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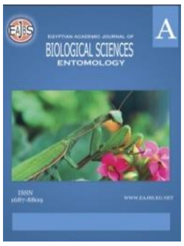


# Comparison of Male and Female Morphometric Indices of the 3-Spot Form of *Calliptamus barbarus* (Costa, 1836), (Orthoptera: Acrididae: Calliptaminae) in Three Areas in The Jijel Region (Northeast Algeria)

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**ABSTRACT**

To carried out this study, three stations were chosen These are Texenna, Kissir and Jijel.11 parameters were taken into account for each individual: Total body Length TL, Length of Elytra EL, Length of Femur FL, Width of Femur FW, Width of Head HW, Width of Pronotum PW, Total Femoral Area TFA and Area of Femoral Spots AFS as well as comparisons of FL / FW, EL / FL, and TFA/AFS. In order to analyze the results, the following statistical parameters are used: correlation and conformity test, regression line, and analysis of variance.

The correlation between different parameters was initially low, then average, and finally strong. The conformity test gives values obst > t 0.95 between FL/ FW in the females of Texenna and between the males in the 3stations. The same observation is made for the EL/FL in females in the 3 stations and in Texenna males. The difference is not significant between these 2 parameters. The conformity test gave values obs t <t 0.95 for FL/FW only in females from Kissir and Jijel and between EL/FL in males from Kissir and Jijel. Difference is slightly significant. For TFA/AFS, the test indicates a significant difference for males of Kissir and Jijel but a non-significant difference in both females of Texenna and Jijel. Moreover, the linear regression shows that the 3 populations are homogeneous from the point of view of EL/FL, FL/FW, and TFA/AFS couples. Analysis of variance showed that the Fisher statisticF observed is higher than the theoretical F.

Despite their apparent differences in size (8 out of 11 parameters gave non-significant differences), we can conclude that the 3 populations living in the Jijel region belong all to a single homogeneous group: the form with 3 femoral spots showing a clear heterogeneity with that of semi-arid bioclimate who contain individuals with big size and having only one femoral spot.

## INTRODUCTION

In Algeria, there are only two species of the genus *Calliptamus*. These are *C. wattenwylianus* (Pantel, 1896) and. *barbarus* (Costa, 1836) (Chara, 1987).
*C. barbarus*, is a species with a strong chromatic polymorphism in its posterior femurs. The color of the latter is qualified by Chopard (1943), Jago (1963), and Larrosa et al. (2008) ruby red, with distinct and well-marked femoral spots, or pale yellow or orange, with a single large

spot. In addition, the tibiae of this locust are reddish or orange on the inner side, yellowish and pale to the external face (Jago, 1963). The wings are pink to purplish red, the elytra have subparallel edges in the apical 2/3 reaching or exceeding the posterior knees (Bellman and Luquet, 1995). The pronotum has a flat shape with two well-marked right lateral carinae and a median keel which carries three transverse furrows (Chopard, 1943). It is a fairly large species of 15 to 24 mm for males and 24 to 40 mm for females. According to Defaut (1988), the dimensions vary greatly from north to the equator. The males of *C. barbarus* are characterized by the apex of the cerci which are bi or three-lobed (Dirsh, 1965). The penis is the same size as *C. wattenwylianus* (Chopard,1943) but shorter than in *C. italicus* (Linnaeus,1758) (Fontana et al., 2002). According to Jago (1963), the subgenital plate is short and rounded at the top. The pallium is short and blunt (Bellman and Luquet, 1995).

According to Jago (1963), this species has a wide geographic distribution. It is widespread mainly in North Africa and the Near East (COPR, 1982). Larrosa et al (2007) found it in Spain and Portugal. It has also been observed in Italy by Fontana et al., (2002) and in France (Claridge and Singhrao, 1978).

*C. barbarus* is found in different localities such as in Mitidja (Doumandji and Doumandji-Mitiche, 1992), in Boumerdes (Doumandji et al., 1992), in steppe or semi-desert places (Doumandji et al., 1993 a, 1993 b, 1993 c). This species is also noted in the region of Jijel (Rouibah and Doumandji, 2013). In their study on inter and intrasexual behavior in captive males of *C. barbarus* with 1 and 3 femoral spots, Larrosa et al.(2007) established eleven behavioral units before mating related to hind legs (femurs, shins) and wings. Mating takes place during June and continues until October. The mating period can sometimes be long for up to two days (Larrosa et al, 2007). Oviposition takes place in rocky soils with level lawns or in garrigues that evolve slowly (Louveaux et al., 1988), but preferably in sandy and cool soils (Mallamaire and Roy,1968). According to Duranton and Lecoq (1990), soils must be moist, at least 5 cm below the surface. The laying begins in August and continues until November. The duration of hypogeal life is almost 10 months (Duranton et al., 1987). According to Chara (1987), the average time between the first and the second laying is 12 days. For Louveaux (1991), the female of *C. barbarus* can lay up to 4 eggs, or 150 eggs.

According to Popov (1996), embryonic lifespan varies in relation to eco-climatic conditions. Hatching begins in May and ends at the end of June (Chara, 1987). The number of larval stages is 5 for males and 6 for females. However, it can vary depending on the latitude (Hugueny and Louveau,1986).

The move to adult for *C. barbarus* is spread over 33 days (Chara, 1987). This later is observed between mid-May and the end of October (Monard, 1986; Chara, 1987). The imagos appear during the first fortnight of July. For Hugueny and Louveaux (1986), the number of ovarioles varies with latitude since the size of the individuals is correlated with this and that the number of ovarioles is all the more important the larger the individual. This locust has on average 38 ovarioles while *C. italicus* has 50 (Louveaux, 1991) and 63 in *C. wattenwylianus*. Doumandji and Doumandji-Mitiche (1994). According to Benzara (2004), there is an anatomical difference in the ovaries in females of the two bioforms. In fact, in the form with a femoral spot, the number of ovarioles is on average 62 while females with three femoral spots have only 51.

According to Legall and Gillon (1989), for the same species, the number of generations can be variable depending on the region in which the population grows and the annual weather characteristics. Monard (1986) points out that the life cycle of *C. barbarus* is that of many locusts in temperate regions, an annual generation with wintering in the egg state, but rarely in adult form (Tumbrink, 2006). After laying, there is a real diapause due to lack of humidity, but also to resist either the harsh winter conditions or the heat and or the summer drought (Ridet et al., 1992). This diapause is lifted by the low winter temperatures and development resumes its course with the rise in spring temperatures (Fabry et al., 1987). Stridulation is a message or a means of communication used for different functions: sexual rapprochement, the confrontation between males, and maintenance of cohesion in a population (Griboval, 2005). In *C. barbarus*, it is performed by mandibular friction (Larrosa et al. 2004), where it has been used as a means to differentiate the two bioforms of this species. Indeed, according to Larrosa et al. (2008), the temporal characteristics of the acoustic emissions of males, and to a lesser degree for females, in the two bioforms showed significant differences. The length of the syllable and the number of pulses emitted are in the first bioform greater than in the second.

Chara (1987), working with the capture-mark-recapture technique in the Orange, noted that the young larvae of *C. barbarus* are more agile than those of *C. wattenwylianus* which always remain sedentary. Adult movement capacities are lower in females than in males (Mokhlesse et al., 2007). For these same authors, the total distance traveled by females is generally less than that of males, which can be as far as 70 m (Termier, 1991). *C. barbarus* has the possibility of adapting to different ecological environments. It is a thermophilic and xerophilic species (Monard, 1986), with a preference for arid lands with sparse vegetation. It is also reported on the dunes, in the steppe and the open scrubland (Chara, 1987; Defaut, 1988; Benzara, 2004) and especially in the semi-open scrub (Blanchet, 2009). According to Claridge and Singhrao (1978), this species can live in high mountains at average altitudes between 300 and 600 m. In some cases, it can even exceed 2000 m (Louveaux et al., 1988, 1996).

Algeria occupies an important place in the habitat area of *C. barbarus*. The one femoral spot form frequents semi-arid regions. Form with three femoral spots lives in the humid and sub-humid regions.

The objective of this study is to determine the degree of differentiation and variation of *C. barbarus*, of the stands of the Jijel region between them, and to know through morphometry, if the specimens living in this region are all small and therefore homogeneous and belonging to the form with 3 femoral spots or on the contrary, there are, among this population, large specimens belonging to the form with 1 femoral spot Classical morphometry aims to highlight the correlations between the sizes of the different organs of the insect's body and to emphasize the degree of variability between populations.

