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Biopesticide Efficacy of Aqueous Extracts of *Jatropha carcus* L. and *Azadirachta indica* (A. Juss) on *Plutella xylostella* (Lepidoptera: Plutellidae) on field in Côte d'Ivoire.

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ABSTRACT

Diamondback moth *Plutella xylostella* is a major pest of crucifers in the tropic and subtropic. The larvae feed on the foliage of cruciferous plants at all stage of development and greatly reduce both yield and quality of the produce. This study aims to evaluate the efficacy of aqueous neem seeds and leaves extracts and of jatropha seeds extract on *P. xylostella* in field to develop alternatives to chemical control harmful to the environment. The aqueous neem seeds and leaves extract and of jatropha seeds at different concentrations, and insecticides Décis and Cypercal were used for foliar application on field in three localities. In these three localities (Ahorosso, Bongouanou and CBC Kangandissou), the biopesticides based on neem and jatropha, and the insecticides Décis and Cypercal were effective against *P. xylostella* adults. Moreover, aqueuous extract of neem seeds (50 g/L and 80 g/L) were the most effective on *P. xylostella* larvae and gave the best yields. The aqueous jatropha seeds extracts 50 and 80 g/L and the aqueous extracts from neem leaves 67 g/L have similar efficacy to the insecticides Décis and Cypercal.
KEYS WORDS : *Plutella xylostella*, biopesticides, *Azadirachta indica*, *Jatropha carcus*, Côte d'Ivoire

1-INTRODUCTION

The Diamondback moth *Plutella xylostella* (L.) (Lepidoptera: Plutellidae) is an important pest of brassica crops and a great threat to crucifer production in the world [1, 2, 3]. They live on the underside of leaves and drop from the plant by hanging by a thread of silk when they feel threatened [4]. The larvae feed on the foliage of cruciferous plants at all stage of development and greatly reduce both yield and quality of the produce. Indeed, it infects and causes 2.5% of crop loss despite the application of pesticides to Brassica crops [1, 5]. In many parts of the world, *P. xylostella* caused more than 90% crop loss [6]. For the control of *P. xylostella*, farmers use improperly insecticides whose cost is more than a billion dollard per year [1]. This intensive use of insecticides has led to the development of resistance of *P. xylostella* to a wide range of insecticides [7] and substantial harm to natural enemies of pests [2, 8]. In addition, numerous studies have shown that most of the products used by farmers are persistent and accumulate in water, soil and air, but also in food [9, 10]. These insecticides caused neurological disorders resulting in neurodegenerative diseases such as Parkinson's disease and Alzheimer [11] and are endocrine disruptors [12]. They are both an ecological, environmental sanitary threat. The control of *P. xylostella* was initially based on pyrethroids, but in 2000 and 2002 indoxacarb and spinosad were respectively used [13, 14]. Indeed, *P. xylostella* developing resistance against the cypermethrin [15, 16]. The control of this insect is difficult because it develops resistance to insecticides and insecticides containing *Bacillus thuringiensis* (Bt) [17]. Ethanoic and aqueous extracts of Annona squamosa seeds tested on larvae of *P. xylostella* consuming cabbage Indénosie showed that these extracts are effective as commercial botanical insecticide (1% rotenone) made of seeds of this plant. In addition, the aqueous extract of these seed is efficiency comparable to those of pyrethroids used fluently [18].

In Bongouanou, vegetable crops are grown near the dam of Ehuikro and of Kabi whose water flows into the dam of Ehuikro. Furthermore, farmers used sometime insecticide of cotton. In addition, each year the production of water by SODECI Bongouanou is interrupted due to pollution. The population would be exposed to environmental and health problems. Thus, control of pests with the insecticides present numerous disadvantages. It is therefore interesting to find other alternatives to overcome these constraints. In view of search for other biodegradable and harmless to the environment, compatible with integrated pest management alternatives, this study was conducted in this area in order to compare the efficacy of aqueous extracts neem seeds and leaves and of jatropha, and insecticides Décis and Cypercal commonly used in vegetable cultivation in order to assess their effectiveness and applicability to large scale.

