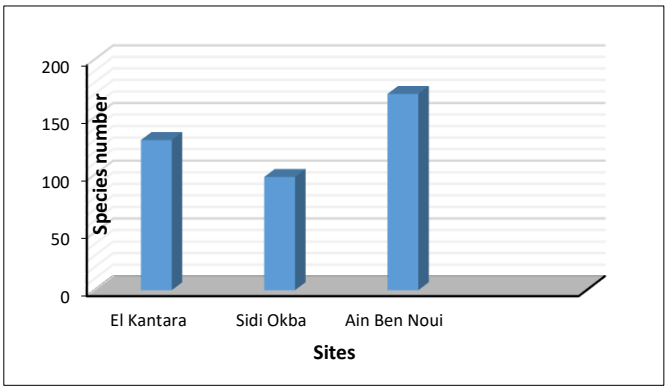

Figure 3. Importance of weed plants by Palm grove

3.1.3. Seasonal distribution

Seasonal effect seems of great importance under palm grove conditions. The most important richness was recorded during springtime with 52% (Figure 4), during summer period, it has registered 31% of the total weeds flora identified. Whereas a low percentage was record during winter period (13%) and autumn (4%).

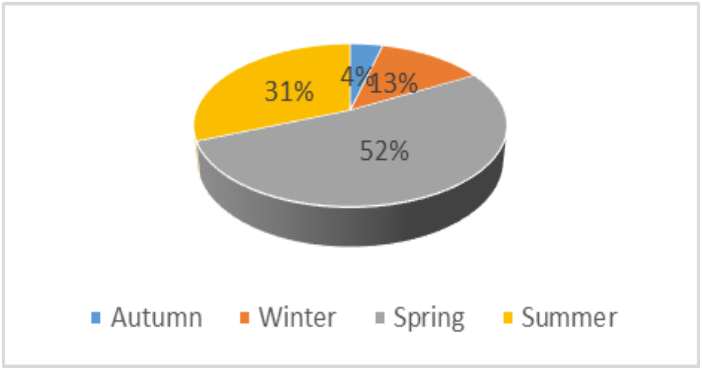

Figure 4. Distribution of weeds species by seasons

The most important average richness was obtained during spring (4.8) and summer (2.8) time, whereas the lowest richness average was noted during the autumn period (0.8).

3.1.4. Relative abundance and density

From the 41 sampling, we noted that the most abundant species were from Caryophyllaceae family represented by Cardaria draba (AR=5.3%; D=9.4 plants/m²) and Spergularia marginata (AR=3.1%; D=5.5 plants/m²). The Brassicaceae family was represented by Neslia paniculata (AR=3.7%; D=6.6 plants/m²) and Sinapsis alba (D=5.7 plants/m2). The most abundant species of the family of Fabaceae were Melilotus indica (AR=2.9%; D=5.2 plants/m²).

3.1.5. Species diversity and evenness

Results of ecological analysis; diversity (H=0.5 bits) and evenness (E =0.061) indicate a low diversity with an imbalance between species; this implies an inequality of vegetation cover distribution.

3.2. Principal Components Analysis (PCA)

To confirm results obtained using ecological indices, statistical analysis using Principal Components Analysis (PCA) of R program was used. Variables and individuals reduced to the PCA indicate that the first factorial plan restores 71.1% of the variance. These were the variables that contribute to the first axis factorial [24,25].The angle between the two variables, extent by its cosine is equal to the coefficient of the linear correlation between the two variables; the interpretation of the main components was carried out by looking at the correlations with the variables of departure. As well all variables were quite remote areas; variables, and the angles that they form, have not been too distorted during projection [24,25].

