Journal of Animal & Plant Sciences, 2011. Vol. 10, Issue 2: 1300- 1305.
Publication date: 30/5/2011, http://www.biosciences.elewa.org/JAPS; **ISSN 2071 - 7024**

Effectiveness of *Furcraea hexapetala* (Jacq.) Urban extract on *Myzus persicae* Zulzer

Leónides Castellanos González 1, Aniurka Fernández Valero 2, Isabel Ortega Meseguer 3, José. Orestes Guerra de León 4

1 CETAS (Centre of Studies for the Sustainable Agrarian Transformation, University of Cienfuegos, Cuba). Rodas road. Km 4 Cienfuegos.
2 Plant Protection Station of Yaguaramas,
3 Provincial Plant Protection Laboratory of Cienfuegos
4 Central University of Las Villas.
Corresponding Author Email Address: lcastellanos@ucf.edu.cu

1 SUMMARY

The investigation was developed during the period of 2008-2009 aiming to determine the technical effectiveness of an extract of *Furcraea hexapetala* (Jacq.) Urban (maquey) on the insect *Myzus persicae* Sulzer, in laboratory and under field conditions. Laboratory assays were carried out to determine the technical effectiveness of natural extracts of *F. hexapetala* on *M. persicae*, spraying insects reared on potato and pepper leaves in Petri dish and in the field conditions the sprays were done with the extract on natural insect populations in potato and pepper crops. In all the cases five treatments were studied: the extract of the plant to 12.5%, 25%, 50% and 100% obtained starting from the juice of the leaves, and a control. Moreover an assay was carried out to determine the technical effectiveness of different fractions of the extract of *F. hexapetala*, obtained with different solvents, on that aphid specie. The extract of *F. hexapetala* manifested technical effectiveness on the insect higher than 73% "in vitro" and 71% under field conditions as much in pepper as in potato. At the 48 hours the fraction of the extract of *F. hexapetala* in n butanol reached 100% of effectiveness. This confirmed that the insecticide effect of the plant is due to the present saponins in the ethanol-water extract and concentrated through successive processes in the n butanol solvent.

2 INTRODUCTION

The environmental contamination is a topic very debated in the last years, and efforts are not scanted by governments' parts, investigators and men of different spheres to know the situation that exists in the world in connection with this problem, to be able to take measures that contribute to the decrease of the adverse effects that it take place for the entrance to the atmosphere of toxic substances and they affect the man's health (García *et al.*, 2002).

At the beginning of last century, the pesticides were constituted fundamentally by metallic salts and extracted natural products of plants as the nicotine, the rotenone and the peritrins; but with the industrial development and the necessity of a competitive agricultural market after the Second World War, the synthetic organic compounds were developed that although they were much more effective, of wide spectrum and easy handling they increased until our days the damages to the environment and the man's health, like they are the increase of the contamination, the resistance appearance in the pest, the destruction of their bioregulators, the exhibition to the long term

effects and the lost of the biodiversity for the affectation of the useful species (Alfonso *et al.*, 2002).

The Flora of Cuba is so rich and varied that has more than six thousand species of superior's plants, of them 50% or more are endemic. The knowledge of them offers the possibility to use these rationally, however, the potentialities are still ignored (Mosquera, 2003). Among the strategies of the sustainable agriculture it is the confrontation to the pests and diseases, by means of technical and appropriate cultivation methods that it doesn't alter the environment in which the crops are developed. In such a sense, with a correct application of a group of principles of the ecological agriculture, a situation of balance between the pests and its bioregulators is achieved, principle that sustains the strategies for the integrated pest management (IPM) (Cuellar *et al.,* 2003).

In the Cuban archipelago the flora constitutes an extensive and varied source that can exploit with effectiveness, having 51.3 % endemism, and up to 1999, 138 species of plants had been reported with some pesticide effect; of them it has been proven the activity of 52 species belonging to 46 genus and 30 families. Different denominations have been used for these natural substances that control pests and diseases of the crops, to those that are called indistinctly biological, biochemical pesticide, bio pesticide, botanical, and other.; but following the approach of international organisms as the European Economic Community, the Agency for the Protection of the Atmosphere of the United States (EPA) and the FAO, the fundamental differences of these with the conventional chemical pesticide consist on their singular way of action that is not a direct toxicity, but to small concentration in the vegetable material with specificity for the species to combat (Alfonso *et al.,* 2002).

For all the previously exposed at the present time many activities must be done to find alternatives that allow the development of a profitable and less polluting agriculture to the environment, where the use of the plants in plant protection plays an important role. Investigations are carried out on products of natural origin. Recently, a project has been developed in Cienfuegos province on the action of the biochemical pesticide or repellent plants on of Urban Agriculture crops (Ortega *et al.,* 2008) that focuses its actions of looking for local solutions for controlling the noxious agents of the using the present vegetable biodiversity and in a sustainable way. It is also necessary work in the rural sector and others crops that are planted in where it is carried out in occasions an indiscriminate use of chemical pesticides.