## MATERIALS AND METHODS

This study was carried out in the region of Jijel in the North East of Algeria (Fig1). It is dominated by a Mediterranean climate, characterized by a dry and hot summer, and a mild and rainy winter. The monthly distribution of precipitation and temperature is represented in table 1 (ONM, 2010). We can see that the region of Jijel enjoys very abundant precipitation; however, they are unevenly distributed over the year, the minimum being located in July-August and the maximum between November and January. As for temperatures, we find that there is an increase from January to August for then regress until December. Bagnouls and Gaussen's ombrothermal diagram (Fig. 2) reveals the presence of 2 periods, one dries from the end of May to the beginning of October and the other humid extending from October to May.

**Table 1**. The average rainfall and temperatures recorded from 1990 to 2010 in Jijel area (ONM, 2010)

| Month | J | F | M | A | M | J | J | A | S | O | N | D | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H (mm) | 133.53 | 97.93 | 65.7 | 84.54 | 56.6 | 17.93 | 3.62 | 11.98 | 71.8 | 110.2 | 153.2 | 205.33 | 1012.36 |
| Tp (°C) | 11,5 | 11,7 | 13,4 | 14,5 | 19,0 | 22,4 | 24,8 | 25,9 | 23,7 | 20,1 | 15,8 | 12,9 | |

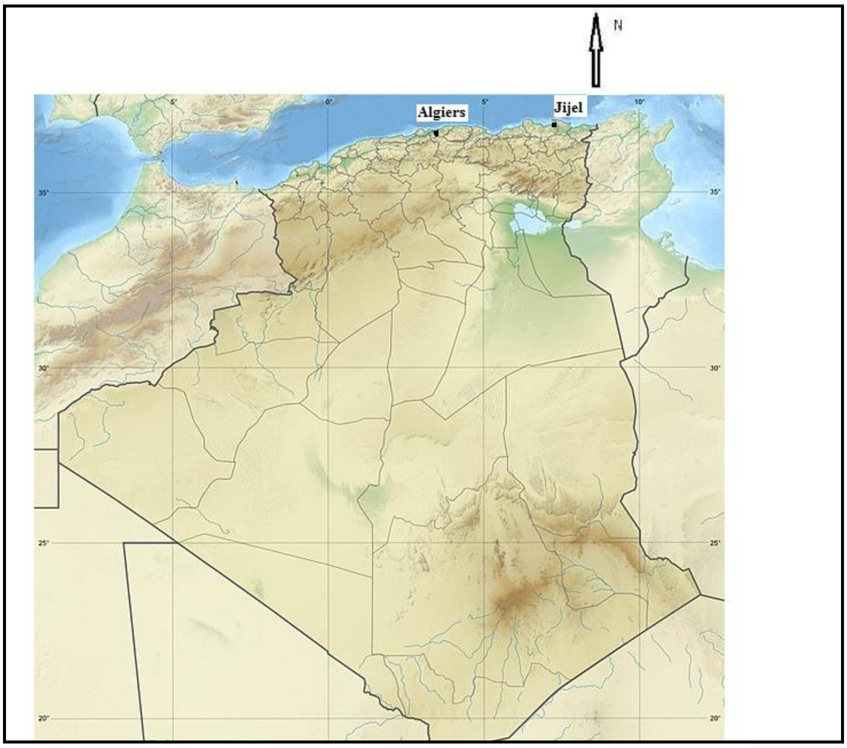


**Fig. 1.** The geographical location of the Jijel region (Wikipedia, 2020) (Scale: 1:6.800.000)

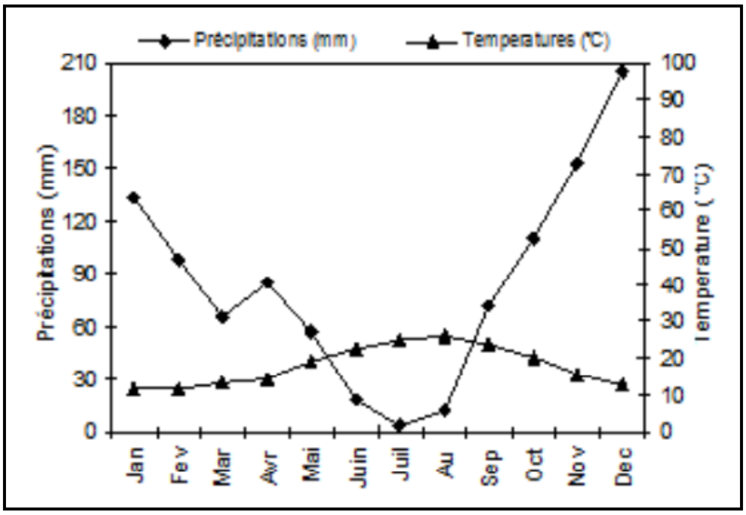


**Fig. 2.** Ombrothermic diagram for Jijel between 1990 and 2010 (ONM, 2010)

To carry out this study three stations are chosen, they are Texenna (S1), Kissir (S2), and Jijel (S3). Texenna is located at 18 Km South of Jijel at 487 m of altitude, with a slope of 7% and a southeast exposure. It is open garrigue, set on calcareous soil, on which grows vegetation dominated by the Cyste: *Cystus monspeliensis*. The station of Kissir is located near the National Park of Taza, 10 Km west of Jijel with an altitude of 11m. It is a wasteland whose soil is flat and slightly acidic. The third station is located at the west exit of Jijel. It is bounded on the north by the Mediterranean Sea. These are fixed dunes of the littoral covered by sparse vegetation with Graminae dominant.

The specimens were collected during the period from June to November 2013. A total of 134 samples including 80 females and 54 males were first sampled then measured Because of the sex ratio in favor of females over males, we were only able to capture 7 male individuals in Jijel station and this compared to other stations where the male population of *C. barbarus* was important. The experiment is carried out in the zoology laboratory of the University of Jijel. The measurements are made with the aid of the millimeter paper placed under the visual field of an electric binocular magnifier.

According to Blondin (1980), the joint analysis of the body dimensions of form and color constitutes an effective method to reduce the risks of appreciation of differences or interindividual resemblances. For the sake of consistency with the work already published by Jago (1963); Benzara (2004) on *C. barbarus* and by Benfekih (2006) on *Locusta migratoria*, 11 parameters were taken into account for each individual:

TL: Total body Length
EL: Length of Elytra (tegmina)
FL: Length of Femur
FW: Width of Femur
HW: Width of Head
PW: Width of Pronotum
TFA: Total Femoral Area
AFS: Area of Femoral Spots
FL / FW
EL / FL
TFA/AFS

In order to exploit the results, the following statistical parameters are used: correlation and conformity test, regression line, and analysis of variance (ANOVA).

**Correlation and conformity test**

The set of values FL, FW, EL, HW, PW, are often considered as components of the matrices and are called correlation matrices. These matrices are frequently designated by the symbol ( ) (Dagnelie, 2012). The correlation coefficient is a symmetrical measure which is used above all to characterize a positive or negative linear relationship (Rakotomalala, 2012). It is calculated using the R software (Lyazrhi, 2005). Its conformity test consists of comparing the observed values (obst) to the theoretical values (t 95% or 0.95).

**Regression Line:**

Calculating the correlation coefficient between two numerical variables amounts to searching for and summarizing the link that exists between these two quantitative variables using a straight line. It is then a linear adjustment (Bhuhan, 1978). The objective of the regression is to describe the relationship between a dependent random variable or response variable y and a set of independent or explanatory variables x (Legras, 1998). The equation for this line is as follows:

$y = ax + b$, knowing that $a = cov(x y) / var(x)$ and $b = y - ax$

**Analysis of Variance (ANOVA):**

According to Scherrer (1984), the ANOVA makes it possible to verify the significance of the variable of interest between all the combinations of the modalities.

## RESULTS

**BodyMeasurements:**

The results on body size measurements for males and females of *C. barbarus* in the Texenna, Kissir, and Jijel populations are summarized in appendix1.

**Correlation Matrix:**

The variations of the couples: FL, FW, EL, HW, and PWare compared between the different populations. The correlation coefficient initially produced values below 30%, explaining that the correlation between these studied parameters is low. Then values varying between 30% and 70%, showing that the correlation is average. Then finally, values close to 100%, that is to say, a strong correlation.

The matrix results of the correlation coefficient between the parameters studied in males and females in the 3 populations are given in appendix 2.

**Conformity Test**:

The variations of the FL/FW and EL/FL couples are compared, two by two, between populations, for each sex considered using discriminant analysis. The conformity coefficient correlation test gives values obs t > t 0.95 between the pairs FL and FW in the females of Texenna on one side and on the other side between the males in the three stations. The same observation is made for the EL/FL pair in females in the three stations and in Texenna males. The difference is not significant between these two parameters. In contrast, the conformity test gave values obs t <t 0.95 for the FL/FW pairs only in females from Kissir and Jijel and between EL/FL pairs in males always from Kissir and Jijel (Table 2). The difference is slightly significant.