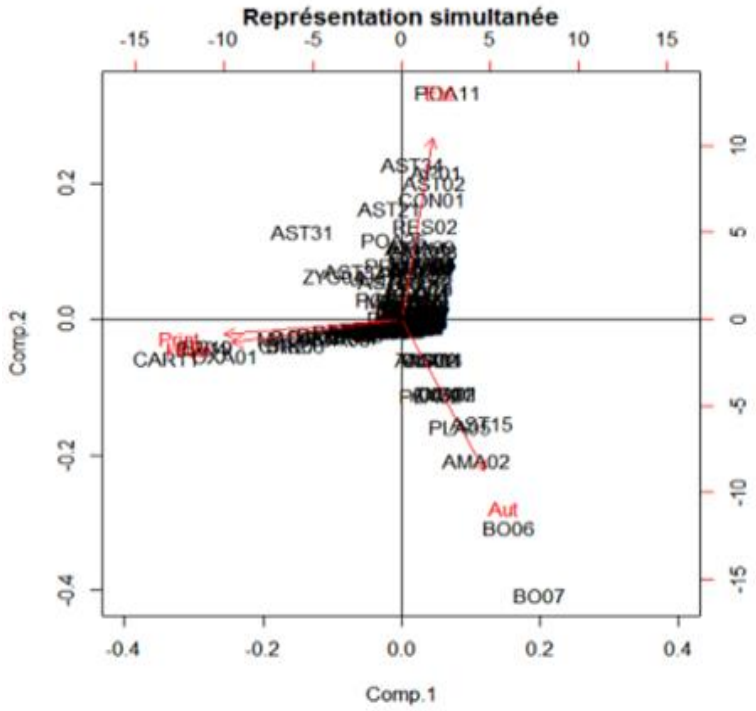

Figure 5. Simultaneous representations of variables on the factorial plan

All variables occupy a relatively small area inside the circle of correlations (Figure 5). The maximum angle between two variables was less than 90° as that is represented by winter and spring in the negative part of the comp1. This suggests that all other variables (months) are positively correlated between them. While it exceeds 90° for the other two seasons autumn and summer (Figure 5), that reflects a negative [25, 24,26].

As represented Figure 5 that some species belonging to Asteraceae family were correlated to summer in the positive part of the axis 2. Whereas Borraginaceae and Amaranthaceae species were correlated to autumn that contribute to the formation of the same axis but in the negative part. Species that contribute to the formation of axis 1 were those correlated to Caryphyllacea and Oxallidaceae species.