In the Plant Protection Station of Yaguaramas, Abreus municipality was identified during the balance report of the year 2004 as deficiencies, the little knowledge that farmers had about the experiences of the peasants in the use biochemical pesticide and the real effectiveness that they had with these (ETPP Yaguaramas, 2004).

An investigation carried out on the knowledge and employment that the different agricultural units had on the repellent and bio pesticide plants in the Cienfuegos province the municipality of Abreus it was being used by the farmers a new plant uninformed by the literature, well-known as Maguey (*Furcraea hexapetala* (Jacq.) Urban). The farmers use the plant against pests as the aquatic beetle of rice, the black beetle of the banana, and different species of aphids (Ortega *et al.*, 2008). *F. hexapetala* belonging to Agavaceae family is a native Cuban plant, very spread in the west part of the Island (Alvarez de Zayas, 1996)

The aphids are insects extremely harmful that affect many species of plants. Among them they are numerous cultivated plants, some ornamental ones and weeds. The aphids constitute pests of many arable plants among those can be found : potato, sweet potato, cabbage, tomato, tobacco, citrus, pepper and beans (Martínez *et al.*., 2007).On the other hand Martin (2006) had pointed out that the aphids (*Myzus persicae* Sulzer) constitute a serious problem of the potato crop in Horquita Mixed Enterprise. The objective of the present investigation was to determine the technical

Journal of Animal & Plant Sciences, 2011. Vol. 10, Issue 2: 1300- 1305.
Publication date: 30/5/2011, http://www.biosciences.elewa.org/JAPS; **ISSN 2071 - 7024**

effectiveness of the extract of *F. hexapetala on M. persicae* in laboratory and field conditions, as well as the extract fraction more effective on the insects.

3 MATERIALS AND METHODS

The present investigation was carried out in the period 2008 - 2009 in two phases: In the first phase an experimental investigation was carried out in the municipality of Abreus, , in laboratory and field, to determine the technical effectiveness of natural extracts of *F. hexapetala* on *M. persicae*. In a second phase an experimental investigation was carried out in the Chemical Pharmacy Department of to the Central University of Las Villas to determine the technical effectiveness of extract fractions of *F. hexapetala*, obtained with different solvents in the laboratory on that specie of aphid.

3.1 Evaluation of the insecticide effect of the vegetable extract of *Furcraea hexapetala* (Jacq.) Urban "in vitro.": The investigation was developed in a local of the of Plant Protection Station of Yaguaramas, Abreus Municipality, Cienfuegos province during the period 2007-2008 being used the extract of *F. hexapetala* Agavacea Family.

The vegetable material was obtained in the community "Babiney "in the municipality of Abreus in Cienfuegos province. The leaves of *F. hexapetala* were harvested from mature plants of 2 m of height that possessed leaves of approximately 1 m of length and 10 cm in their wider part, which were on a shaft of 50 cm of height and 15 cm in diameter (Figure 1).

The vegetable material was taken from the Community of Horquita where were obtained the vegetable extract by means of sugar mill (Figure 2). The product (Figure 3) was filtered and starting from this it was gotten different proportions 50%, 25%, 12.5%, coinciding this last one with the concentration used by the farmers.


Figure 1: Cutting leaves

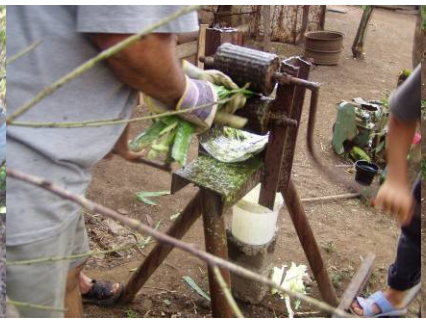
Figure 2: Milling leaves


Figure 3: The vegetable extract

Two assays were carried out, one with aphids reared on potato leaves and another on pepper leaves. Each assay was mounted with five treatments, (four with prepared of the vegetable extract *F. hexapetala* to 100%, 50%, 25%, 12.5%, a control where water distilled sterile was applied.

The aphids of the species *M. persicae* were obtained from potato fields of Desirée variety of 35 time planted days in the Horquita Varied Crops Enterprise, Abreus Municipality, where they had not been carried out chemical neither biological treatments. They stayed in the laboratory of the Plant Protection Station of Yaguaramas during seven days on potato leaves that had been obtained from potato tubers planted in the own centre and maintained under isolation conditions.

