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Analyzes in Principal Component of the Physical Parameters of Algerian Honey

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Abstract: The bees form the group of predominant pollinators and the most important economic terms in many regions of the world. However these last years, the populations of bees know an obvious and alarming decline in Algeria. As part of this work, stations were studied (Annaba, Skikda, El Taref, Sétif, Souk Ahras). The present study is also aimed to assess the effect of phytosanitary products, climatic factors on the bees and on the products of the Hive and particularly the honey. The principle component analysis *PCA* was carried to design interaction between these parameters. The Method was applied to 5 individuals (5 sites) and 15 variables which are: Number of beehives (NBR);Agricultural Surface (SA); distance of location of beehives (DR); rate of use of Insecticides during flowering (TUI); rate of use of fungicides (TUF); rate of use of Herbicides during flowering (TUH); Rate of use of Acaricides (TUA); PHm: PH of the honey Hm; humidity of the honey (%); the EST: Total dry Extract of the honey (%); ESS: Soluble dry Extract of the honey (%); T: Average Annual Temperature (°C); TM: Mean Annual Maximum Temperature (°C); Tm: Mean Annual Minimum Temperature (°C); PP: Annual presipitation and/or snow (mm). The results have shown an interaction between these parameter was recorded in the different sites of studies.

Key words: Apis mellifera intermissa; Climatic factor; honey; Physico-chemical analyzes; Phytosanitary product; Principal Component Analysis

INTRODUCTION

In Algeria the apiculture is meadow dominant feature in the north region of the country where found the best lands and the most favorable climatic conditions [1]. Environmental and agricultural welfare depend on large number of different species of pollinators, including bees who contribute to the evolution of living beings and a large number of plants [2]. They polonaise about a third of cultures intended for our feeding [3], However, the domestic bees were roughly felt these last years [4, 5], apiaries are co-talks with multiple combinations of factors [6], what influences negatively on the life of the bees and the quality of the honey. In 2010, the apiculture in Algeria counted 1,2 about million colonies and 20 000 beekeepers. The evolution of the production of honey shows a net increase from 2002 till 2010 [1] owed probably to climatic conditions and forests fires. The honey has sensory characteristics and physicochemical very variable due to climatic and environmental conditions and to diversity of the origins of plants from which they are harvested [7, 8].

The inquiries was performed in the region East-Algeria in order to evaluate the situation of the colonies in this case we had chosen 5 sites of studies: S1: El-Tarf (Ben Amar); S2: Annaba (Tréat); S3: SkikdA (Azzaba); S4: Souk-Ahras (Sidi Fredj); S5: Setif (El Eulma).This original work treats various aspects, the first update on the rate of pesticides and we have in a second shutter centered on a study of meteorological parameters (precipitation, temperature) and finally an analysis physicochemical of different honey harvested in these sites of studies. The principle component analysis *PCA* was accomplished to conceive correlation between these parameters. The principle component analysis, which is a method of reduction among variables allowing

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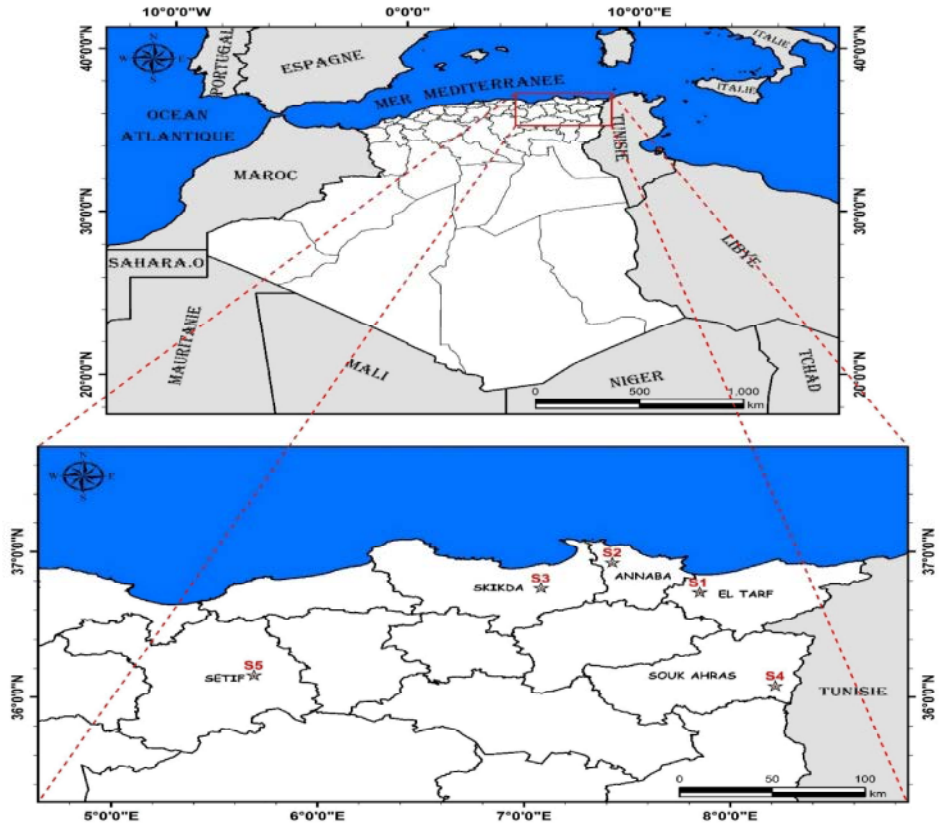