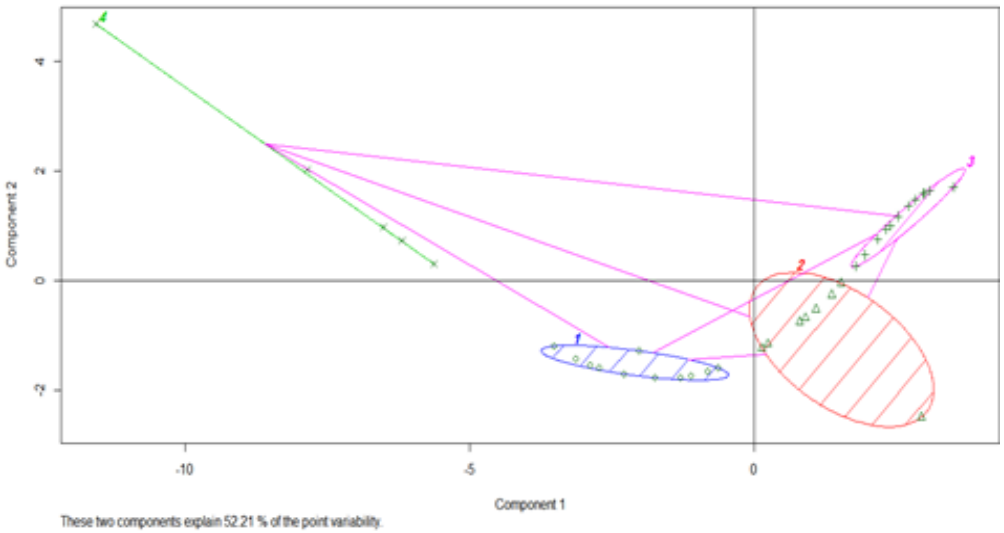

Figure 6. Classification of group structure of spontaneous species

3.3. Dendrogram Cluster and Hierarchical Classification Analysis

The Ascending Hierarchical Clustering (Figure 6) obtained for species from the three palm groves shows a classification of relatively similar species grouped into 4 groups and 8 sub-groups (Figure 6). The use of this classification method has led an existence of several species assemblages' that indicate changes in species composition. So, in assembling all species, they didn't have the same distribution. The first group was represented by early species that their activities start with the first rainfall (end of winter) and warm temperatures, case of species from Caryophyllaceae, Frankeniaceae and Brassicaceae families. While the second class grouped a few individuals that persist during the dry season during summer period characterized by drought specially perennials belonging to the monocotyledonous class (*Cynodon dactylon, Impirata cylindrica*, ...). The third group includes all the most abundant species with a height density under palm groves, mainly annuals species (*Melilotus indica, Sinapis arvensis, Neslia paniculata*,). Finally, the Fourth class groups the species growing during autumn period (*Moricandia arvensis*,) that persist even after tillage.

Indeed, based on Ascending Hierarchical Classification (AHC), results from calculating abundance and frequency of plant species that form the four heterogeneous groups and their sub-groups, was proposed in phytosociology assigned by species frequency classes, this index is the probability to gather floristic cortege species (Figure 7) and consolidating results obtained using the Ascending Hierarchical Classification.