In each assay five of Petri dishes were used per treatment which constituted the replicates. It was located a pepper leaf or potato one by Petri dish according to the case. A piece of cotton humidified with sterile distilled water was placed in the peduncle of the leaf and surrounding it, to avoid that the aphids escaped. With the help of a paintbrush 10 aphids were located on each leaf. The vegetable extracts as well as the distilled water were applied with a manual sprayer on the leaves after having located the aphids on these.

Daily observations were carried out in the assay guaranteeing the humidity of the cotton. Every day the live aphids were counted by Petri dish. The percentage of each agent's mortality was determined by treatment at the 24, 48 and 72 hours of mounted

the assay, for which was used the Abbot formula (Ciba Geygi, 1981).
% mortality = A - B / A x 100
Where
A: Live individuals' number in the control.
B: Live individuals' number in the treatment

With the data of mortality obtained for each variant an analysis of variance was carried out , using the statistical package SPSS for Windows version 11. The percentage data were transformed in 2 arc sin√ p (Lerch, 1977) and media were compared by the test of multiple ranges of Duncan with a probability of error of 5%.

3.2 Evaluation of the vegetable extract of *Furcraea hexapetala* (Jacq.) Urban for the control of *Myzus persicae* Sulzer in potato (*Solanum tuberosum* L.) and pepper (*Capsicum annuum* L.),

In order to determine the insecticide effect of *Furcraea hexapetala* (Jacq.) Urban, two field assays were carried out, one on potato (*Solanum tuberosum* L.) and another on pepper (*Capsicum annuum* L.), which had the presence of *M persicae* and application index according to signalling methodologies (INISAV, 1979). The experiment in potato was developed in a field of 40 days planted time in a watering area with machine of central pivot (Kuban 5) in the Horquita Mixed Enterprise. The experimental plots had 20 m². The experiment in the pepper field was carried out in an area of 1 ha of the organoponic of the Popular Council Yaguaramas of the municipality of Abreus, when the crop had 45 days. Each assay had five treatments, four with vegetable extracts of the plant with a proportion of 100%, 50%, 25% and to 12.5% and a control. The assays were carried out in simple plots of 20 m². In each plot 10 plants were evaluated constituting each one of them an observation. On each plant an initial count of the quantity of present aphids was carried out.

The vegetable material (leaves of *Furcraea hexapetala*) was obtained in the community "Babiney" in the municipality of Abreus at the same condition explained in the previous experiment, being obtained the vegetable extract by means of a sugar mill. The sprays of the extract were carried out in the afternoon with a manual sprayer of 16 litres of capacity, being used a final solution of 240 l/ha.

At the 24, 48 and 72 after spray the plants were evaluated determining the number of aphids for plant in each plot. In each plant three leaves were evaluated (superior, half and inferior level) according to signalling methodology (INISAV, 1979). In each leaf the number of aphids was counted both on the upper and the back sides. This information allowed determining the technical effectiveness of each treatment of the vegetable extract on the insects, using the Abbott formula (Ciba Geygi, 1981) With the population data (aphid/leaf) obtained per plot in each assay it was carried out an analysis of variance, using the statistical package SPSS for Windows version 11. The media were compared by the test of multiple ranges of Duncan with a probability of error of 5%.

3.3 Determination of the effect of different fractions of the extract of *F. hexapetala M persicae* under laboratory conditions: The vegetable material (leaves of *F. hexapetala*) was obtained in the community "Babiney" in the municipality of Abreus in similar conditions to those that it was explained in the previous experiment. It was taken to the laboratory of Chemical Pharmacy Department of the Central University of Las Villas to process it. To the leaves they were separated the cuticle that covers them and they were chopped in fine fractions, they were placed in a stove to a temperature of 40°C until obtaining a constant weight (approximately 10 days). Later they were milled mechanically until a fine powder. Starting from that material different extracts were gotten.

3.4 Preparation of the hydro alcoholic mixture: It was done a mixture ethanol-water (70:30). For they were measured 445 ml of distilled water and they were added in volumetric flasks of 2000 ml and it was completed with ethanol at 90º, with that a solution of ethanol-water was obtained (70:30)(v/v).

3.5 Obtaining of the hydro alcoholic extract: The vegetable material 545.90 g (powdered) was macerated with 2000 ml of the hydro alcoholic, mixture to ambient temperature and in the darkness. At the 72 hours it was filtered to reduced pressure, the obtained extract was accumulated and later the extraction process was carried out twice more repeating the same procedure. The whole accumulated hydro alcoholic extract was concentrated to dryness on a rotational evaporator to reduced pressure.

3.6 Obtaining the crude of saponins: The hydro alcoholic extract was subjected to successive extraction processes with solvent of growing polarity (ether of petroleum, chloroform, ethyl

acetate and n-butanol) until obtaining a crude of saponins (butanolic extract) according to procedure recommended by Guerra *et al.* (2008).

