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Comparative study of some parameters biological of *Bactrocera dorsalis* and *Ceratitis cosyra* (Diptera :Tephritidae) pests of mango (*Mangifera indica*) in Côte d'Ivoire

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ABSTRACT

Bactrocera dorsalis and *Ceratitis cosyra* are the major pests of mango (*Mangifera indica*), in Côte d'Ivoire. The study of biological parameters of these pests has revealed that the development of *B. dorsalis* is higher than that of *C. cosyra* in the three agro-ecological areas. The experiments were performed in semi-natural conditions in the orchard and in the conditions of ambient laboratory environment. A specific breeding *B. dorsalis* and *C. cosyra* been taken. The duration of the life cycle of *B. dorsalis* are shorter (20.93 days in the South, 18.67 days and 17.93 days in the center and north respectively) than *C. cosyra* (22.53 days in the south, 20.2 days in the center and 19.5 days in the north). The male development time was shorter than this of females, as in *B. dorsalis* in *C. cosyra*. The number of eggs laid by the female of *B. dorsalis* (269 in the south, 347 in the center and north) was higher than this of the female of *C. cosyra* (186 in the south, 196 in the center, 197 in the north). Longest life was recorded in adult *B. dorsalis*. Adult males have lived longer than adult females, in both species. The study on the biology of these two fruit flies showed that *B. dorsalis* is a serious pest in all the views of the various parameters studied. These results allow a better determination of the periods and means of intervention in the control against *B. dorsalis* and *C. cosyra*.

Keywords : *Bactrocera dorsalis*, *Ceratitis cosyra*, biological parameters, pests of mango, agro-ecological areas,

1.INTRODUCTION

Among the fruit crops of the country, the cultivation of mango has been very promising in the north of the country in recent decades. Indeed, faced with the collapse of world cotton costs, a growing interest has been granted for cultivation of mango in this region. Farmers, gradually transforming their old plots of cotton, cultivated for over 30 years in mango orchards. Thus, the Côte d'Ivoire is the largest producer of mangoes in Africa and third countries exporting to the European market [1]. In northern populations, the large production area, mango contributes to food security and the fight against poverty. The concern for producers and distributors as well as consumers is to have quality of crop products [2]. Unfortunately, the fruit industry in Africa and particularly in Côte d'Ivoire is facing great economic losses because of the numerous attacks by pests. This predatory activity is essentially the fact of fruit flies. These insects belong to the family Tephritidae with some 4 500 species known, including 250 economic importance [3]. In Côte d'Ivoire, the Tephritidae cause of mangoes losses estimated at more than 50 % of annual production [4]. The situation has worsened with the introduction of new invasive species *Bactrocera dorsalis*, which causes enormous damage on fruits [1]. Thus in 2012, Côte d'Ivoire, with 34 interceptions on European soil, is top of the list, followed by Ghana (28) and Mali (15) [5]. Besides the problem of commercial penalties, possible loss of customers and reputation for the exporter, the financial damage was estimated at over 30 000 per container seized. In Africa, *Ceratitis cosyra* Walker has long been known as the most destructive pest of mangoes [6]. Ago 2005, *B. dorsalis* Hendel supplanted *C. cosyra*. Despite the presence of *B. dorsalis*, in Côte d'Ivoire, the species *C. cosyra* remains in orchards [7]. Control methods used against fruit flies are manifold [8]. Among these products, the GF 120 or Success Appat is the new generation of pesticide [9; 10]. But despite all efforts to control the populations of fruit pests, national production is still low compared to those of South American and Asian countries [11]. It is therefore necessary to better understand the biology of mango pests, in order to offer more appropriate forms of struggles in three agro-ecological areas of Côte d'Ivoire. This work is part of a perspective of biological control overall objective to study the biological activity of *B. dorsalis* and *C. cosyra*, to propose a suitable fight schedule in three agro-ecological areas of the Côte d'Ivoire, to better control the populations of these pests.