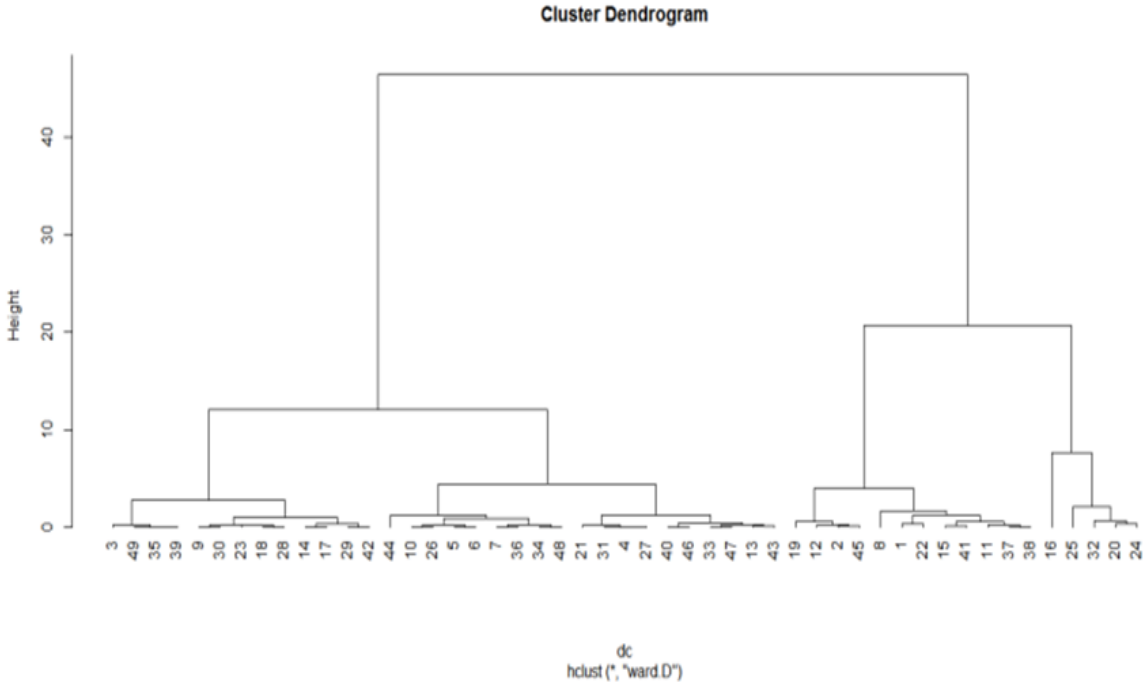

Figure 7. Cluster analysis Dendrogram of spontaneous plants under palm groves

4. Discussion

From the 41 surveys conducted in different palm groves of Ziban oasis, we highlighted the total richness of 300 plant species with dominance of dicots species, represented especially by Asteraceae. The monocotyledons mainly represented by species from Poaceae family. In comparison, of our results with those of the national flora, Asteraceae family was by far the most important botanical family in Algeria, since it contains 408 species distributed in 109 genera [20,18], we note that the Poaceae family was everywhere predominant represented in the Algerian flora by 284 species [18]. As repoted [27], that the presence of species from Poaceae family in oasis determines the phenomena of competition for water, nutrition and space. As well, the significant representation of species belonging to the family of Chenopodiaceae (Amaranthaceae) explains their good adaptation to oases conditions [28,29] soil and water (type of sandy soil and the presence of salts).

The biological spectrum for all species shows annual species were best represented during the spring period, they perform their biological cycle quickly profiting from rain and warm temperature for germination before summer time [14,29]. The high rate obtained of annual species also indicates that the cropping habitats were often disturbed due to agronomic interventions and repeated tillage [27]. The study of spontaneous flora by [30], in naturel areas in Biskra region, indicated the identification of 44 families and 145 species dominated by annual species. Little variations have been found in comparison with earlier works [31], where 130 species were inventoried at Ain Ben Noui palm grove, with dominance of annual (80%) compared to perennials (15%). In addition, Deghiche-Diab N. [32] indicated an important presence of weeds under palm groves about 80 species especially from Paoceae family. The study of weeds variation under palm groves of steppe region by [33], indicated also the important adaptation of species belonging to both Poaceae and Amaranthaceae families.

In southern Algeria, at Ouargla oasis, 58 species were recorder by [34] were 71% were from dicots versus 29 species from monocots. Whereas in his study [35], counted 120 species of weeds associated to crops in Batna region.

The variation, distribution and average richness of spontaneous plants could be explained by biotic or abiotic factors [36], including water (rain and/or frequency of irriga-

tions), that was a significant discriminating factors that explain their change of distribution. Temperature represents another important factor that have great effect on spontenous plants growing under in association to palm trees [3,14, 32], since, Ombro-thermic Diagram for Biskra region was characterized by a long period of drought being much more scope with high temperatures. Regulation of temperature, precipitation (February, March), as well as the presence of intercropping combined with cultural techniques practiced (irrigation, organic and mineral fertilization) positively affect the development of spontaneous flora in plots under palm groves [37,38]. This may explain in part the large number of annual species during spring in comparison to perennial species.

Because plots are subject to important emissions of manure by domestic animals under palm groves, this phenomenon have inconsiderable consequences on the richness and distribution of plant species [14,33]. While species numbers depend on temperature that adjusts their growing season. The nature of the substrate (soil) can also have an effect on their distribution [27,13].

Abundance of spontaneous plants varies for the same species from palm grove to another; this variation seems to prevent essentially from the ability of species to be adapted to edaphic conditions of each palm grove and climatic conditions of the year. Presence of spontaneous plants in each plot was probably linked to the ecological conditions, their strategy for competition or to the agronomic influence [38]. The most abundant species present with height densities were mostly from the annual species developed during springtime, this period was characterized, in general, by transition between wet period (spring) and the dry period (summer), and by an important precipitation with a modification of temperature, that plays an important role in the distribution and presence of species.

The low value of Shannon index and evenness calculated that implies an inequality distribution of the vegetation cover present in imbalance, it could be explaining by the sampling period that coincides with the coldest months of the year. As well, the imbalance between species can be explained by the decrease in specific richness during the warmest months (June, July, August). Whereas, low presence of species can be justified by the fact that during the summer period the lands are usually put to rest with a low frequency of irrigation. While a drop in temperatures characterized the winter period for this year, summer period was also characterized by a high temperature that have exceeded 40°C during July and August.

5. Conclusions

Even the importance of the annual weeds presents in association with crops cultivated under date palm competitive to water, organic matter and that mineral but also they can present a positive effect as host plant of the auxiliary fauna this aspect which deserves to be studied in future studies.

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