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2. MATERIALS AND METHODS

2.1- Study area

Cropping trials were conducted in the department of Bongouanou, located in east-central Côte d'Ivoire in the region of Moronou. Moronou region is located between longitude 3° 40' and 4° 43' East and latitudes 6° 7 'and 6° 55'.

2.2. Insects

P.xylostella adults and larvae were counted on cabbage (*Brassica oleracea* var. *capitata*, GALASSI SEMENTI, Italy).

2.3. Brassica fields

Brassica oleracea were used as the host plant of field tests. Brassica plants were transplanted in Koffikro plot in 3rd January, 2012 and in Bongouanou plot in 21th July, 2012. In CBC Kangandissou, Brassica plants were transplanted in 1st February, 2013.

The experimental design was a fisher block with three replications. Each unit plot measuring 5 m by 1 m. Each elementary plot has 3 lines of plants spaced to 0.40 m. The lines are arranged in the direction of the length of parcels. In Koffikro, the number of treatments was reduced to 5 for the correct application of products by farmers.

Nurseries were conducted on beds. These beds were first disinfected by covering them with FURADAN 5G at a rate of 10 g/m² and fertilized with NPK at the rate of 10 g/m² five days before planting. For better lift, a shade house of a meter in height is achieved over the board until the seed germination. Watering and treatment with fungicide Maneb and weeding of nurseries were made.

Transplanting was done on the beds, with a spacing of 40 cm between plants. This gives a density of 36 feet per repetition. After transplanting, dead plants were replaced and maintenance such as weeding, hoeing them, and irrigation were performed regularly.

2.4. Pesticides, biopesticides and their preparation

Pesticides used in this study are Cypercal (50 EC, AF- CHEM SOFACO, Côte d'Ivoire) and Decis (12 EC, AF- CHEM SOFACO, Côte d'Ivoire). The active ingredient of Cypercal 50 EC and decis 12 EC 50 g / L are respectively cypermethrin ($C_{22}H_{19}C_{l2}NO_3$) and deltamethrin ($C_{22}H_{19}Br_2NO_3$). They belong to the family of synthetic pyrethroids and EC formulation. The recommended dose is 40 mL in 15 L of water to 400 m^2 for the Cypercal. For Décis, 50 mL of the product are added to 15 L of water to spray 500 m^2. These are foliar insecticides acting by contact and ingestion.

Biopesticides used were aqueous extracts prepared with seeds and leaves of neem (*Azadirachta indica*), and seeds of Jatropha (*Jatropha carcus*) at different concentrations. In Koffikro, treatments applied to Brassica plants to control *P. xylostella* were aqueous neem seeds extracts (80 g/L) and of jatropha seeds extract (80 g/L), aqueous neem leaves extracts 67g/L and insecticide Décis. In Bongouanou and CBC Kangandissou, in addition to these treatments, the aqueous neem seeds extracts (50g/L) and of jatropha seeds extract (50 g/L), and pesticide Cypercal were used to foliar application (Table 1).

Aqueous extracts of neem seeds and jatropha were prepared at 500 or 800 grams of grains in 10 L of water. As for the aqueous neem leaves extracts, they were prepared in an amount of 1kg pulp sheets in 15 L of water. The neem leaves were harvested during the day and neem seeds were dried in the shade.

For a better extraction of the active material 500 or 800 grams of neem or jatropha seeds were cleaned, de-shelled and subsquently the kernels and hulls were separated manually. The kernels were grounded to fine powders. The fine powders were placed in a bucket with 10 liters of water. The content is vigorously stirred every 2 hours. After 24 hours of soaking, the solution is filtered through a piece of fabric so as to retain the tissue and debris on the filter and the filtrate into a clean bucket. Then, the filtrate was poured into a spray for the treatment plots weekly. In severe attacks, additional applications are made [19].