2. MATERIALS AND METHODS

2.1. Study area

The experiments were conducted in three agro-ecological areas of the Côte d' Ivoire, they are : Southern area (subequatorial climate) : the area of Abidjan (latitude 5 ° 23' N and long 11 ° 4' W ; annual average of 27 ± 1.4 ° C and 1500 mm of rainfall). Central area (climate of transition between the subequatorial climate and the sudanese climate): the

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area of Yamoussoukro (latitude 6 ° 48 ' N and longitude 17 ° 5 'W ; annual average (28 ± 3.1) ° C and 1100 mm. rainfall). Northern area (Sudanese climate): the area of Korhogo (latitude 9 ° 34' N and longitude 5 ° 37' W ; annual average of 24.42 ± 0.5 ° C and 928.85 mm rainfall).

2.2. Breeding of fruits flies

The fruits, bitten by female flies collected from fruit trees, were brought to the laboratory. They were incubated in trays containing sterilized and humidified sand. Sterilization was carried out using an autoclave at a temperature of 121°C and a pressure of 1.5 bar. Five days later, the incubated fruits were immersed. The pupae were recovered by floating and the larvae by sieving. Larvae and pupae were then kept in plexiglas boxes (28 x 27 x 9.5 cm) containing sterilized and humidified sand, until adult emergence. The biological parameters studied were the number of eggs laid per female during its life, the duration of the incubation period of eggs, duration of the biological cycle, rate of emergence, sex ratio and adult longevity.

2.2. Determination of the number of eggs laid per female and the duration of eggs incubation period

Two batches of thirty pairs of *B. dorsalis* and *C. cosyra*, newly emerged, were made. They were placed, each in a muslin sleeve containing five healthy fruits on the tree. Every 24 hours, the pitted fruits, were removed from the sleeve and was moved to continue the experiments on other healthy fruits on the tree, until the death of the female. For the first batch, the eggs laid by the females under the skin of the fruit were counted, under binocular magnifying glass, removal of pulp, at the place of the deposit of eggs. The average number of eggs laid per female during its life (L) was calculated by the formula following :

$L = \frac{\sum eini}{\sum ni}$; ei : number of laid eggs; ni: number of the females

For the second batch, fruits containing eggs were placed in trays composed sterilized sand. These eggs were observed daily until hatching. The average incubation period (Pi), which is the time between egg lying (l) of the hatching (h) was noted.

$Pi = \frac{\sum ti\ vi}{\sum vi}$; ti = h – l ; vi = number of eggs

2.3. Determination of the duration of biological cycle, the rate of emergence, sex ratio and longevity of the adults

At the hatching of the second batch of females, the larvae stage 1 were isolated and deposited in healthy fruits having undergone a notch and then they were placed, each in a box with holes covered by muslin and containing sterilized sand. These fruits were monitored daily and the dates of successive exuviae were noted,development times (DL1, DL2, DL3) of three (3) larvae stages and the total duration larvae development (Dl) were noted, expressed in days, was given.

$$Dl1 = \frac{\sum xi1ni1}{\sum ni1} \quad Dl2 = \frac{\sum xi2ni2}{\sum ni2} \quad Dl3 = \frac{\sum xi3ni3}{\sum ni3} \quad Dl = \frac{\sum xi\ ni}{\sum ni}$$

xi1 = time taken by the egg to become the larvae stage 1; ni1 = number of larvae stage 1; xi2 = time taken by the larvae stage 1 to become the larvae stage 2; ni2 = number of the larvae stage 2; xi3 = time taken by the larvae stage 2 to become the larvae stage 3; bi3 = number of the larvae stage 3; xi = Time between egg and larvae stage 3 (TS3); ni = number of larvae stage 3.

Pupation (P), expressed in days was noted. It is the time between (TS3) the moment of obtaining the pupa (Tp).

$P = \frac{\sum ai\ bi}{\sum bi}$; ai = Tp - TS3: time taken by the larvae stage 3 to become a pupa; bi: number of pupae

The duration of pupal development (Dp), in days, was determined. It corresponds to the time between pupation (P) and the emergence of the adult (Ea).

$Dp = \frac{\sum ci\ di}{\sum di}$; ci = Ea – P : time taken for the pupa to become adult ; di: number of adults

The average number of offspring (No) was calculated.