Furthermore, the TFA/AFS couples are also compared between the 3 populations. The conformity coefficient correlation test sometimes indicates a significant difference (obs t < t 0.95). This is the case for the males of Kissir and Jijel on one side and the females of Kissir on the other side. In contrast, this test indicated a non-significant difference (obs t > t 0.95) in both the females of Texenna and Jijel as in the males of Texenna (Table 2).

**Table 2.** Conformity test of correlation coefficients of measuring couples: FL/FW, EL/ FL and TFA/AFS of both females and males in the 3 stations**.**

| Gender | | FL /FW | | | EL/ FL | | | TFA / AFS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | S1 | S2 | S3 | S1 | S2 | S3 | S1 | S2 | S3 |
| ♀ | n | 38 | 24 | 18 | 38 | 24 | 18 | 38 | 24 | 18 |
| | r | 0.53 | 0.67 | 0.84 | 0.32 | 0.65 | 0.76 | -0.07 | 0.72 | 0.58 |
| | df | 36 | 22 | 16 | 36 | 22 | 16 | 25 | 11 | 3 |
| | obs t | 7.73 | 1.76 | 1.10 | 3.93 | 2.93 | 2.35 | 4.75 | 2.03 | 4.52 |
| | t0.95 | 2.08 | 2.07 | 2.10 | 2.08 | 2.07 | 2.10 | 2.06 | 2.20 | 3.18 |
| | test | > | < | < | > | > | > | > | < | > |
| ♂ | n | 25 | 22 | 7 | 25 | 22 | 7 | 25 | 22 | 7 |
| | r | 0.40 | 0.29 | 0.12 | 0.38 | 0.14 | 0.53 | -0.12 | 0.46 | 0.81 |
| | df | 23 | 20 | 5 | 23 | 20 | 5 | 13 | 9 | 1 |
| | obs t | 2.53 | 5.28 | 4.02 | 5.16 | 1.08 | 0.036 | 6.36 | 1.89 | 0.02 |
| | t0.95 | 2 .06 | 2.08 | 2.44 | 2.07 | 2.08 | 2.44 | 2.16 | 2.26 | 2.70 |
| | test | > | > | > | > | < | < | > | < | < |

n: number of individuals in the population; r: correlation coefficient; df: degree of freedom; obs t: observed value; t0.95: theoretical value at 95%; test: obs t /t0.95; S1: Texenna; S2: Kissir; S3: Jijel

**Regression lines**

The regression lines of the pairs of measurements: FL/FW, EL/FL, TFA/AFS of females, and males of the three populations are reported in Table 3.

**Table 3**. The equations of the regression lines of females and males of Texenna, Kissir, and Jijel

| Gender | | S1 | | S2 | | S3 | |
|---|---|---|---|---|---|---|---|
| | | Equation | r | Equation | r | Equation | r |
| ♀ | FL / FW | y=0,21x+1.82 | 0.53 | y=0.026x+5.86 | 0,67 | y=0.47x-2.24 | 0.84 |
| | EL / FL | y=0.33x+10.25 | 0.31 | y=0.37x+8.35 | 0.64 | y=0.54x+4.69 | 0.76 |
| | TFA/AFS | y=0.009x+7.73 | 0.07 | y=0.157x-0.94 | 0.72 | y=0.28x-5.69 | 0.58 |
| ♂ | FL / FW | y=0.23x+1.15 | 0.40 | y=-0.04x+3.97 | 0.21 | y=0.06x+2.81 | 0.12 |
| | EL / FL | y=0.33x+5.53 | 0 .38 | y=1.37x-7.61 | 0,14 | y=0.14x+8.58 | 0.53 |
| | TFA/AFS | y=0.044x+2.41 | 0.12 | y=0.23x-0.99 | 0,46 | y=8.51x-80.4 | 0.81 |

r: correlation coefficient; S1: Texenna; S2: Kissir; S3: Jijel

The EL/FL criterion does not clearly separate the females from the 3 stations (Fig. 3). It shows a homogeneity between the 3 populations. As for the males, the population of Jijel is divided into two subsets, those of Texenna and Kissir also show a clear overlap between them (Fig. 4). Moreover, the FL/FW couples of Texenna, Kissr, and Jijel form a cloud of scattered points both in females (Fig. 5) and in males (Fig. 6). Finally, with respect to the pair TFA/AFS, there is also heterogeneity in the scattering of points. This indicates that this parameter does not clearly separate the females in the 3 populations as well as the males of Texenna and Kissir (Fig. 7). The exception is made for the males of Jijel who formed a slightly isolated group (Fig. 8) maybe because of the number of individuals measured (only 7). It should be noted that the details concerning the characteristics of the line of the pairs of measurements of the 3 population groups are given in appendix 3.