For extraction of active substance of neem leaves, the leaves are collected during day time and immediately ground in a mortar to obtain a pasty content. The pasty content was weighed and introduced into a plastic bucket containing water at a dose of 1 kg in 15 liters of water. The mixture was vigorously stirred every two hours and the maceration lasts at least three days. After steeping, the solution is filtered through a clean cloth and the filtrate was used to spray the plots each week [20, 21]. The treatable area by biopesticide was 200 m^2.

Table 1: Treatment of area of study.

Treatment of area of study		
Koffikro	Bongouanou	CBC Kangandissou
Aqueous neem seeds extract 80 g/L (T1)	Aqueous neem seeds extract 80 g/L (T1)	Aqueous neem seeds extract 80 g/L (T1)
-	Aqueous neem seeds extract 50 g/L (T5)	Aqueous neem seeds extract 50 g/L (T5)
Aqueous neem leaves extract 67g/L (T3)	Aqueous neem leaves extract 67 g/L (T3)	Aqueous neem leaves extract 67 g/L (T3)
Aqueous jatropha seeds extract 80 g/L (T2)	Aqueous jatropha seeds extract 80 g/L (T2)	Aqueous jatropha seeds extract 80 g/L (T2)
-	Aqueous jatropha seeds extract 50 g/L (T6)	Aqueous jatropha seeds extract 50 g/L (T6)
Insecticide Décis 12EC (T4)	Insecticide Décis12EC (T4)	Insecticide Décis 12EC (T4)
-	Insecticide Cypercal 50 EC (T7)	Insecticide Cypercal 50 EC (T7)

2.5. Field efficacy trials

Field trials were conducted to evaluated efficacies of biopesticides made of neem and jatropha, and of insecticides Decis and Cypercal in 2012 at Koffikro and at Bongouanou, and in 2013 at CBC Kangandissou. Insecticides and biopesticides were used to foliar application with an insecticide applicator back. Only the control plots are not treated.

Number of *P. xylostella* larvae and adult were counted by checking both the upper and lower surfaces weekly, 3 days after treatment to 6 at 8 hours and 12 plants taken at random per plot, that is to say 36 seedlings per treatement.

The evaluation of production focuses on the total weight of mature fruit harvested per treatment, until the end of the experiment. Thus, the yield (R) is estimated at the end of harvest by the formula:

R (kg / ha) = P (kg) x 10 000 / S (m^2) where P is the total weight of ripe fruit harvested from a surface S.

2.6. Data analysis

For results, statistical treatments were performed. To do this, the data were entered in Excel. The data obtained were subjected to analysis of variance (ANOVA main effect) on the threshold of 5% and average discriminated with the Student-Newman-Keuls (SNK) using the STATISTICA software version 7.1 (2005).

3 - RESULTS AND DISCUSSION

3.1. Efficacy of aqueous extract of neem and of jatropha, and insecticides Décis and Cypercal on the abundance of *P. xylostella* adults and larvae

In Koffikro, aqueous neem seeds extracts 80 g/L (T1) and of Jatropha seeds extract 80 g/L (T2) and the aqueous neem leaves extract 64 g/L (T3) and the insecticide Décis 12 EC (T4) are equally effective on *P. xylostella* larvae and adults. They significantly reduce the number of *P. xylostella* adults (P = 0.02) and their larvae (P = 0.00) compared to control (T0) (Table 2).

In Bongouanou, the aqueous jatropha seeds extract 50 g/L (T6) are not efficacy on *P. xylostella* adults per plant, all other treatments tested were effective against *P. xylostella* adults. Furthermore, aqueous neem seeds extract and of neem leaves extract (T3), and those aqueous extract based on jatropha seeds 80g/L (T2) and 50 g/L (T6), and the insecticides Décis and Cypercal significantly reduce the number of *P. xylostella* larvae per plant compared to the control (P = 0.00) . The aqueous neem seed extract 80 g/L was most effective on *P. xylostella* adults and larvae. The aqueous extracts T3, T5 and T6 have similar efficacy than insecticide Décis (T4) and Cypercal (T7) against *P. xylostella* larvae. Such products had a low efficiency of the number of *P. xylostella* larvae per plant. As for aqueous extracts of jatropha seeds 80g/L, they were not very effective against *P. xylostella* larvae (Table 2).