$No = \frac{\sum ei\ fi}{\sum fi}$; ei = number of adult emerging ; fi = number of batch

The duration of biological cycle (Dc.), expressed in days, the period egg-laying and adult stage, was determined.

Dc = Pi + Dl + P + Dp

The mean of the sex ratio (Sr), as a percentage, was calculated for the offspring of the 30 females.

$Sr = \frac{\sum gi\, hi}{\sum hi}$; $gi = \frac{\text{number of male emerging}}{\text{number of female emerging}} \times 100$; hi = number of female parent

Adults were fed honey diluted in water to 5%, in muslin sleeves. The number of dead imagoes was increased each day until death of the last individual. The average longevity of adults (Fd), expressed in days, was determined.

$Fd = \frac{\sum li\, ki}{\sum ki}$; li: longevity ; ki : number of insects

2.4. Statistical analysis

Data processing was carried out using the software Statistica version 6.0. Each test was repeated 30 times. The results were subjected to a variance analysis (ANOVA). Mean separations were done using the Newman-Keuls test at 5 %.

3. RESULTS

3.1. Number of eggs

In the south, a female has laid *B. dorsalis* from 201 to 325 eggs, or an average of 269.13 ± 41.20 eggs. As for female of *C. cosyra,* it laid an average number egg of 186.5 ± 16.40 eggs with a minimum of 165 eggs and maximum of 205 eggs.

In the center, the female of *B. dorsalis* has laid from 339 to 353 eggs with an average number of 347.53 ± 6.80 eggs. Against by that of *C. cosyra* laid an average number of 196.7 ± 7.3 eggs with a minimum of 189 eggs and maximum to 207 eggs.

In the north, the female of *B. dorsalis* has laid from 323 to 348 eggs: an average number of 347.67 ± 5.71 eggs. For female of *C. cosyra*, the average number laid eggs was 197.43 ± 8.24 eggs. The female begins to lay *C. cosyra* from about 6.3 days after emergence. The female of *C. cosyra* has laid an average of 3.2 eggs per day (Figure 1).

3.2. Number of offspring and sex ratio

In the south, the average number of offspring per female of *B. dorsalis* was 138 ± 19 individuals. The sex ratio of *B. dorsalis* was 42.1 ± 1.67 %. In the center and north, a female of *B. dorsalis* produced on average 220 ± 19 descendants including 141 ± 13 females and 79 ± 7.2 males or a sex ratio of 36 ± 0.38 %.

In the south, the number of individuals from a female of *C. cosyra* was 128.3 ± 5.8 with 73.65 ± 4.5 females and 54.65 ± 1.4 males with a sex ratio 42.6 ± 0.5%. In the center, the average number of **o**ffspring of a female of *C. cosyra* amounted to 125.7 ± 1.53 including 78.3 ± 5.51 females and 44.67 ± 2.89 male with sex ratio 35.7 ± 2.08%.

In the north, this species has given 126 ± 1.4 individuals with 74.97 ± 0.5 females and 45.99 ± 0.8 males (Figure 2, Table 1). Both in *B. dorsalis* than in *C. cosyra*, the number of females was higher than this males in each area. The proportion of males increased when the female progenitor older, in two species. The number of descendants of *B. dorsalis* was higher than *C. cosyra*. Statistical analysis of the results showed significant differences between the number of offspring and sex ratio in the north, center and south.

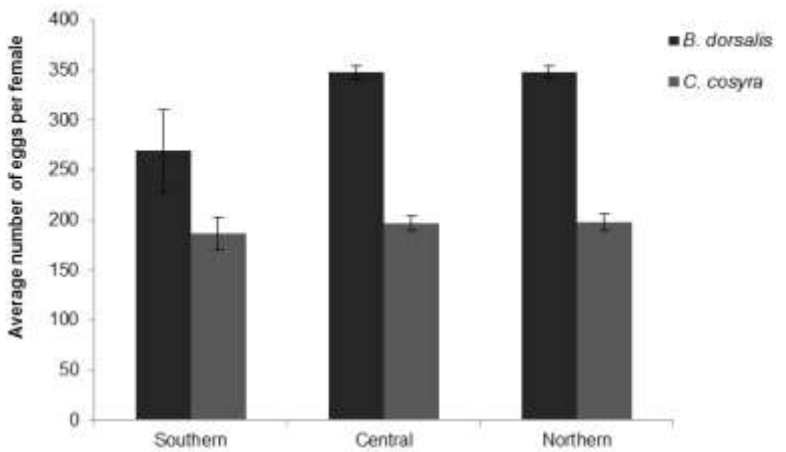

Figure 1: Number of eggs laid by *B. dorsalis* and *C. cosyra* according to agro-ecological