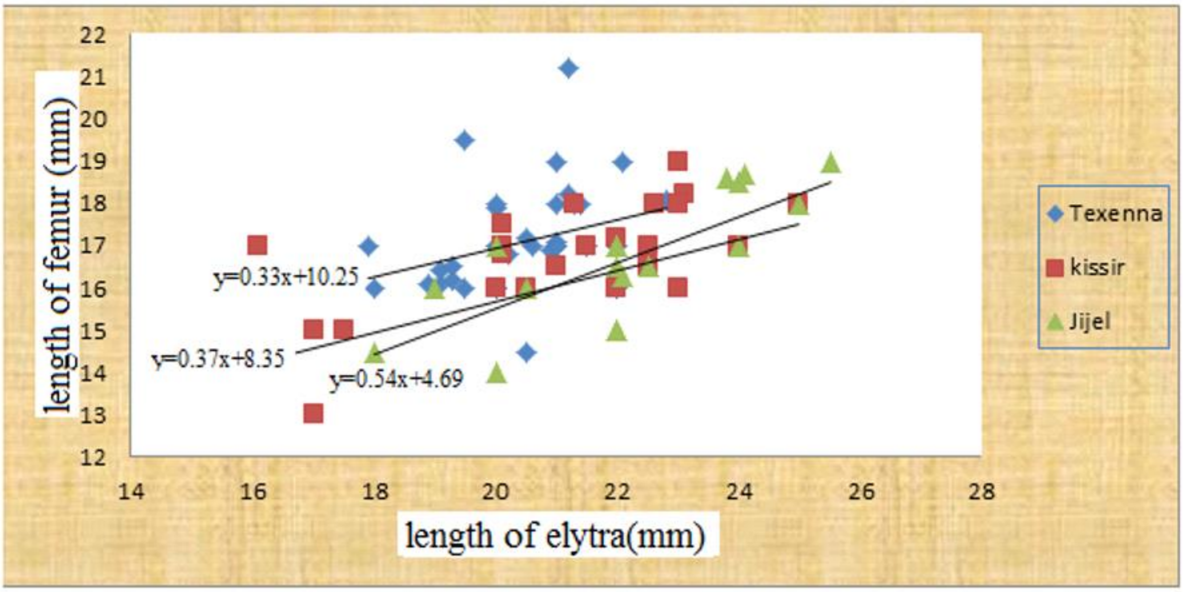


**Fig.3.** Linear regression between length of elytra and length of femur in the female's populations of the 3 stations

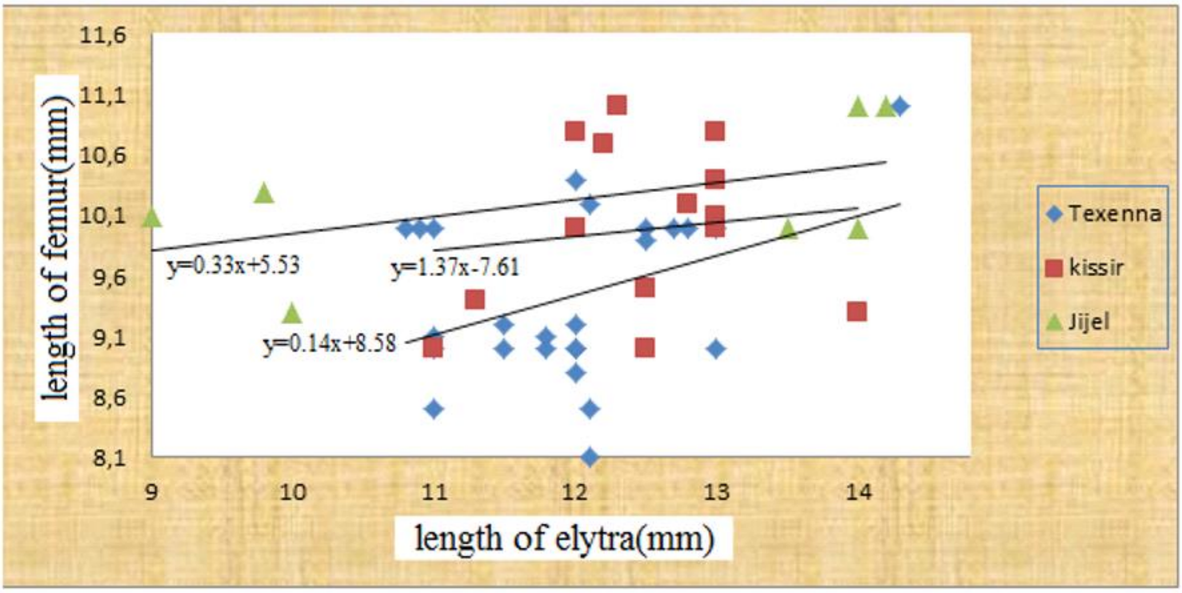


**Fig. 4.** Linear regression between length of elytra and length of femur in the male's populations of the 3 stations

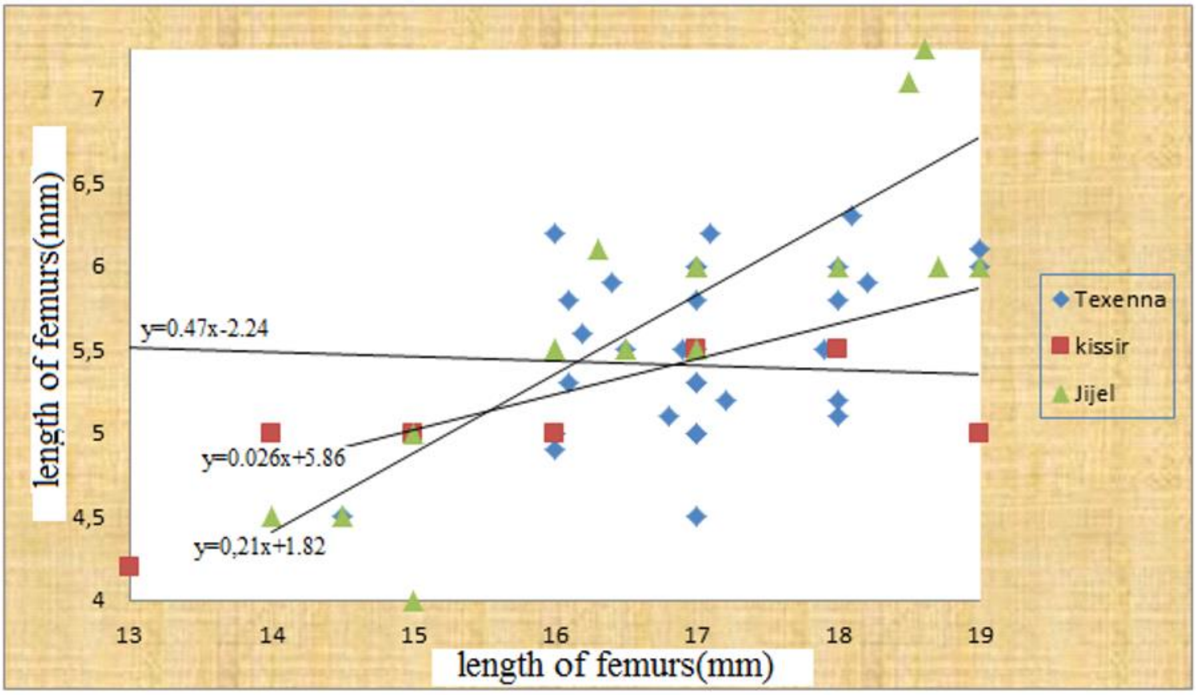


**Fig. 5.** Linear regression between length and width of femur in the female's populations of the 3 stations

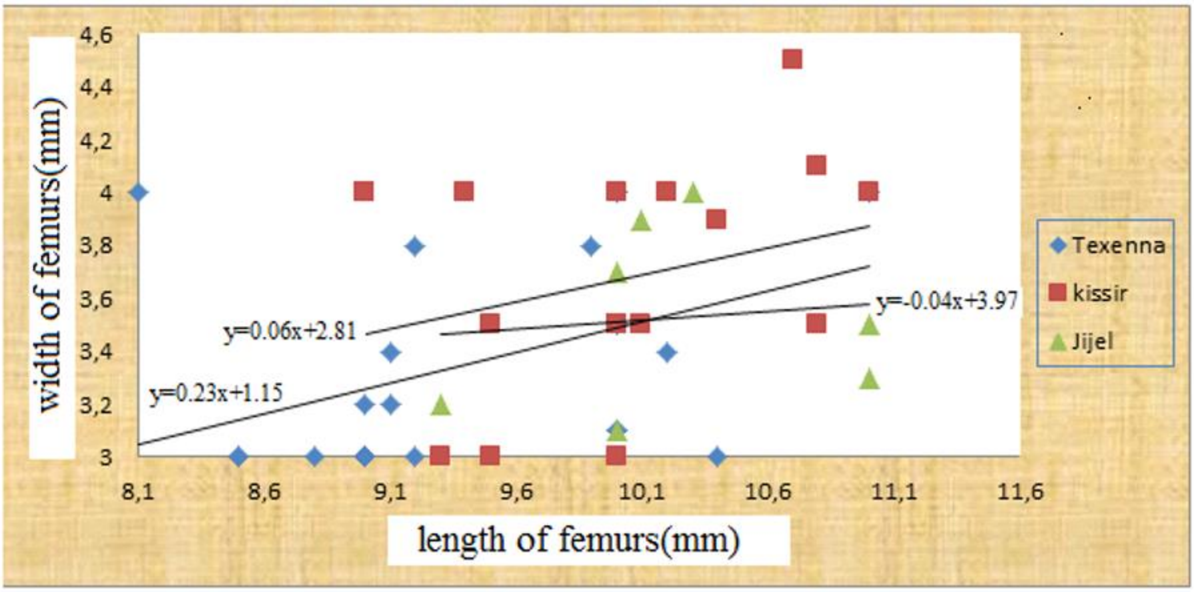


**Fig. 6.** Linear regression between length and width of femur in the male's populations of the 3 stations

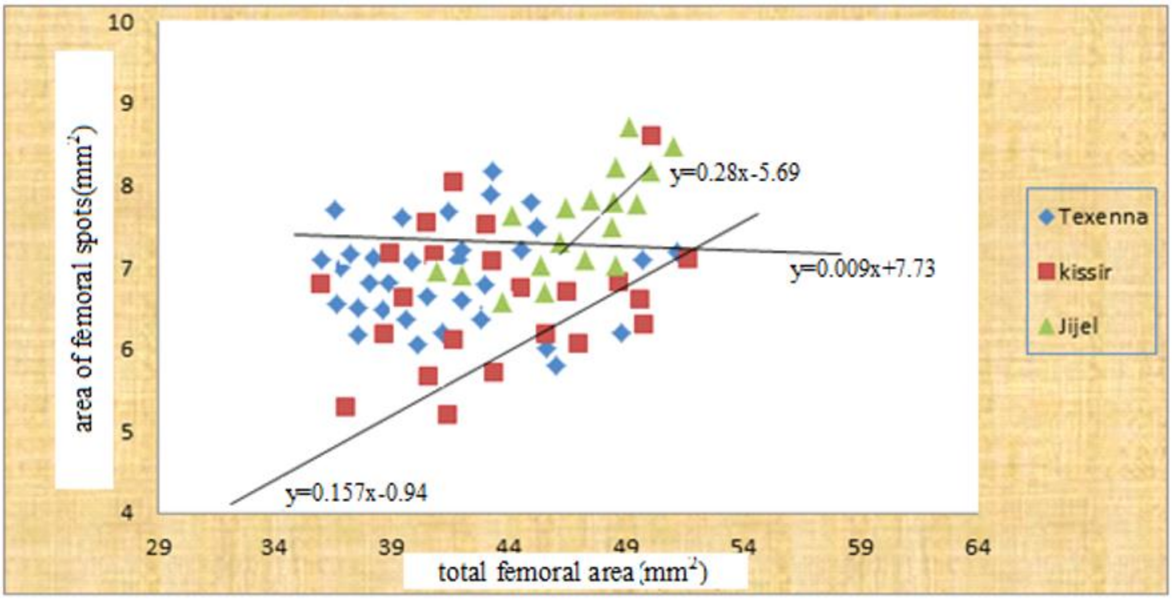


**Fig.7.** Linear regression between the surface of the femurs and the surface of the femoral spots in the male's populations in the 3 stations