Table 2: Effects of aqueous extracts of neem, jatropha and insecticide Décis and Cypercal on the number of *Plutella* adults and larvae per plant in Koffikro, in Bongouanou and in CBC Kangandissou

	Koffikro		Bongouanou		CBC Kangandissou	
Treatment	Adult per plant	Larvae per plant	Adult per plant	Larvae per plant	Adult per plant	Larvae per plant
Control	0.41 b ± 0.15	0.08 b ± 0.04	0.04c ± 0,01	0.11d ± 0.03	0.16b ± 0.01	0.23c ± 0,02
Neem seeds 80 g/L	0.25a ± 0.05	0.01 a ± 0.00	0.01a ± 0,00	0.01a ± 0.00	0.01a ± 0.00	0.00 a ± 0,00
Jatropha seeds 80 g/L	0.24a ± 0.03	0.02 a ± 0.02	0.01a ± 0,00	0.05c ± 0.01	0.02a ± 0.01	0.13b ± 0,01
Neem leaves 67 g/L	0.24a ± 0.04	0.01 a ± 0.01	0.01a ± 0,00	0.04bc ± 0.01	0.01a ± 0.01	0.11b ± 0,02
Décis	0.30a ± 0.09	0.01 a ± 0.01	0.01a ± 0,00	0.02ab ± 0.01	0.01a ± 0.00	0.01b ± 0,02
Neem seeds 50 g/L	-	-	0.01a ± 0,00	0.04bc ± 0.01	0.00a ± 0.00	0.00a ± 0,00
Jatropha seeds 50 g/L	-	-	0.03b ± 0,01	0.04bc ± 0.01	0.01a ± 0.01	0.11b ± 0,02
Cypercal	-	-	0.01a± 0,01	0.02ab ± 0.01	0.01a± 0.01	0.03a± 0,02
P	0.02	0.00	0.00	0.00	0.00	0.00

Means followed by the same letter in a same column are not significantly different at P <0.05 level (Newman-Keuls test).

In CBC Kangandissou plots, biopesticides based on neem and jatropha, and insecticides Décis and Cypercal used for foliar application were all effective against *P. xylostella* adults. Significantly more *P. xylostella* per plant were observed in the control compared to any of the other treatments, with no differences among the latter (P=0.00). The number of *P. xylostella* adults per plant obtained in plots treated with aqueous neem seed extracts 80 g/L and 50 g/L and of jatropha seeds 50 g/L, and aqueous neem leaves extracts 67 g/L, and in plots treated with the insecticides Décis and Cypercal were 0.01 *P. xylostella* adults per plant in each plot. The number of *P. xylostella* per plant in plots treated with aqueous jatropha extract was 0.02 *P. xylostella* per plant (Table 2). At *P. xylostella* larvae, aqueous neem seeds extract 80 g/L and 50 g/L have similar efficacy to the insecticide Cypercal. They dramatically reduce the number of *P. xylostella* larvae per plant. The aqueous extracts of neem leaves 67 g/L, and of jatropha seeds 80 g/L and 50 g/L moderately limit the number of *P. xylostella* larvae per plant. Their effectiveness against *P. xylostella* larvae is similar to that of the insecticide Décis. All products tested significantly reduced the number of *P. xylostella* larvae per plant compared to the control (P = 0.00) (Table 2).