3.3. Development time of immature stages

3.3.1. Duration of egg incubation

In the south, the average incubation period of the eggs of *B. dorsalis*, (2.6 ± 0.5 days) was shorter than that obtained in *C. cosyra* (2.8 ± 0.41 days). In the center, the incubation period of *B. dorsalis*, was 1.7 ± 0.48 days. In *C. cosyra*, it was 1.97 ± 0.41 days. To the north, the incubation period of *B. dorsalis*, was 1.13 ± 0.35 days. In *C. cosyra*, the

incubation period was 1.43 ± 0.5 days (Table 2). Statistical analysis showed a significant difference between the durations of egg incubation of *B. dorsalis* and *C. cosyra* in each area (F = 65.53, df = 5, p < 0.00).

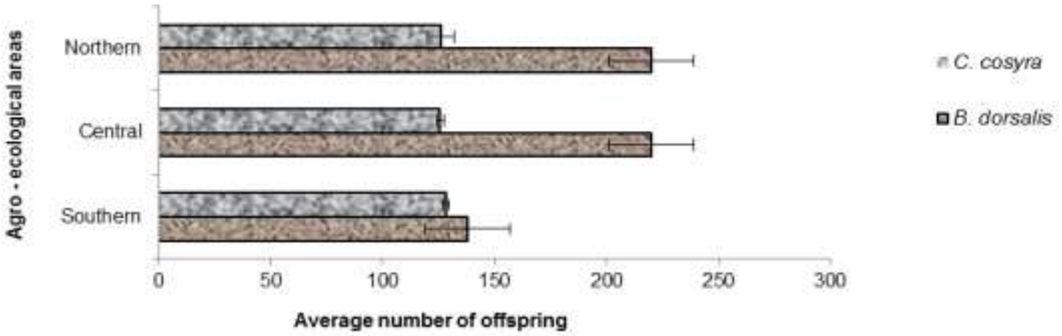

Figure 2 : Number of offspring of *B. dorsalis* and *C. cosyra* according to agro-ecological areas

Table 1: **Average sex ratio of *B. dorsalis* and *C. cosyra* in three agro-ecological areas**

Agro-ecological areas	Species of fruit flies	
	B. dorsalis	***C. cosyra***
Southern	42.1 ± 1.67 [a]	42.6 ± 0.5 [a]
Central	36 ± 0.38 [bc]	35.7 ± 2.08 [c]
Northern	36 ± 0.38 [bc]	36.5 ± 0.63 [b]

In the same column and on the same line, the averages followed by the differents letters are significantly differents

Table 2 : Average duration of egg incubation (day) in three agro-ecological

Agro-ecological areas	Species of fruit flies	
	B. dorsalis	***C. cosyra***
Southern	2.6 ± 0.5 [a]	2.8 ± 0.41 [a]
Central	1.7 ± 0.48 [c]	1.97 ± 0.41 [b]
Northern	1.13 ± 0.35 [e]	1.43 ± 0.5 [d]

In the same column and on the same line, the averages followed by the differents letters are significantly differents

3.3.2. Duration of development of each larvae stage and duration of pupation

In *B. dorsalis*, the length of the head capsule of the first larvae stage was 7.03 ± 0.71 µm. These larvae of the second and third stage measured 11.57 ± 1.13 µm, respectively, and 16 ± 0.74 µm. In *C. cosyra*, the length of the head capsule of the first stage larvae was 6.23 ± 0.43 µm. These larvae of the second and third stage measured 10.53 ± 0.86 µm, respectively, and 13.1 ± 0.23 µm. Thus, the lengths of the head capsules of the first, second and third larvae stage, measured in *B. dorsalis* are higher than those recorded in *C. cosyra* (Table 3). Statistical analysis showed a significant difference between the lengths of the head capsules larvae of *B. dorsalis* as those of *C. cosyra* (F = 580.20, df = 5, p < 0.00).