Fig. 1: Geographical location of the zone of study.

the geometric representation of observations and of variables. This reduction is possible only if initial variables are not independent and have not any coefficients of correlation [9].

Presentation of the Region of Study: As part of this work, 5 stations were studied (Annaba, Skikda, El Taref, Sétif, Souk Ahras). The choice of sites is based on the level of the pollution and climate, as well as the easiness of access to the zone of study and the abundance of *Apis mellifera interimissa* (Fig 1).

Statistical Analysis: *PCA* was accomplished to conceive correlation between the studied parameters for this job which consists in:

- Transform calculated data has the assistant of software ArcGIS and WMS;
- Calculate matrix of covariance or of correlation [R] as well as statistical parameters;
- Diagonals [R] (research of the clean vectors); calculate the main elements;
- Graphically visualize and interpret these results

RESULTS

We have subjected all physical parameters calculated for the different sites of studies in the principle component analysis, to determine affinity between these sites and to deduct the most characteristic parameters.

Table 1: Statistiques descriptives des variables

Variables	Individuals	Minimum	Maximum	Moyenne	standard deviation
NBR	5	70	500	178	180.89
SA	5	4.00	60.00	17.60	23.96
DR	5	5.00	11.00	7.40	2.30
TUI	5	0.00	60.00	30.94	21.63
TUF	5	0.00	66.66	36.57	26.77
TUH	5	0.00	100.00	27.73	41.34
TUA	5	0.00	18.18	7.68	7.78
PHm	5	3.72	4.85	4.23	0.45
Hm	5	6.19	11.52	9.08	2.22
EST	5	88.52	93.81	90.93	2.22
ESS	5	52.70	70.50	63.38	7.09
T	5	14.90	19.30	17.76	1.71
TM	5	22.20	23.90	22.90	0.68
Tm	5	8.00	15.10	12.32	2.77
PP	5	384.28	844.60	631.90	190.96

Table 2: Own value and cumulative variance

Axe	I	II	III	IV
Valeur propre	6.07	5.10	2.34	1.49
Variance [%]	40.47	33.99	15.61	9.94
Cumulative Variance [%]	40.47	74.46	90.06	100

Table 3: Correlations between variables and the main axes:

	Axe I	Axe II	Axe III
NBR	0.428	-0.227	-0.504
SA	0.554	0.172	0.814
DR	0.737	-0.145	-0.407
TUI	0.0003	0.922	-0.360
TUF	0.882	0.247	-0.373
TUH	-0.682	-0.651	0.321
TUA	0.927	0.093	0.362
PHm	-0.268	0.864	0.222
Hm	0.102	0.912	0.357
EST	-0.109	-0.910	-0.361
ESS	0.871	0.400	0.071
T	0.806	-0.539	0.234
TM	0.814	-0.024	-0.063
Tm	0.867	-0.451	-0.026
PP	0.136	-0.769	0.619

Correlations Between Variables and Principle Axes: Analysis of the curve of the own value shows that first four factors allow represent the maximum of information. So first four factorial axes express 100% of the total variances; with 40.47% for the first factor; 33.99% for second, 15.61% for the third and 9.94% for the last factor. The Table 2 expresses the own values of the coefficients matrix of correlation, the percentage of variance explained and cumulated by every axe.

The analysis of the matrix of correlation (Table 3), shows that (TUI, Axe II is well correlate positively with; TUA, Axe I. PHm Axe II well correlate with ESS, T, TM, Tm but negatively with the EST.

Plans of Correlations of Variables: The circle I - II representing 74.46% of inertia (Fig. 3), points out that the axe I determines parameters physicochemical of some honey harvested in different stations of studies and meteorological parameters. The axe II has rather a topographical signification. The circle I - III with 56.08% of inertia, specifies the signification of the axe I that was given before and points out that the axe III can express interconnected.