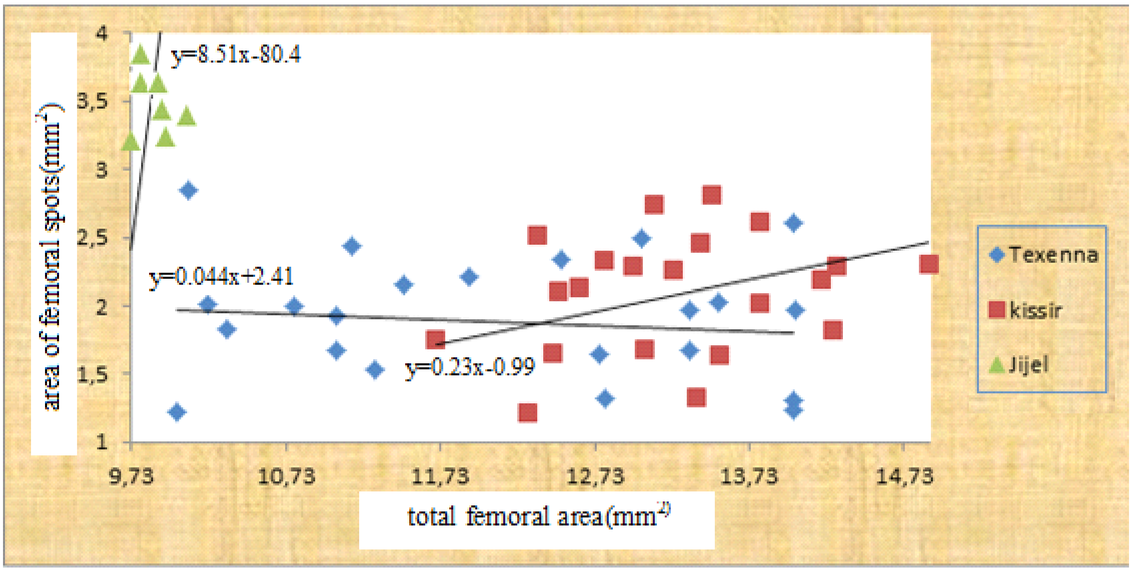


**Fig. 8.** Linear regression between the surface of the femurs and the surface of the femoral spots in the male's populations in the 3 stations

**Analysis of Variance (ANOVA)**:

The different parameters studied show a less different distribution between the 3 stations. Analysis of the variance of total body length in *C. barbarus* females population between the 3 stations gives a calculated F-value equal to 1.689 and a probability P equal to 0.191 (> 0.05), (Table 4 and 5). The difference is therefore not significant.

**Table 4.** Analysis of total length variance female's population between the 3 stations

| Source | Sq'sum | Df | Sq'mean | F value | Pr (>F) |
|---|---|---|---|---|---|
| Modeling | 13.732 | 2 | 6.866 | 1.689 | 0.191 |
| Résidue | 312.982 | 77 | 4.65 | | |
| Total | 326.714 | 79 | | | |

**Table 5**. Descriptive Analysis of variance of total length in female population between the 3 stations

| | N | Mean | Standard deviation | Standard error | Confidence interval at 95% for the mean | | Min | Max |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lowerlimit | Upperlimit | | |
| S 1 | 25 | 17.416 | .8280 | .1656 | 17.074 | 17.758 | 16.0 | 19.8 |
| S 2 | 22 | 17.736 | .8220 | .1753 | 17.372 | 18.101 | 16.4 | 19.0 |
| S 3 | 7 | 18.029 | 2.1461 | .8111 | 16.044 | 20.013 | 15.1 | 19.9 |
| Total | 54 | 17.626 | 1.0709 | .1457 | 17.334 | 17.918 | 15.1 | 19.9 |

On the other hand, analysis of the total length variance in *C. barbarus* males population between the three stations gives a calculated F-value equal to 1.096 and a probability P equal to 0.342 (> 0.05) (Table 6 and 7). The difference is also not significant.

**Table 6.** Analysis of total length variance in male's population between the 3 stations

| Source | Sq'sum | Df | Sqmean | F value | Pr (>F) |
|---|---|---|---|---|---|
| Modeling | 2.505 | 2 | 1.252 | 1.096 | 0.342 |
| Résidue | 58.279 | 51 | 1.143 | | |
| Total | 60.784 | 53 | | | |

Sq'sum: total of yaw square; Df: degree of freedom; Sq'mean: variance due to the factor mean = Sq Sum / Df; F: the value of Fisher statistic; Pr (> F): the probability that we can meet the calculated value of statistics.

**Table 7**. Descriptive Analysis of variance of total length in male population between the 3 stations

| | N | Mean | Standard deviation | Standard error | Confidence interval at 95% for the mean | | Min | Max |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lowerlimit | Upperlimit | | |
| S 1 | 38 | 29.382 | 1.7331 | .2811 | 28.812 | 29.951 | 24.5 | 32.0 |
| S 2 | 24 | 29.267 | 2.2803 | .4655 | 28.304 | 30.230 | 24.0 | 33.0 |
| S 3 | 18 | 30.322 | 2.1996 | .5185 | 29.228 | 31.416 | 25.0 | 33.0 |
| Total | 80 | 29.559 | 2.0336 | .2274 | 29.106 | 30.011 | 24.0 | 33.0 |

N: number of individuals in the population; S1: Texenna; S2: Kissir; S3: Jijel

## DISCUSSION

The analysis of morphometric parameters permits to appreciate the degree of variability of populations. The couples length femur / width femur, length elytra / length femur, femoral surface / femoral spots surface of the three populations are homogeneous in morphometric couples considered. Based on the results, 8 out of 12 parameters gave insignificant differences. This means that in general, the pairs including FL / FW and EL / FL are homogeneous for all three stations. On the other hand, analysis of variance of total body length showed that the F observed or calculated (the value of the Fisher statistic) is higher than the theoretical F (the probability that we can meet the calculated statistical value) in males and females population, we can conclude that there is a low or no significant difference between the populations of 3 stations, the reason for this slight difference is probably due to the difference in altitude and vegetation that characterize each station. it is accepted that food and altitude are 2 important factors in the life of an insect, they can cause size differences between individuals. Texenna station which is an open scrubland with a flora consisting of *Cystus monspeliensis* is located at 600 m of altitude, where there is a fresh climate. It is therefore different from Jijel station which is located on sand dunes set at 0 m altitude (seaside) and characterized by grassy vegetation, so this will generate even slight differences in size between the individuals of the 2 stations.

According to Hugueny and Louveaux (1986), as soon as the body dimensions are very closely correlated with each other, growth occurs in the same proportions for the different parts of the body. The larger individuals are isometric of the smaller ones. But for this, the measurements must be made on several morphometric criteria.

The region of Jijel which belongs to the humid bioclimate, exclusively hosts individuals with 3 separate black spots, the size of these individuals varies from 24 mm to 33 mm for females and 15.1 mm to 19.8 mm for males (appendix1). Benzara (2004) in his study of the geographical polymorphism of this species indicates that the population of sub-humid bioclimate is distinguished by three separate black spots on the inner side of the femur. According to this same author, the females belonging to the subhumid, region have a size between 25 mm and 30 mm that of the males ranged from 13 mm to 16 mm. So the measurements obtained in this work confirm those of Benzara (2004). We conclude that there is no polymorphism between populations of sub-humid and humid which apparently forms the same homogeneous group, unlike the population of semi-arid bioclimate who according to Benzara (2004) contain individuals with only one femoral spot, their size varied from 33 mm to 44 mm for females and 19.2 mm to 29 mm for males, showing a clear heterogeneity with the previous group. This difference in size between individuals explains that in Algeria there is a geographical polymorphism in *C. barbarus* between the population of semi-arid characterized by a large size and the population of humid and sub-humid both characterized by a smaller size. This polymorphism is expressed by differences in size between individuals or morphometric change reports and requires the understanding of mechanisms including geographical and ecological isolation of species (Dreux, 1972). But Jago (1963) considers that the *C. barbarus* polymorphism is mostly related to environmental conditions.

According to Hugueny and Louveaux (1986), It is well established that southern populations of *C. barbarus* differ from northern populations on the one hand by the large size of the adult and on the other by a supernumerary stage of development. The size varies from single to double between latitude30 ° and 48 ° (Hugueny and Louveaux, 1986). The pigmentation of the inner face of the femur is also subject to various degrees of variation. For Jago (1963), they can indeed be reduced, expanded, or fused according to the environmental conditions. In this case, the fusion or separation of the spots is just an adaptation to different ecological conditions, which obviously involves geographical distribution clearly separated from ecotypes. Despite the apparent differences in size between the two forms it is difficult to discuss their status because of geographical polymorphism of this species, as several authors have already shown. According to Clement et al. (1987), it would even be possible to propose the establishment of a new taxon in the case of *C. barbarus* based on morphometric, ecological and ethological studies that are necessary in the case of species with high polymorphism and wide geographical distribution (as is the case for our species).