Table 3 : Average lengths of the head capsules (µm) of larvae stages at *B. dorsalis* and

Larvae stages	Species of fruit flies	
	B. dorsalis	***C. cosyra***
Larvae L_1	7.03 ± 0.71 ^{e}	6.23 ± 0.43 ^{f}
Larvae L_2	11.57 ± 1.13 ^{c}	10.53 ± 0.86 ^{d}
Larvae L_3	16 ± 0.74 ^{a}	13.1 ± 0.23 ^{b}

In the same column and on the same line, the averages followed by the differents letters are significantly differents

Larvae L_2 had the shortest duration, south, center and north. Analysis of the results revealed the existence of a significant difference between the development times of each of the larvae stages of *B. dorsalis* and *C. cosyra* in each area ($F = 128.98$, $df = 17$, $p < 0.00$) (Table 4).

The total duration of larvae development (from larvae stage 1 to the larvae stage 3) of the two flies species has varied in each agro-ecological zone. Analysis of the results revealed the existence of a significant difference between the larvae development duration of *B. dorsalis* and *C. cosyra* in each area ($F = 51.12$, $df = 5$, $p < 0.00$) (Table 5). Thus, at *B. dorsalis*, the average development time was 7.97 ± 0.60 days in the south, 7.36 ± 0.72 days in the center and 5.36 ± 0.81 days in the north.

Table 4 : Average duration of development (day) of each larvae stage of *B. dorsalis* and *C. cosyra* in three agro-ecological areas

Agro-ecological areas	Larvae stages	Species of fruit flies	
		B. dorsalis	***C. cosyra***
Southern	Larvae L_1	2.30 ± 0.3 ^{ghi}	2.57 ± 0.55 ^{gh}
	Larvae L_2	2.10 ± 0.01 ^{hi}	2.23 ± 0.03 ^{ghi}
	Larvae L_3	3.76 ± 0.2 ^{cd}	4.00 ± 0.22 ^{cd}
Central	Larvae L_1	2.10 ± 0.40 ^{hi}	2.3 ± 0.14 ^{ghi}
	Larvae L_2	1.97 ± 0.03 ^{i}	2.00 ± 0.11 ^{i}
	Larvae L_3	3.27 ± 0.15 ^{ef}	3.67 ± 0.3 ^{cde}
Northern	Larvae L_1	1.16 ± 0.01 ^{j}	1.43 ± 0.5 ^{j}
	Larvae L_2	1.1 ± 0.12 ^{j}	1.23 ± 0.9 ^{j}
	Larvae L_3	3.10 ± 0.70 ^{f}	3.37 ± 1.5 ^{def}

In the same column and on the same line, the averages followed by the differents letters are significantly differents

While in *C. cosyra*, larvae development time was 8.8 ± 0.8 days in the south, 7.97 ± 0.55 days in the center and 6 ± 1.9 days in the north.The larvae development time was longer and shorter south to north, for two species the values obtained at the center were between those of the south and north.

In the three areas, pupation lasted 1-2 days for both species. At *B. dorsalis*, the average lengths of pupation were 1.37 ± 0.48 days in the south; 1.13 ± 0.35 days in the center and 1.03 ± 0.18 days in the north. Whereas for *C. cosyra*, the larvae are nymphosées 1.47 ± 0.5 days in the South, 1.2 ± 0.43 days in the center and 1.07 ± 0.25 days in the north. The duration of the pupal stage was shorter and longer south to north, for two species the values obtained at the center were between those of the south and north. Statistical analysis indicated that there is a significant difference between pupal durations in each area ($F = 4.385$, $df = 5$, $p < 0.003$).