In the localities of Koffikro, Bongouanou and CBC Kangandissou, biopesticides of neem seeds and leaves and of jatropha seeds extract and the insecticides Décis and Cypercal were all effective on *P. xylostella* adults than their larvae. This is explained by the fact that the *P. xylostella* adults are more sensitive to biopesticides and to insecticide Décis and Cypercal. The effectiveness of aqueous neem seeds and leaves extracts and of jatropha seeds extract on adults of *P. xylostella* is linked to the presence of toxic susbstances [22, 23, 24, 25, 26], repulsive [27, 28] and antifeedant effect on *P. xylostella* [28, 29]. The considerable reduction in the number of *P. xylostella* adult by foliar application of biopesticides based jatropha in different localities would be related to the toxicity of aqueous extracts of *J. curcas* attributed to several of its compounds comprising curcin and phorbol ester [24, 25, 30]. Curcin is a toxalbumin belonging to a group of proteins called ribosome-inactivating proteins (RIP), which inhibit ribosome by specific modification of larger rRNA. Curcin has protein translation inhibitory activity or N-glycosidase activity [31]. Solsoloy and Solsoloy, [32] and Adebowale and Adelire, [33] showed that jatropha products significantly reduce nesting insects at high concentrations and cause total mortality of eggs and larvae whatever concentration. According to these authors, these insecticides effects could be cause by sterols and terpenes contained in products of jatropha. Bouchelta *et al.* [34] work on *B. tabaci* and those of Choi *et al.*[35] on *Trialeurodes vaporariorum* (Homoptera: Aleyrodidae) showed that aqueous extracts of jatropha seeds contain flavonoids and steroids are also toxic to eggs and adults.

The aqueous neem seeds and leaves extracts contain secondary metabolites that have insecticidal activity on *P. xylostella* larvae and adults. Indeed, aqueous extract of neem contain azadirachtin, Nimbin, salanine and sterol [34, 36, 37], a significant fraction of alkaloids [38], the saanine and méliantriol were also present in these aqueous extracts and haved an effect on insect biology [39].

The aqueous neem seeds and leaves extract effective against *P. xylostella* because it would have a toxic effect for adults and eggs of this insect. The insecticidal effects of their constituents have been mentioned by several authors. Azadirachtin is a tetranortriterpenoid which has insecticidal properties, fungicide, repellent [27], and antifeedant effect [29]. Azadirachtin inhibits growth by inhibiting the insect ecdysteroids synthesis by inhibition of prothoracicotropic hormone (PTTH) which blocks interrupt driven and thus the reproductive cycle [40]. This was in accordance with Nijhout [41], who reported that the biosynthesis of ecdysteroids can be inhibited by interaction with the prothoracicotropic hormone (PTTH), a polypeptide produced by neurosecretory cells from the insect brain that is responsible for the production of ecdysone at the prothoracic glands, the primary source of

ecdysteroids in developing insects. Ecdysone is the insect molting hormone which induces a series of events critical for ecdysis, beginning with the formation of a complex between ecdysteroid receptor (EcR) and its partner protein, ultraspiracle (Usp) [42]. Azadirachtin is mediated by its binding to the ecdysone receptor (EcR) in the presence of a heterodimeric partner, ultraspiracle protein (Usp). Then, the EcR-Usp heterodimerbinds to a DNA ecdysone response element (EcRE) that is located in the promoter region of a series of ecdysteroid-responsive genes and thereafter triggers the expression of genes involved in regulating some key developmental events in insects [42]. According to Viňuela *et al.* [22], azadirachtin has similar effects to that of diflubenzuron (DIMILIN 25 WP, AgrEvo, Valencia, Spain) with similar actions in juvenile hormone blocking insect metamorphosis. Thus, this substance in aqueous extracts of leaves and neem seeds inhibit the development of caterpillars and egg fertility. Alice and Sujeetha [43] showed that neem seeds and leaves extracts inhibit the growth and development of *Sogatella furcifera* (Horvath) (Homoptera: Delphacidae). Senthil-Nathan *et al.*[23] also reported that these extracts reduce the weight of nymphs of *Nilaparvata lugens* (Stål) (Homoptera: Delphacidae) to 45 at 60%. Even low concentrations can effectively inhibit the growth and survival of N. lugens.The salanine is a glycoalkaloid which exerts repulsive or toxic effects on insects [34, 37]. It inhibits the growth that affects spawning [44, 45] and moulting and larval development [29, 46]. Thus, herbivores that consume the leaves of cabbage plants sprayed with these biopesticides of neem and jatropha seeds extract could be exposed to the toxicity of their compounds. This could explain the low frequency of larvae and adults of *P. xylostella* on cabbage plants treated with these biopesticides. In general, these secondary compounds of neem affect the behavior of insects [47]. The effectiveness of aqueous neem and jatropha extracts on *P. xylostella* would also relate the harmlessness of these extracts on beneficial arthropods and they would not mutagenic insects [48].