## CONCLUSION

A study on the morphometric of Orthoptera is mainly based on the classical method of measurements of different parts of the body: abdomen, femur, tegmina. In this study, we used several parameters: Total body Length, Length of Eytra, Length and Width of Femur, Width of Head, Width of Pronotum, Total Femoral Area and Area of Femoral Spots. We must remember that the 3 populations studied belong to a single set that of the humid bioclimatic stage. In this stage, lives only individuals with 3 femoral spots as has been reported by different authors. Effectively, no individual with one femoral spot was sampled on the ground in the region of Jijel during all the years that this study lasted.

Although the limited number of individuals analyzed especially the population of Jijel (only 25 individuals), our morphometrical analysis shows that there are low differences between the populations of Jijel, Kissir, and Texenna. Despite their apparent differences in size (8 out of 12 parameters gave non-significant differences), we can conclude that the 3 populations living in the Jijel region belong all to a single homogeneous group: the form with 3 femoral spots

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**Appendix1**

Morphometric of female population in the station 1(Texenna)

| Parameters (in mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Individuals | TL | EL | FL | FW | HW | PW | TFA | AFS |
| 1 | 29,2 | 21,3 | 18 | 5,1 | 4,3 | 5,1 | 39,4 | 7,6 |
| 2 | 29,7 | 20 | 17 | 5,8 | 5 | 4 | 37,4 | 5,8 |
| 3 | 28,1 | 19,3 | 16,2 | 5,6 | 5.5 | 4,8 | 40,25 | 5,9 |
| 4 | 32 | 22,1 | 19 | 6,1 | 6,1 | 5,5 | 37,31 | 7,4 |
| 5 | 30,4 | 21 | 17,1 | 6,2 | 5,8 | 5 | 38,15 | 5,9 |
| 6 | 30,3 | 20,6 | 17 | 6 | 5,9 | 5,1 | 36,04 | 8,1 |
| 7 | 30,7 | 21 | 18 | 5,2 | 5,6 | 5 | 43,2 | 7,9 |
| 8 | 26,1 | 19,1 | 16,4 | 5,9 | 4,8 | 5,2 | 38,03 | 6,5 |
| 9 | 28,4 | 19,5 | 16 | 6.2 | 5,1 | 4,7 | 36,82 | 7 |
| 10 | 31,2 | 22,8 | 18,1 | 6,3 | 6 | 5 | 49,68 | 7,08 |
| 11 | 29 | 22 | 17 | 6 | 5,4 | 5 | 39,82 | 7,06 |
| 12 | 29,2 | 20,9 | 16,9 | 5,5 | 4,9 | 4 | 41,78 | 7,1 |
| 13 | 28 | 19,1 | 16,1 | 5,3 | 5,1 | 4 | 38,04 | 6,8 |
| 14 | 30 | 21,4 | 18 | 5,8 | 5,1 | 4,7 | 44,97 | 7,8 |
| 15 | 30 | 19,3 | 16,5 | 5,5 | 4,9 | 4,2 | 44,5 | 7,2 |
| 16 | 28,1 | 18,9 | 16,1 | 5,8 | 4,7 | 4,1 | 46,03 | 5,8 |
| 17 | 25 | 17,9 | 17 | 5,3 | 4,6 | 4,8 | 40,13 | 6,05 |
| 18 | 28 | 20 | 16 | 4,9 | 4,8 | 4,8 | 41,16 | 6,21 |
| 19 | 30 | 20 | 17,9 | 5,5 | 5,1 | 4,3 | 42,02 | 7,2 |
| 20 | 28 | 20 | 17 | 5,3 | 5,1 | 5,1 | 34,88 | 6,4 |
| 21 | 31 | 20,5 | 17,2 | 5,2 | 5,3 | 4 | 48,8 | 6,2 |
| 22 | 29,8 | 20,2 | 16,8 | 5,1 | 5,1 | 4,8 | 38,84 | 6,8 |
| 23 | 30 | 20 | 18 | 6 | 5,5 | 4 | 45,6 | 6 |
| 24 | 30,3 | 21,2 | 18,2 | 5,9 | 5,1 | 4,9 | 34 | 6,8 |
| 25 | 32 | 21 | 19 | 6 | 5,5 | 4,8 | 45,18 | 7,5 |
| 26 | 31 | 21,2 | 18 | 6 | 5,2 | 5 | 43,3 | 8,18 |
| 27 | 28 | 19,5 | 17 | 6 | 5,1 | 4,9 | 35,1 | 7,18 |
| 28 | 32 | 21 | 17 | 5 | 4,9 | 3,5 | 34,95 | 6,3 |
| 29 | 30 | 21,5 | 17 | 5 | 4,8 | 4 | 39,8 | 6,5 |
| 30 | 29 | 22 | 16 | 5 | 5 | 4 | 38,2 | 5,9 |
| 31 | 24,5 | 18 | 16 | 5 | 5 | 3,5 | 37,9 | 6,5 |
| 32 | 29 | 22 | 16 | 5 | 5,1 | 3,5 | 35,1 | 6,1 |
| 33 | 27,5 | 20,5 | 14,5 | 4,5 | 49 | 3 | 36 | 5,9 |
| 34 | 31,5 | 21 | 17 | 5 | 4,8 | 4 | 38,7 | 5,8 |
| 35 | 30 | 21,5 | 17 | 45 | 5,1 | 4 | 35,5 | 6 |
| 36 | 30 | 20 | 16 | 5 | 4,8 | 3,5 | 41,5 | 6,5 |
| 37 | 29,5 | 20 | 16 | 5 | 4,8 | 3,5 | 34,9 | 5,9 |
| 38 | 30 | 22 | 17 | 5,5 | 5,1 | 4 | 38,2 | 5,9 |
| M | 29,4 | 20.5 | 17 | 6.5 | 6.3 | 4.4 | 39.7 | 6.6 |

Morphometric of male population in the station 1(Texenna)

| Parameters (in mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Individuals | TL | EL | FL | FW | HW | PW | TFA | AFS |
| 1 | 19,8 | 14,3 | 11 | 4 | 4 | 3,2 | 14,01 | 2,6 |
| 2 | 17 | 11,8 | 9 | 3 | 3,7 | 2,9 | 12,8 | 1,32 |
| 3 | 17 | 12 | 9,2 | 3,8 | 3,6 | 2,4 | 13,53 | 2,03 |
| 4 | 17 | 12,5 | 9.9 | 3,8 | 3,5 | 3 | 10,22 | 2,01 |
| 5 | 16,5 | 12,1 | 8,5 | 3 | 3 | 2,5 | 14,02 | 3,31 |
| 6 | 16 | 11 | 9,1 | 3,4 | 3 | 2,8 | 10,78 | 2 |
| 7 | 18 | 12,8 | 10 | 4 | 3,5 | 2,5 | 13,03 | 2,5 |
| 8 | 17,5 | 11 | 10 | 3,1 | 3,5 | 2,2 | 10,03 | 1,22 |
| 9 | 17 | 10,9 | 10 | 3,5 | 3,4 | 2,3 | 10,35 | 1,83 |
| 10 | 17 | 11,8 | 9,1 | 3,2 | 3,9 | 3 | 14,01 | 1,24 |
| 11 | 17,6 | 12,7 | 10 | 4 | 4 | 3 | 11,16 | 2,43 |
| 12 | 17 | 12 | 8,8 | 3 | 3,8 | 2,8 | 11,3 | 1,53 |
| 13 | 17 | 10,8 | 10 | 4 | 3,9 | 3,2 | 10,10 | 2,85 |
| 14 | 18 | 12,1 | 10,2 | 3,4 | 4 | 3 | 11,06 | 1,68 |
| 15 | 17 | 12 | 10,4 | 3 | 4 | 3,2 | 11,06 | 1,93 |
| 16 | 18 | 12,1 | 8,1 | 4 | 3,9 | 3,1 | 11,3 | 1,98 |
| 17 | 17 | 12,5 | 10 | 3,5 | 3 | 2,8 | 11,5 | 2,25 |
| 18 | 17 | 11 | 9 | 3 | 3 | 2,8 | 11,25 | 2,1 |
| 19 | 17,1 | 11,5 | 9 | 3 | 3 | 2,8 | 10,5 | 1,9 |
| 20 | 17,5 | 12 | 9 | 3 | 3,1 | 2,1 | 12,5 | 2,3 |
| 21 | 17,4 | 12 | 9 | 3 | 3,2 | 2,2 | 12,75 | 2,4 |
| 22 | 16,9 | 11 | 8,5 | 3 | 3 | 2 | 11,1 | 2,2 |
| 23 | 19 | 13 | 9 | 3,2 | 3.3 | 2,5 | 14,0 | 2,85 |
| 24 | 18 | 13 | 10 | 3,1 | 2,9 | 2,5 | 13,75 | 2,9 |
| 25 | 17,2 | 11,5 | 9,2 | 3 | 3 | 2,3 | 11,65 | 2,65 |
| M | 17,38 | 11,97 | 9,42 | 3,36 | 3,45 | 2,68 | 11,91 | 2,16 |