3.3.3. Development time of the pupa

In the south, in *B. dorsalis*, obtaining the adult from the pupa lasted from 8 to 10 days with an average of 8.87 ± 0.66 days. In *C. cosyra* this time was 9.47 ± 1.48 days (Table 5).In the center, at *B. dorsalis*, developing pupae took place on 7 to 9 days with an average duration of 8.5 ± 0.82 days. In *C. cosyra*, the development of the pupa was between 9 to 11 days with a mean of 9.03 ± 0.5 days.To the north, in *B. dorsalis*, developing pupae spanned 10 to an average duration of 10.4 ± 0.93 days. In *C. cosyra*, the development of the pupa is made of 10 and 11 days for an average duration of 10.63 ± 0.76 days.

Unlike other immature stages with development times were longer and shorter south to north, those pupae were longer and shorter north to south, for both species; the values obtained in the center being between those of the south and north. Statistical analysis indicated that there is a significant difference between the pupal development times in *B. dorsalis* and in *C. cosyra* in each area ($F = 27.81$, $df = 5$, $p < 0.00$).

3.3.4. Duration of biological cycle

The duration of biological cycle includes embryonic development (from laying to hatching), and post-embryonic (from larvae stage 1 to adult). Statistical analysis showed that there is a significant difference between the total times of development of the immature stages in each area ($F = 14.75$, $df = 5$, $p < 0.00$) (Table 5).

In *B. dorsalis*, this period lasted an average of 20.93 ± 0.96 days in the south, 18.67 ± 2.20 days in the center and 17.93 ± 2.26 days in the north. In *C. cosyra* this time was 22.53 ± 3.09 days in the south; 20.2 ± 1.98 days in the center and 19.5 ± 3.45 days in the north.

Table 5: Average duration of development (day) of immature stage and biological cycleof *B. dorsalis* and *C. cosyra* in three agro-ecological areas

	Species of fruit flies	Agroecological areas		
		Southern	Central	Northern
Duration of development larvae stage	*B. dorsalis*	7.97 ± 0.60 [b]	7.36 ± 0.72 [b]	5.36 ± 0.81[d]
	C. cosyra	8.8 ± 0.8 [a]	7.97 ± 0.55 [b]	6 ± 1.9 [c]
Time development of the pupation	*B. dorsalis*	1.37 ± 0.48 [a]	1.13 ± 0.35 [c]	1.03 ± 0.18 [c]
	C. cosyra	1.47 ± 0.5 [a]	1.2 ± 0.43[b]	1.07 ± 0.25 [c]
Time development of the pupa	*B. dorsalis*	8.97 ± 0.66 [b]	8.5 ± 0.82 [c]	10.4 ± 0.93 [a]
	C. cosyra	9.47 ± 1.48 [b]	9.03 ± 0.5 [b]	10.63 ± 0.76 [a]
Duration of biological cycle	*B. dorsalis*	20.93 ± 0.96 [b]	18.67 ± 2.20 [cd]	17.93 ± 2.26 [de]
	C. cosyra	22.53 ± 3.09 [a]	20.2 ± 1.98 [bc]	19.5 ± 3.4 [c]

In the same column and on the same line, the averages followed by the differents letters are significantly differents

3.3.5. Life span of adults

Span of life of fruit flies differed from one area to another. Males of these pests were, generally, a longer span of life than females. The male and female of *B. dorsalis* were more experienced than *C. cosyra* in the all areas. Analysis of the results revealed the existence of a significant difference between the life span of adults of *B. dorsalis* and *C. cosyra* in each area ($F = 3921$, $df = 11$; $P < 0.00$).

In the south, the average life span of male *B. dorsalis* was 82 ± 5.82 days; while that of the female was 75.96 ± 4.49 days. In *C. cosyra*, it was 63.14 ± 1.5 days for the buck. As for the female, she lived 53.42 ± 2.67 days (Figure 3).

In the center, in *B. dorsalis*, the average lifes pan of male was 81.6 ± 1.52 days and 74.8 ± 0.66 days in the female. The male of *C. cosyra* lived 63.3 ± 0.61 days, while the life of the female was 53.67 ± 1.14 days (Figure 3).

In the north, Chez *B. dorsalis*, longevity was 81.73 ± 3.4 days at the males and 74.83 ± 0.65 days at the female. At *C. cosyra*, the male lived 64.75 ± 1.4 days, while the life of the female was 54.19 ± 0.49 days (Figure 3).

