

Short Research Article

Abundance and incidence of zucchini (*Cucurbita pepo* L) flies in the Korhogo department of northern Côte d'Ivoire

ABSTRACT

To improve the production of zucchini in Côte d'Ivoire and particularly in the department of Korhogo, a study was realized at the Peleforo Gon Coulibaly University research site and at four farmers sites during dry and rainy seasons. During this study, on each plot, the number of healthy and attacked fruits was evaluated on a sample of 100 fruits randomly. The attacked fruits were transported to the laboratory and incubated to determine the causative agents. During the rainy season, 86.06% of the fruit was attacked by flies but 13.94% was healthy. In the dry season, for a total of 9 617 controlled fruits, 7 439 (77.35%) were healthy and 22.65% were attacked. Four species of flies emerged from infested fruit. It was *Bactrocera cucurbitae*, *Dacus ciliatus*, *Dacus bivittatus* of the family Tephritidae and *Scaeva pyrastris* that of Syrphidae. Pesticides used by farmers to control fruit flies were not indicated.

Keywords: zucchini, fly, attacked fruits, pesticides.

INTRODUCTION

Zucchini is a vegetable rich in protein, amino acids, minerals, vitamins and fatty acids. Seed and leaf extracts of this vegetable are used in the treatment of many uro-genital diseases (European Medicines Agency, 2012). This vegetable is therefore very important for the health of humans. The production cycle of zucchini is on average 45 days. It could therefore be an excellent palliative for eggplant (4 months) and cabbage (3 months) in the diet. The cultivation of zucchini could thus contribute to improving the living conditions of the

populations. According to the 2014 estimates of FAO, zucchini production in Côte d'Ivoire was 19,296 tonnes. However, the production is limited by several constraints including insects pests and particularly fruit flies (Bharathi and *al.*, 2004). The pressure of fruit flies causes damage ranging from 30 to 100% depending on the species of cucurbits and the season (Dhillon and *al.*, 2005). Females lay their eggs generally in tender fruits using their ovipositor. The sting area is marked by the presence of a brown resin deposit. At hatching, the larvae feed on the pulp, causing fruit rot (Dhillon and *al.*, 2005, Ganie and *al.*, 2012). The sting marks depreciate the market value of the fruit and the activity of the larvae renders them unfit for self-consumption. **see**ing the extent of the damage, it would be important to know the species of zucchini flies in Côte d'Ivoire, evaluate their impact on the quality and quantity of production and determine the action of insecticides on their activity. **t**hese different activities will allow the establishment of an appropriate control method.

MATERIAL AND METHODS

Study site

The present study was carried out in the sub-prefecture of Korhogo, located between 8°26 and 10°27 **n**orth latitude and 5°17 and 6°19 **w**est longitude 600 km from Abidjan in the north of the Côte-d'Ivoire. This locality belongs to the Sudano-Sahelian dry tropical climate regime whose rhythm of the seasons is regulated by the displacement of the Intertropical Front (Jourda and *al.*, 2005). This climate is characterized by two seasons.

The rainy season extends from May to October with a maximum of precipitation in September and the dry season from November to April, characterized by the harmattan that settles from December to February. During the year 2016, **a**n average rainfall of 1324.7 mm was recorded and the annual average temperature varies between 24,6 ° C and 30,2 ° C (SODEXAM, 2017). This research was done on 5 sites including an experimental plot housed in the botanical garden of Peleforo Gon Coulibaly University and the four (4) others

distributed throughout the sub-prefecture. These sites (Promafolo, Lataha, Kassirimé and Takali) were chosen for their high production of zucchini.

Methodology

Vegetable equipment was made up by the varieties of zucchini most produced in north, in particular Aurore F1 and Color F1.

Experimental device

The experimental device was a block of Fisher completely randomized with two (2) blocks and five (5) repetitions. Each variety of zucchini was represented by a block, with two (2) objects (T0 = untreated plots, T1 = plots treated with approved synthetic insecticide). The zucchini varieties used were Aurore F1 and Color F1.

Inventory of zucchini flies

Fruits with bite marks were systematically harvested during the various surveys.

These fruits were brought back in plastic bags to the laboratory and incubated. The fruits were placed on wet sand facilitating the metamorphosis. Once a week, this sand was washed and sieved to collect pupae of the week.

These pupae were then placed on moistened blotting paper in boxes and monitored. After emergence, young flies were kept in 70% alcohol.

Impact of flies on production

As Mokam and *al.*, 2014, each plot was visited once a week from flowering to fruiting. During these visits, the number of healthy fruits and attacked by the flies was estimated. The attack of the flies on the fruits is characterized by the presence of exudates and the shape of the fruit at the point of bite.