Morphometric of female population in the station 2 (Kissir)

| Parameters (in mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Individuals | TL | EL | FL | FW | HW | PW | TFA | AFS |
| 1 | 29,1 | 22 | 17,2 | 5,8 | 5,3 | 5,2 | 34,6 | 8,5 |
| 2 | 29 | 16,1 | 17 | 6 | 5,4 | 5 | 33,18 | 8,1 |
| 3 | 27,2 | 20,1 | 17 | 6 | 5,6 | 5,1 | 41,68 | 6,1 |
| 4 | 30 | 21 | 17,1 | 5 | 5 | 4 | 45,6 | 6,17 |
| 5 | 29,1 | 21,3 | 18 | 6,1 | 5,8 | 4,3 | 43,4 | 5,7 |
| 6 | 30 | 20,1 | 17,5 | 5,5 | 5,5 | 4,9 | 42,7 | 5,31 |
| 7 | 31 | 23,1 | 18,2 | 6,2 | 5,8 | 4,8 | 41,3 | 5,4 |
| 8 | 30 | 22,5 | 16,5 | 6,2 | 6 | 4,1 | 50,1 | 8,8 |
| 9 | 29 | 20,1 | 16,8 | 5 | 5 | 4,1 | 49,8 | 6,3 |
| 10 | 31,2 | 22,6 | 18 | 6,1 | 6 | 5 | 51,7 | 7,1 |
| 11 | 29 | 21 | 16,5 | 6 | 6 | 5,1 | 48,68 | 6,8 |
| 12 | 30 | 20,5 | 16 | 6,1 | 6 | 5 | 49,58 | 6,6 |
| 13 | 24,5 | 17 | 13 | 4.2 | 5 | 3,1 | 35,16 | 5,8 |
| 14 | 29 | 24 | 17 | 5 | 5 | 5 | 41,5 | 8,3 |
| 15 | 29,1 | 20 | 16 | 5 | 5 | 4 | 38 | 7,5 |
| 16 | 24 | 17,5 | 15 | 5 | 4,9 | 3,5 | 42,1 | 6,7 |
| 17 | 31 | 23 | 18 | 5,5 | 6 | 5 | 42,6 | 8,1 |
| 18 | 31,5 | 23 | 16 | 5,5 | 5 | 4 | 45 | 5.9 |
| 19 | 24 | 17 | 15 | 5 | 5,2 | 4 | 40 | 7,5 |
| 20 | 30,5 | 22,5 | 17 | 5,5 | 5,1 | 4,5 | 38,7 | 7 |
| 21 | 31 | 23 | 19 | 6 | 5 | 4,5 | 36,7 | 5,3 |
| 22 | 30 | 21,5 | 17 | 6 | 5,1 | 4 | 38,4 | 5,15 |
| 23 | 30,2 | 22 | 16 | 4,5 | 5 | 4 | 36,1 | 5,55 |
| 24 | 33 | 25 | 18 | 5,6 | 5,3 | 4 | 41,6 | 6,3 |
| M | 29,26 | 21,07 | 16,78 | 5,59 | 5,37 | 4,42 | 42,00 | 6,66 |

Morphometric of male population in the station 2(Kissir)

| Parameters (in mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Individuals | TL | EL | FL | FW | HW | PW | TFA | AFS |
| 1 | 18,9 | 13 | 10,4 | 3,9 | 4 | 3 | 14,3 | 2,28 |
| 2 | 18,9 | 13 | 10,1 | 3,5 | 3,8 | 3 | 12,8 | 2,33 |
| 3 | 18 | 12,8 | 10,2 | 4 | 4,1 | 3,1 | 14,2 | 2,18 |
| 4 | 18 | 12,5 | 9 | 4 | 4 | 3 | 12,5 | 2,1 |
| 5 | 17,8 | 13 | 10,8 | 3,8 | 3,8 | 3,1 | 13,81 | 26 |
| 6 | 17 | 11 | 9 | 4 | 4 | 3 | 14,9 | 2,3 |
| 7 | 18,5 | 12 | 10,8 | 3,9 | 3,9 | 3 | 13,5 | 2,8 |
| 8 | 18 | 12,3 | 11 | 3,8 | 3,8 | 3 | 13,4 | 1,32 |
| 9 | 17,8 | 12,2 | 10,7 | 4 | 4 | 3,2 | 12,63 | 2,12 |
| 10 | 16,4 | 11,3 | 9,4 | 3,8 | 3,8 | 3 | 11,7 | 1,74 |
| 11 | 16,5 | 12 | 10 | 3,9 | 3,9 | 3 | 12,3 | 1,21 |
| 12 | 16,4 | 11 | 9,8 | 3,9 | 3,9 | 3,1 | 12,13 | 1,36 |
| 13 | 19 | 13 | 10 | 3,5 | 3,3 | 2,5 | 14 | 2,5 |
| 14 | 19 | 14 | 9,3 | 3 | 3,1 | 2,8 | 13,9 | 275 |
| 15 | 17,8 | 13 | 10 | 3,5 | 3,2 | 3 | 12,5 | 2,9 |
| 16 | 17,7 | 13 | 10 | 3,5 | 3,1 | 2,5 | 12,4 | 2,91 |
| 17 | 18 | 13 | 10 | 3,5 | 3,5 | 3 | 13,5 | 2,8 |
| 18 | 17,5 | 12 | 10 | 3,5 | 3,5 | 3 | 13,2 | 2,6 |
| 19 | 17,4 | 12,5 | 9,5 | 3,5 | 3,5 | 3 | 13,25 | 2,65 |
| 20 | 17,6 | 12,5 | 9,5 | 3 | 3,1 | 2,1 | 13,6 | 2,5 |
| 21 | 16,5 | 12 | 10 | 3,5 | 3,1 | 2,5 | 11,75 | 2,85 |
| 22 | 17,5 | 13 | 10 | 3 | 3,2 | 3 | 11,9 | 2,4 |
| M | 17,73 | 12,45 | 9,97 | 3,63 | 3,61 | 2,90 | 13,09 | 15,76 |

Morphometric of female population in the station 3 (Jijel)

| Parameters (in mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Individuals | TL | EL | FL | FW | HW | PW | TFA | AFS |
| 1 | 32 | 24 | 18,5 | 7,1 | 5,2 | 4,9 | 46,18 | 7,3 |
| 2 | 33 | 23,8 | 18,6 | 7,3 | 5,8 | 5,1 | 50,03 | 8,16 |
| 3 | 32,4 | 24,1 | 18,7 | 6 | 5,1 | 4,1 | 48,53 | 7,01 |
| 4 | 30 | 22,1 | 16,3 | 6,1 | 6 | 4 | 49,18 | 8,7 |
| 5 | 33 | 24 | 17 | 6 | 5 | 4 | 49 | 7,6 |
| 6 | 32,5 | 25,5 | 19 | 6 | 5 | 5 | 42 | 6,5 |
| 7 | 25 | 18 | 14,5 | 4,5 | 4 | 4 | 41,5 | 6,6 |
| 8 | 32,5 | 24 | 17 | 6 | 5,5 | 4 | 46 | 7,6 |
| 9 | 29 | 22 | 17 | 6 | 5 | 4 | 45 | 6,9 |
| 10 | 29,5 | 22,5 | 16,5 | 5,5 | 5,2 | 4 | 48 | 6,95 |
| 11 | 33 | 25 | 18 | 6 | 6 | 5 | 44,5 | 7,5 |
| 12 | 30 | 22 | 15 | 4 | 5 | 3,5 | 44 | 6,3 |
| 13 | 30 | 22 | 15 | 5 | 5 | 4 | 49,5 | 7,7 |
| 14 | 29 | 20 | 17 | 6 | 5 | 5 | 47,5 | 7,75 |
| 15 | 28,5 | 20 | 14 | 4,5 | 5,1 | 3,5 | 50,5 | 8,4 |
| 16 | 29 | 20,5 | 16 | 5.5 | 4,9 | 4 | 41 | 7,1 |
| 17 | 29,4 | 22 | 16,5 | 5,5 | 5,1 | 4 | 48,5 | 8,2 |
| 18 | 28 | 19 | 16 | 5,5 | 4,5 | 3 | 42,5 | 6,5 |
| M | 30,32 | 22,25 | 16,7 | 5,70 | 5,13 | 4,17 | 46,30 | 7,37 |