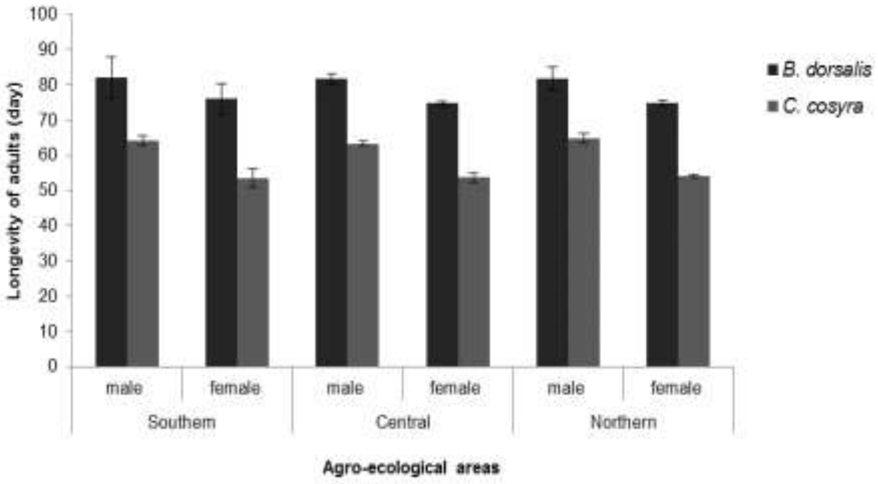

Figure 3 : Average longevity of adults of *B. dorsalis* and *C. cosyra* in three agro-

4. DISCUSSION

Like most insects, there is variability in the number of eggs laid during the imaginal life of females of both species of flies. This variability in the number of eggs laid by the females of *B*. *dorsalis* and *C*. *cosyra* would be related to the variability of the lifetime of these females. Indeed, the degree of completion of oogenesis to fledging insects varies according to the species [12]. So [13] has shown that in some species of Lepidoptera Bombycidae, vitellogenesis was completed in the imago emergence and had full stock of mature eggs. In this case, the adult female lays the maximum of eggs during the first days of its emergence and fertility may be independent of its longevity. At the flies fruits studied, females continue to form ovogonia during their imaginal life. So these are synovigenic species such as Hymenoptera *Dinarmus basalis* and *Eupelmus vuilleti* [12].The average number of eggs laid by *B. dorsalis* was 347.67 with 4.7 eggs laid per day. While [14] had obtained a average number of 794.6 eggs on artificial environment at a constant temperature of 28° C with daily egg production of 18.2 eggs in *B. dorsalis*. On one hand, this difference could be the result of study conditions, given that the fertility of eggs 347.67 was obtained under ambient conditions of temperature (30° C). On the other hand, this difference is due to the food consumed by insects, during maturing. So [3] showed that the fruit fly *C. capitata* can lay several hundred eggs, depending on power consumed during its larvae and imaginal life.

The average development of immature stages of *B. dorsalis* and *C. cosyra* obtained differ from one agro-ecological area to another. They were shorter in the north where the temperature was the highest and the lowest relative humidity. They were longer in the south where the temperature was the lowest and the highest relative humidity. In the central area, the duration obtained in the average conditions of temperature and relative humidity were between those of the two areas mentioned except the average duration of pupae. It was rather longer north than in the other two agro-ecological areas. The differences between the average development in the three study areas are attributable to weather conditions, including temperature and relative humidity. This argument joined those of [15] and [16], which reported that several abiotic factors affect the growth and development of insects; the temperature is probably the most critical environmental factor. This finding is the same as that of [14] who indicated that temperature influences the development of the immature stages of *B. dorsalis*. This result corroborates those of many authors who have reported similar results at other species of Tephritidae at different temperatures [17]. According to [18], there is a range of optimum temperatures extending from 25 to 30° C for a good development of Tephritidae. The temperatures of the three areas fall within this range. [14] and [19] showed that *B. dorsalis* is developing successfully, when the rearing temperature is in this range.