Identification of flies

Harvested flies were identified using the binocular loupe based on morphological characters.

Identification keys of White and Elson-Harris (2004) and White (2006) were used.

Statistical analyzes

The analyzes were performed using Statistica software (version 7.1). Single-factor variances (ANOVA, $p < 0.05$) were performed. Homogeneous averages were pooled using the Newman-Keuls test. Thus, the abundance of species, the rate of attacked fruits and the impact of insecticides have been evaluated. The four sites of the study were compared by an Ascending Hierarchical Classification (ACH) based on fly populations.

RESULTS

Proportion of zucchini flies

Four species of flies attack the fruits of zucchini in the department of Korhogo. They were *B. cucurbitae*, *D. ciliatus*, *D. bivittatus* of the family Tephritidae and *Scaeva pyrastris* belonging to the family Syrphidae (Figure 2). The averages of the different fly species differed significantly at $\alpha = 0.05$, $p = 0.000001$ and $ddl = 44$. The Newman-Keuls test showed that *B. cucurbitae* with a total of 109 specimens was the most abundant. In addition, no significant difference was observed between the means of *D. ciliatus* (4.75), *D. bivittatus* (2.66) and *S. pyrastris* (2.00).

Characteristics of the flies harvested

No specimens of *S. pyrastris* emerged from the attacked fruits that were in a poor state of field degradation. They hatched fruits whose decomposition was already well advanced in the field. As regards three species of Tephritidae, they were found only in the boxes containing stung fruits whose decomposition was very early in the field.

Impact of the flies on the production

The impact of flies on production was evaluated in the rainy season and in the dry season. At the experimental plot level, 86.06% of the fruits were attacked in the rainy season while 13.94% were healthy. In the dry season, 75.48% of the fruits were healthy against 24.52% of attacked fruits. Regarding the farming environment, 77.35% of the fruits were healthy and 22.65% were attacked. For all four sites surveyed in the dry season, those of Kassirimé and Promafolo were the most infested by the flies with respectively 26.70% and 26.22% of attacked fruits. That of Takali with 20.82% of fruit destroyed was a little less attacked. With an attack rate of 17.26%, fruits from Lataha were the least infested. Based on the fruit infestation rate, the Ascending Hierarchical Classification revealed two groups: the one consisting of the Kassirimé and Promafolo sites, which have the highest infestation rates, opposed to the group formed by the sites of Lataha and Takali with low infestation (figure 3).

Pesticides used

The investigation revealed that eight (8) types of insecticides were used against pests in zucchini production in Korhogo Department. These are Lambda 25 EC, Cypercot 336EC, Tropist P336 EC, Conquest C 88, K. Optimal, Doni 672 EC, Blast 52 EC, Polytrine 336 E (Table III). Among all these pesticides used, 6 (96.38%) are advised in cotton cultivation, while 2 (3.62%) are authorized on food crops and in market gardening crops in Côte d'Ivoire.