Morphometric of male population in the station 3 (Jijel)

| Parameters (in mm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Individuals | TL | EL | FL | FW | HW | PW | TFA | AFS |
| 1 | 15,1 | 10 | 9,3 | 3,2 | 4 | 2,7 | 9,73 | 3,22 |
| 2 | 16,2 | 9,8 | 10,3 | 4 | 4 | 3 | 10,09 | 3,93 |
| 3 | 16 | 9 | 10,1 | 3,9 | 4 | 3 | 10,32 | 3,25 |
| 4 | 19,5 | 13,5 | 10 | 3,7 | 3,5 | 2,8 | 9,5 | 3,5 |
| 5 | 19,8 | 14 | 11 | 3,3 | 3,6 | 2,9 | 9,65 | 3,2 |
| 6 | 19,9 | 14,2 | 11 | 3,5 | 3,5 | 2,8 | 10,05 | 3,8 |
| 7 | 19,7 | 14 | 10 | 3,1 | 3,5 | 2,9 | 10,25 | 3,75 |
| M | 18,02 | 12,07 | 10,24 | 3,52 | 3,72 | 2,87 | 9,94 | 3,52 |

## Appendix2.

**Appendix2.** Correlation matrix of Texenna females

| | FL | FW | EL | HW | PW |
|---|---|---|---|---|---|
| FL | 1.00 | 0.52 | 0.48 | 0.52 | 0.58 |
| FW | 0.52 | 1.00 | 0.13 | 1.00 | 0.63 |
| EL | 0.48 | 0.13 | 1.00 | 0.13 | 0.19 |
| HW | 0.52 | 1.00 | 0.13 | 1.00 | 0.63 |
| PW | 0.58 | 0.63 | 0.19 | 0.63 | 1.00 |

Correlation matrix of Texenna males

| | FL | FW | EL | HW | PW |
|---|---|---|---|---|---|
| FL | 1.00 | 0.40 | 0.38 | 0.37 | 0.33 |
| FW | 0.40 | 1.00 | 0.35 | 0.51 | 0.45 |
| EL | 0.38 | 0.35 | .00 | 0.25 | 0.27 |
| HW | 0.37 | 0.51 | 0.25 | 1.00 | 0.65 |
| PW | 0.33 | 0.45 | 0.27 | 0.65 | 1.00 |

Correlationmatrix of Kissir females

| | FL | FW | EL | HW | PW |
|---|---|---|---|---|---|
| FL | 1.00 | 0.64 | 0.64 | 0.36 | 0.60 |
| FW | 0.64 | 1.00 | 0.31 | 0.69 | 0.63 |
| EL | 0.64 | 0.31 | 1.00 | 0.22 | 0.28 |
| HW | 0.36 | 0.69 | 0.22 | 1.00 | 0.57 |
| PW | 0.60 | 0.63 | 0.28 | 0.57 | 1.00 |

Correlationmatrix of Kissir males

| | FL | FW | EL | HW | PW |
|---|---|---|---|---|---|
| FL | 1.00 | 0.28 | 0.16 | 0.20 | 0.25 |
| FW | 0.28 | 1.00 | -0.44 | 0.81 | 0.58 |
| EL | 0.16 | -0.44 | 1.00 | -0.44 | -0.19 |
| HW | 0.20 | 0.81 | -0.44 | 1.00 | 0.71 |
| PW | 0.25 | 0.58 | -0.19 | 0.71 | 1.00 |

Correlation matrix of Jijel females

| | FL | FW | EL | HW | PW |
|---|---|---|---|---|---|
| FL | 1.00 | 0.85 | 0.77 | 0.45 | 0.72 |
| FW | 0.85 | 1.00 | 0.57 | 0.53 | 0.67 |
| EL | 0.77 | 0.57 | 1.00 | 0.64 | 0.55 |
| HW | 0.45 | 0.53 | 0.64 | 1.00 | 0.43 |
| PW | 0.72 | 0.67 | 0.55 | 0.43 | 1.00 |

Correlation matrix of Jijel males

| | FL | FW | EL | HW | PW |
|---|---|---|---|---|---|
| FL | 1.00 | 0.12 | 0.53 | -0.47 | -0.57 |
| FW | 0.12 | 1.00 | -0.53 | 0.44 | 0.34 |
| EL | 0.53 | -0.53 | 1.00 | -0.98 | -0.96 |
| HW | -0.47 | 0.44 | -0.98 | 1.00 | 0.99 |

**Appendix3.** Means & standard deviation of EL/FL FL/FW, TFA/AFS pairs of S1♀ & ♂population

| | Mean | Stand. dev. | N | Max | Min |
|---|---|---|---|---|---|
| ♀ | | | | | |
| EL | 20.50 | 1.15 | 38 | 22.8 | 17.9 |
| FL | 17,02 | 0.93 | 38 | 19 | 14,5 |
| ♂ | | | | | |
| EL | 12.06 | 0.82 | 25 | 14.3 | 10.8 |
| FL | 9.44 | 0.7 | 25 | 11 | 8.1 |
| ♀ | | | | | |
| FL | 17.02 | 0.93 | 38 | 19 | 14.5 |
| FW | 5.47 | 0.49 | 38 | 6.3 | 4.5 |
| ♂ | | | | | |
| FL | 9.44 | 0.68 | 25 | 11 | 8.1 |
| FW | 3.37 | 0.40 | 25 | 4 | 3 |
| ♀ | | | | | |
| TFA | 39.76 | 4.04 | 38 | 49.68 | 34 |
| AFS | 6.65 | 0.71 | 38 | 8.18 | 5.8 |
| ♂ | | | | | |
| TFA | 11.91 | 1.38 | 25 | 14.02 | 10.03 |
| AFS | 2.16 | 0.53 | 25 | 3.31 | 1.22 |

Means & standard deviation of EL/FL FL/FW, TFA/AFS pairs of S2♀♂& population

| | Mean | Stand. dev. | N | Max | Min |
|---|---|---|---|---|---|
| ♀ | | | | | |
| EL | 21.07 | 2.30 | 24 | 25 | 16.1 |
| FL | 16.78 | 1.27 | 24 | 19 | 13 |
| ♂ | | | | | |
| EL | 12.45 | 0.73 | 22 | 14 | 11 |
| FL | 9.98 | 0.55 | 22 | 11 | 9 |
| ♀ | | | | | |
| FL | 16.78 | 1.27 | 24 | 19 | 13 |
| FW | 5.53 | 0.57 | 24 | 6.2 | 4.2 |
| ♂ | | | | | |
| FL | 9.98 | 0.55 | 22 | 11 | 9 |
| FW | 3.63 | 0.32 | 22 | 4 | 3 |
| ♀ | | | | | |
| TFA | 42 | 5.25 | 24 | 51.7 | 33.18 |
| AFS | 6.66 | 1.11 | 24 | 8.8 | 5.15 |
| ♂ | | | | | |
| TFA | 13.09 | 0.95 | 22 | 14.9 | 11.7 |
| AFS | 2.28 | 0.51 | 22 | 2.91 | 1.21 |

Means & standard deviation of EL / FL, FL / FW TFA / AFS pairs of S3 ♀ & ♂population

| | Mean | Stand. dev. | N | Max | Min |
|---|---|---|---|---|---|
| ♀ | | | | | |
| EL | 22.25 | 2.1 | 20 | 25.5 | 18 |
| FL | 16.70 | 1.48 | 20 | 19 | 14.5 |
| ♂ | | | | | |
| EL | 12.07 | 2.34 | 7 | 14,2 | 9 |
| FL | 10.24 | 0.6 | 7 | 11 | 9.3 |
| ♀ | | | | | |
| FL | 16.70 | 1.48 | 20 | 19 | 14.5 |
| FW | 5.7 | 0.83 | 20 | 7.3 | 4 |
| ♂ | | | | | |
| FL | 10.24 | 0.6 | 7 | 11 | 9.3 |
| FW | 3.52 | 0.34 | 7 | 4 | 3.1 |
| ♀ | | | | | |
| TFA | 46.3 | 3.12 | 18 | 50.5 | 41 |
| AFS | 7.37 | 0.70 | 18 | 8.7 | 6.3 |
| ♂ | | | | | |
| TFA | 9.94 | 0.31 | 7 | 10.32 | 9.5 |
| AFS | 3.52 | 0.3 | 7 | 3.93 | 3.2 |