As for the duration of pupal development, it was longer in the north, which is area high temperature and shorter south, which is area low temperature. Extending the pupal development time would be that the pupa takes longer to turn into imago, when the temperature is high. A similar observation was made by [14] and [19] who reported that the high temperatures slow down the development of fruit flies within nymphs or kill, to the point where no adult emerges from the pupalat a constant temperature of 35° C.

The total development time (from incubation of the egg to adult emergence) was shorter in the north and longer in the south. The work of [20] indicate that the development time of cochineal yam *Aspidiella hartii* was elongated in the conditions of low temperatures and shortened when temperatures are higher. Under the same conditions of humidity, the development of weevil *Sitophilus oryzae* was faster at 25 ° C than at 20 ° C [21]. These observations were also made on the biological parameters of the weevil *Callosobruchus maculatus* [21]. The embryonic development time of this insect related to temperature conditions prevailing during the growing larvae [12]. These same authors have shown that temperatures near 20 ° C induce elongation of the total duration of growth of *C. maculatus*; while temperatures above 30 ° C cause the shortening of the duration.The lengthening of the total period of development, found at *C. cosyra* could reflect slower larvae development as indicated [12]. The present work also shows that *B. dorsalis* development time is shorter than that obtained by [14]. This difference is attributable to the temperature. Indeed, our experiments were conducted at an average temperature (30.97 ± 0.95° C) above that at which these authors performed their work (28 ± 1° C).

The lives of adult flies were shorter or longer according tothe species. The male lifespan was longer than this of females. The short span of life the females would be the fact of the great energy released by them during laying. This argument was made by [22]. Indeed, the female insects use their energy reserves to produce eggs. This argument was also issued by [23] who have studied the biological parameters of adults *C. maculatus* strain in Benin. Reproductive activity (mating and egglaying) contributes to a large decrease the span of life the females. This is what [24] has called "reproduction cost" concept linking the effort of reproduction to the other functions of the insect.

The life times of *B. dorsalis* adults were longer than *C. cosyra* adults. Short life times of adults *C. Cosyra* would be related to the longtime of development of their stages pre-pupal [12].The long-time development of pre-imaginal stages of *C. cosyra* seems to affect the life of adults. Indeed, the long-time need for optimal development of the larvae,would extendits period of development and would shorten the life of the adults from those.

The results of this study showed that adult longevity of *B. dorsalis* is higher than this of adult *C. cosyra*. This result corroborates those of [25] who reported that the species of the genus *Bactrocera* have superior longevity to those of the genus *Ceratitis*. In our experimental condition, the average span of life of *B. dorsalis* was 75.97 ± 4.49 days for the female and 82 ± 5.82 days for the male. These results confirm those of [22]. They are close to those of [14]. At 28 ± 1 ° C and 50 ± 8 % relative humidity, these authors obtained an average life span of 75.1 days and 86.4 days respectively at the female and the male of *B. dorsalis*. Other authors such as [26] got shorter lifetimes for the female (51.94 ± 21.03 days) and the male (55.03 ± 30.75 days) of this species in the conditions of 27.5 ± 1° C and 79.5 ± 3% RH. The differences are explained by rearing conditions (adaptation to the food, overcrowded cages and environmental conditions), as reported [27]. Also, [28] showed the influence of temperature on the longetivity of three species of *Ceratitis*. In the present work, the longevity of adult *B. dorsalis* was slightly different from north to south. Those obtained in the north were shorter. The same observation was done at *C. cosyra*. This would be related to climatic conditions (temperature and relative humidity) that differ from north to south and influence the longevity of these insects.

5. CONCLUSION

Fertility has varied according to the species ; it was higher at *B. dorsalis*. The development times (duration) of *B. dorsalis* were shorter than those of *C. cosyra*. *B. dorsalis* adults lived a long time than those of *C. cosyra*. The males lived a long time than females, both at *B. dorsalis* and *C. cosyra*. *B. dorsalis* has a higher reproductive capacity than *C. cosyra*. All these parameters studied, with the exception of development times, values were higher in the north and shorter in the south. The values obtained in the central area were included between those of northern and south areas. *B. dorsalis* is therefore a serious pest of mango in the three agro-ecological areas studied.

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