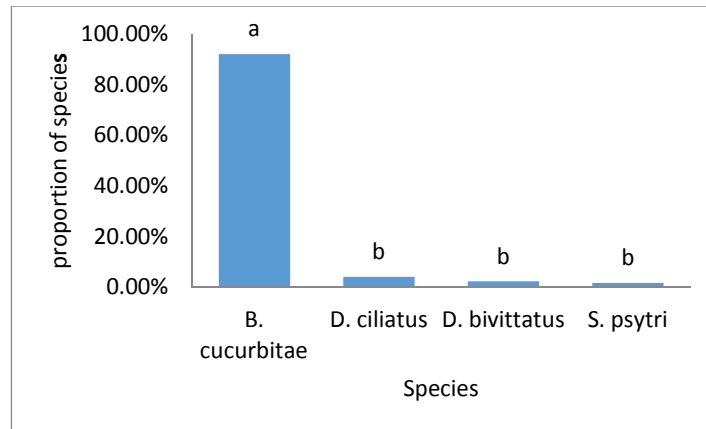


Figure 2: Proportion of fly species recovered from infested zucchini

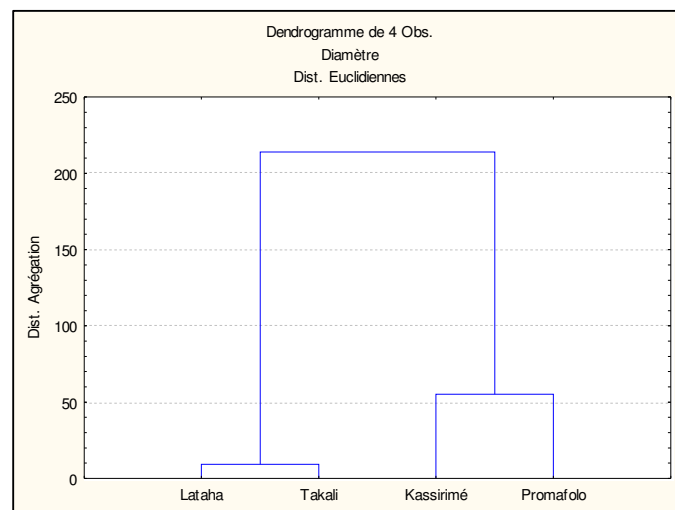


Figure 3: Classification of collection sites based on fly infestation rate

Table III: Insecticides Used by Zucchini Producers

Commercial name	Active substance	Plant approved
Lambda 25 EC	Lambda-cytrine	Food crops
Cypercot 336EC	Cyperméthrine 36g /L	Coton,
Tropist P336 EC	Cyperméthrine 36g/L	Coton
Conquest C 88	cyperméthrine 72g/L	Coton
K.optimal	Lambda-cyhalotrine 15g/L	Market gardening
Doni 672 EC	Cypermétrine 36g/L	Coton
Blast 52 EC	Lambda-cyhalotrine 36g/L	Coton
Polytrine 336 EC	Cyperméthrine 36g /L	Coton

DISCUSSION

This study revealed that flies infesting zucchini fruits in Korhogo Department are mainly *B. cucurbitae*, *D. ciliatus* and *D. bivittatus*. These results are similar to those obtained by Vayssières *and al.* (2008), Bonnet (2010), Deguine *and al.* in 2012 on the island of Reunion. According to these authors *Bactrocera cucurbitae*, *Dacus ciliatus* and *Dacus demmerezi* were the most devastating flies of Cucurbitaceae on this island.

According to the results of these authors, the three species of Tephritidae identified are responsible for fruit rot. This result is similar to those obtained by Dhillon *and al.* (2005). According to this author, female fruit flies lay their eggs in the fruit. At hatching the larvae feed on the fruit pulp, thus involving the decomposition of the fruit.

The decomposition of zucchini fruits is not directly due to *S. pyrastris*. The action of this fly is secondary. In fact, during this study, this fly only emerged from fruit in a state of advanced decomposition in the field. This species only lays its eggs on the zucchini when it is in process of decomposition. This observation is consistent with the results of Mokam *and al.* (2014). For these authors, some zucchini flies are saprophagous.

Our results showed that the loss of production caused by fruit flies on zucchini is related to the season. This loss is close to 100% in the rainy season and is less than a third of the production in the dry season. According to Dhillon *and al.*, 2005, losses related to flies could be around 90% or even the total production, in relation to the season and the species of Cucurbitaceae.

These high losses may explain the low production of zucchini during the rainy season. Indeed, during this study, very few producers of zucchini were counted. The main reason given is the poor performance during this season.

The investigation revealed that the pesticides used in zucchini cultivation are not indicated for this plant. This could be explained by the high cost of pesticides approved in

market gardening compared to those of cotton. In favor of cotton production in this area, cotton pesticides are available on the market at low cost. Indeed, cotton companies offer insecticides to cotton growers at the beginning of the season. Moreover, when they need money, producers offer pesticides at low prices. In addition, according to the survey the majority of farmers are unaware of the risks associated with unconventional use of pesticides. These results are similar to those obtained by Doumbia and Kwadjo (2009). according to these authors market gardeners in the city of Abidjan and suburbs (Dabou and anyama) use unapproved pesticides for market gardeners. the phytosanitary practices that are appropriate would be linked to the total ignorance of the producers. According to a study conducted in Abidjan 73.4% of producers are not aware of the risks of contamination due to their behavior against 8.3% who claim to know their share of responsibility in the contamination of market garden produce (WOGNIN and *al.*, 2013).

the majority of market gardeners cannot read. Consequently, they cannot appropriate the instructions of good use written on the ambalages of the pesticides. Similar results have been obtained by Tuo and *al.* (2017). According to these authors, the inappropriate use of pesticides is due to the inability of market gardeners to appropriate the instructions for use on packaging.

CONCLUSION

At the end of this research, it emerges that the main zucchini pest in the department of Korhogo are *Bactrocera*, *cucurbitae*, *Dacus*, *ciliatus*, *Dacus*, *bivittatus* of the family Tephritidae. The species *Scaeva pyrastris* of the family of Syrphidae is not responsible for the loss of fruit; it comes only secondarily after the attack of Tephritidae. Pesticides used by growers in the control of pests are not indicated. Because of the strong presence of flies in the rainy season on zucchini and the damage they cause, the production of this speculation during this season may not be profitable.

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