The efficacy of aqueous extracts of neem seeds 50 and 80 g/L on *P. xylostella* larvae than aqueous extracts of Jatropha seeds and insecticidees Décis and cypercal led to azadirachtin from seeds of neem tree prossesses strong antifeedant and growth inhibitor effects against insects pests and their larvae [40]. In fact, the insecticidal activity of neem aqueous extracts persists in plant level for four to seven days after application [49, 50]. The active particles of neem penetrate in the different parts of the plant via the xylem, the phloem, and the particles reaching the soil by the roots penetrate [51]. Schmutterer [52] suggested that most insect groups treated with the extract of neem modify the programs of insects by influencing hormonal systems, especially that of ecdysone, to prevent both ecdysis and apolysis, and can cause death before or during molting and the few survivors were malformed at the wings and thorax adulthood. The insecticides Décis and Cypercal moderate activity is linked to the development of resistance to these insecticides commonly used by farmers. According to Lee *et al.* [53], *P.*

xylostella is resistant to many chemical insecticides including organophosphates, carbamates and pyrethroids. The resistance developed by the insects would also relate to the fact that chemical insecticides generally have a single molecular target. Furthermore, chemical treatments probably involving the elimination of natural enemies of the pest unlike biopesticides [54]. Plots treated with chemical insecticides are therefore an environment conducive to the development of resistant population of *P. xylostella* because it does not suffer the action of their chemical insecticide susceptible to parasitoids.

3.2. Yield of cabbage

In Koffikro, the yields from plots treated with aqueous neem seeds extract 80 g/L (37787 kg/ha), aqueous jatropha seeds extract 80 g/L (25527.36 kg/ha), aqueous neem leaves extract 67g/L (37536.16 kg/ha), insecticide Décis (28395.25 kg/ha) and control (9747.01 kg/ha) were significantly different to the control (P = 0.01). These biopesticides made of neem and jatropha haved similar efficacy to the insecticides Décis (Table 3).

In Bongouanou plots, yields from plots treated with products are significantly different than the control (P = 0.00). Foliar application of aqueous extracts of neem seeds 80 and 50 g/L reduced yield loss due to *P. xylostella* to those treated with insecticides Décis (T4) and Cypercal (T7), aqueous jatropha seeds extract 80 and 50 g/L and aqueous neem leaves extract 67g/L . The yields of the plots treated with aqueous extracts of neem leaves 67 g/L (T3) and of jatropha seeds 80 g/L (T2) were similar to the yied of plots treated with insecticide Cypercal (T7). In these plots, the yields are low and are respectively 3194.44 kg / ha (T3), 3055.56 kg / ha (T2) and 3194.44 kg/ha (T7). Yields on plots treated with the aqueous extract of Jatropha seeds 50g / L (787.04 kg / ha) and the insecticide Décis (1481.48 kg/ha) were similar and are very low. Yield of control (untreated plots) remains the lowest and a value was 138.89 kg/ha) (Table 3).

In CBC Kangandi, there was a significant difference between the yields of different treatments and the control (P = 0.00). Yields from plots treated with aqueous extracts of neem seeds 50 g/L (11733.33 kg/ha) and 80 g/L (10066.67 kg / ha) were more effective than the insecticides Cypercal and Décis. Yields from plots treated with aqueous neem leaves extracts 67 g/L (2733.33 kg/ha), and of jatropha seeds extract 50 g/L (1366.67 kg/) and 80 g/L (3166.67 kg/ha), and those treated with the insecticides Décis (1433.33 kg/ha) and Cypercal (1266.67 kg/ha) were not significantly different from one another. However, yields from plots treated with the aqueous jatropha seeds extract 80 g/L is the highest after those obtained with aqueous neem seeds extract 50 and 80g /L and the control had the lowest yield (Table 3).