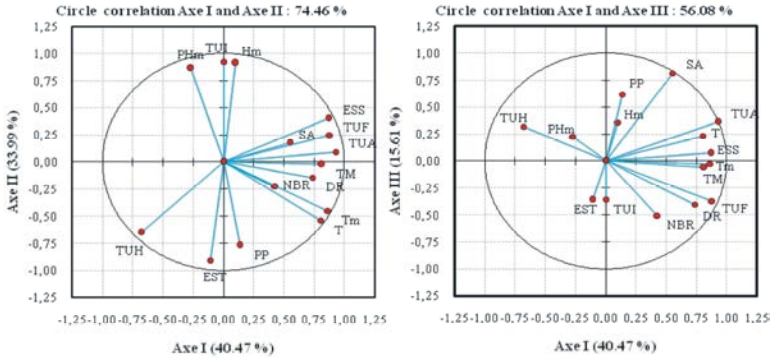

Fig. 3: Plans of correlations of variables.

Table 4: Matrix of correlation between variables

Variables	NBR	SA	DR	TUI	TUF	TUH	TUA	PHm	Hm	EST	ESS	T	TM	Tm	PP
NBR	1.00														
SA	-0.20	1.00													
DR	0.18	0.04	1.00												
TUI	0.08	-0.13	-0.06	1.00											
TUF	0.40	0.22	0.84	0.34	1.00										
TUH	-0.37	-0.23	-0.49	-0.73	-0.87	1.00									
TUA	0.18	0.82	0.53	-0.05	0.71	-0.57	1.00								
PHm	-0.68	0.17	-0.22	0.66	-0.05	-0.28	-0.08	1.00							
Hm	-0.22	0.51	-0.29	0.74	0.16	-0.56	0.31	0.78	1.00						
EST	0.22	-0.51	0.29	-0.73	-0.16	0.57	-0.31	-0.77	-1.00	1.00					
ESS	0.44	0.62	0.41	0.38	0.80	-0.86	0.86	0.03	0.53	-0.53	1.00				
T	0.40	0.55	0.54	-0.57	0.48	-0.13	0.78	-0.66	-0.31	0.31	0.52	1.00			
TM	-0.03	0.38	0.93	-0.08	0.82	-0.51	0.74	-0.04	-0.06	0.06	0.54	0.61	1.00		
Tm	0.64	0.39	0.61	-0.38	0.63	-0.33	0.75	-0.70	-0.30	0.29	0.63	0.95	0.60	1.00	
PP	-0.02	0.45	-0.08	-0.92	-0.31	0.60	0.28	-0.59	-0.45	0.45	-0.12	0.67	0.04	0.47	1.00

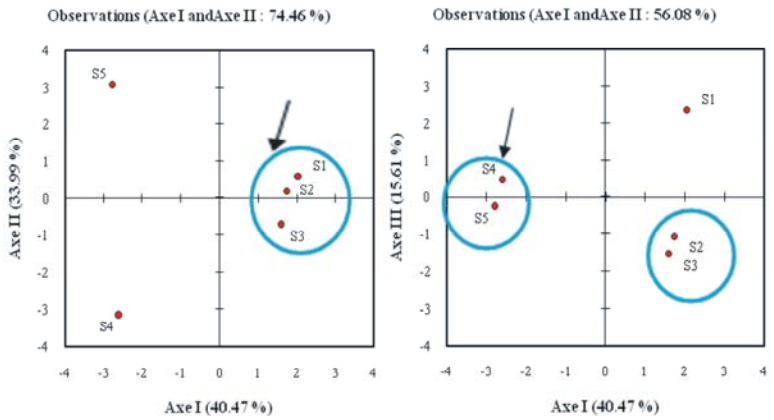

Fig. 4: Factorial Plans of the individuals.

The projection of the individuals in plan I - II (Fig. 4), highlights three groups in the region of study: the first forming by sites (S2 and S3). The second group is formed by (S4 and S5). The third group by S1; S2; S3.

We subjected to an analysis in main element of the physical parameters of honey harvested in 5 stations of studies to control and to improve the quality of the Algerian honey. The results of the sensory analyses of honey harvested at the level of regions of studies are similar has those Persano[10] and Maria *et al.* [11]. Concerning the pH which is located between 3,72 - 4,85 these values are similar to those reported back for other honey samples coming from India, Brazil, Spain and Turkey which would have 3,49 and 4,70 [12]. Concerning the content of water (humidity), samples of analysed honey, values are pointed out go from 8,28% to 13,84% which are widely below the maximum limit recommended by the Codex Food on 2001. which is 20% maximum. Our results are similar to those reported for other samples of Algerian honey [13].

Climate upheaval will have certainly repercussions on the interactions between pollinators and their sources of food, that is to say plants with flowers, notably because of confusion of dates and rhythms of flowering [14] and this has a covalent relation with geography of different stations of studies, **3** sites: S1; S2; S3 present a humid climate, average contrary in souk Ahras and Sétif which present an almost dry climate, which influenced directly on agriculture and quality of the honey. Johnston *et al.* [15] Tirado *et al.* [16] also showed that the use more and more spread by manure, by weed killers and by insecticides, have effects harmful synergetic as the health of the honeybees [17].

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