Tableau 3: Average yield (± SD) of *Brassica oleracea* treated with aqueous extracts of neem, jatropha and insecticide Décis and cypercal inKoffikro, in Bongouanou and in CBC Kangandissou

Treatment	Yield (kg/ha)		
	Koffikro	Bongouanou	CBC Kangandissou
Control	9747.01b ± 2061,17	138.89c ± 138,99	133.33b±230,94
Neem seeds 80 g/L	37787.0 a ± 11286,39	8148.15a ± 2621,78	10066.67a±5063,93
jatropha seeds 80 g/L	25527.36a ± 850,97	3055.56b ± 555,56	3166.67b±450,93
Neem leaves 80 g/L	37536.16a ± 19396,21	3194.44b ± 844,83	2733.33b±709,46
Décis	28395.25a ± 5177,11	1481.48bc ± 160,38	1433.33b±585,95
Neem seeds 50 g/L	-	6851.85a ± 424,31	11733a±4313,16
jatropha seeds 50 g/L	-	787.04bc ± 289,12	1366.67b±450,93
Cypercal	-	3194.44b ± 636,47	1266.67b±115,47
P	0.01	0.00	0.00

Means followed by the same letter in a same column are not significantly different at P <0.05 level (Newman-Keuls test).

The best yields of cabbage plots sprayed with aqueous neem seeds extracts 80 g/L and 50g/L were due to azadirachtin from seed of neem which have high toxicity, strong antifeedant and growth inhibitor against various insect pest like *P. xylostella* larvae and adults [40]. These results are consistent with many previous studies that have shown that Azadirachtin first exhibits strong antifeedant effects on the insect's chemoreceptors to deter the insect from consuming the plant [55, 56]. If the insect does persist in consuming, azadirachtin blocks peptide hormone release, which results in severe growth defects and molting abnormalities [55, 56]. Lastly, azadirachtin has a damaging effect on most of the insect's tissues, including muscle, fat and gut cells [55, 56].The biopesticides based on neem extract contain salanine, a glycoalkaloid which exerts repulsive effects or toxic on insects [34, 37]. The moderatly yields of plots treated with aqueous extracts of Jatropha seeds 80g /L could be led to the low penetration of the active particles in the plant and also to their low persistence. However, biopesticides of neem seeds 50 g/L and 80g /L and aqueous extracts of jatropha gave interesting returns relative insecticide Decis and Cypercal. This ineffectiveness of insecticides commonly used by farmers to be linked to the resistance of *P. xylostella*. The insecticides generally have a single molecular target, which could facilitate the emergence of resistant populations unlike biopesticides that several compounds with multiple mechanisms of action, which may delay the emergence of resistant populations in their use in agriculture. These results are consistent with those of Sayyed and Wright [57] have shown that populations of *P. xylostella* collected in fields treated in Malaysia had a significant resistance indoxacarbes compared to untreated students in the laboratory.

Attique *et al.* [58] and Zhao *et al.* [59] showed the resistance of field populations of *P. xylostella* gradually increases. Ahmad *et al*. [60] also showed that *Choristoneura rosaceana* (Lepidoptera: Tortricidae) collected at Michigan, USA develops resistance indoxacarbes after three generations. Indeed, insecticides Decis and Cypercal would have repellency and antiappétence low rate and then their foliar application couldn't reduce yield loss.

4-CONCLUSION

The aqueous extracts of neem seeds 50 and 80 g / L and those obtained from jatropha seeds extract 80 g /L were more effective than insecticides Décis and Cypercal commonly used to foliar application on cabbage plants. Thebiopesticide made of neem and jatropha seeds 80g/L can be used against insects harmful to crops and particularly resistant to insecticides like *P. xylostella*.

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