The treatment with ether of petroleum extracts compounds of smaller polarity. The solvents of medium polarity (chloroform and ethyl acetate) were used with the purpose of separating present steroidal sapogenins in the hydro alcoholic extract. In the n-butanol they are the saponins, for the specificity of this solvent for the glycosides extraction

3.7 For the obtaining of the extracts the following steps were developed: 16,92 g was weighed of the hydro alcoholic extract (solid), they were dissolved in 100 ml of distilled water and it was extracted in a decantation funnel with 100 ml of each solvent of the series of having referred the organic phase previously they accumulated and later on they concentrated until dryness to reduced pressure, being obtained the solids extract.

The effect of the four obtained extracts was evaluated on *Myzus persicae* under laboratory conditions. The hydro alcoholic extract with chloroform, extract with ethyl acetate and the n-butanol extract of crude of saponins. For that, 1 g of each fraction or obtained extract was taken and it was added to 100 ml of sterile distilled water. An assay was developed on a design totally randomized with five treatments and four replicas. The treatments consisted on the four obtained extracts and a control (distilled sterile water), and each replicate consisted in a Petri dish where 10 aphids (*M. persicae*) were located on pepper leaves. To the insects it was carried out the same process and they were raised in the leaves with a similar procedure to the one explained previously.

As the four vegetable extract as the distilled water were applied with a manual sprayer on the leaves after being located the aphids in these. They were carried out daily observations guaranteeing the humidity of the cotton. Every day the aphids were counted per Petri dish. The percentage of each agent's mortality was determined by treatment at the 24, 48 and 72 hours of mounted the experiment, for that which was used the formula of Abbot (Ciba Geygi, 1981).

With the obtained data of mortality for each treatment or fraction of the extract, it was carried out an analysis of variance, using the statistical package SPSS for Windows version 11. The percentage data were transformed in 2 arc sin√ p (Lerch, 1977) and the media compared by the test of multiple ranges of Duncan with a probability of error of 5%.

4 RESULTS AND DISCUSSION

4.1 Evaluation of the insecticide effect of the vegetable extract of *Furcraea hexapetala* (Jacq.) Urban "in vitro" : As results of the laboratory assay where individuals of *M. persicae* raised on pepper leaves were exposed to the extracts of *F. hexapetala*, it could be observed at the 24 hours 48% of technical effectiveness for the smallest proportion (12.5%) and 64% for the biggest proportion (100%), although there were not statistical difference among these values. At the 48 hours the technical effectiveness varied between 68% and 86.5%, and at the 72 hours between 74.25% and 88%, without statistic difference to each other (Table 1).

Table 1: Technical effectiveness of the vegetable extract of *Furcraea hexapetala* (Jacq.) Urban *Myzus persicae* Sulzer reared on pepper under laboratory conditions.

Variants	Technical effectiveness (%)		
Time of exposition	24 h	48 h	72 h
Extract of *F. hexapetala* 100%	64.0 ns	80.5 ns	88.00 ns
Extract of *F. hexapetala* 50 %	54.55 ns	73.0 ns	78.0 ns
Extract of *F. hexapetala* 25 %	50.5 ns	69.0 ns	76.5 ns
Extract of *F. hexapetala* 12.5 %	48.0 ns	68.0 ns	74.25 ns
Standard error	0.055	0.033	0.058
Coefficient of variation (%)	4.01	1.7	2.68

n/s - Not statistically significant.

These results of technical effectiveness close to 80% to 12.5% and 25% of the vegetable extract concentrations at the 72 hours surpassed the value of 70%, minimum threshold settled down by the

Journal of Animal & Plant Sciences, 2011. Vol. 10, Issue 2: 1300- 1305.
Publication date: 30/5/2011, http://www.biosciences.elewa.org/JAPS; **ISSN 2071 - 7024**

Cuban Plant Protection (CNSV, 2008) for a chemical pesticide and superior to 69%.

The laboratory assay to evaluate the concentrations of the vegetable extract of *F. hexapetala* on *M. persicae* reared on potato leaves showed technical effectiveness between 47% and 60% to the extract proportion of 12.5% and 100% respectively at the 24 hours of initiate this, between 69% and 82.25% of technical effectiveness at the 48 hours and between 73% and 84% at the 72 hours. In any time it was difference among the technical effectiveness to the different proportions of the extract (Table 2)., it is necessary to pointing out that the same as on the pepper at the 72 hours all the treatments presented more than 70% of technical effectiveness, what suggests that to concentrations between 12.5% and 25% an acceptable level of control can be obtained on this group of insects, that which should be checked under field conditions.

Table 2: Technical effectiveness of the vegetable extract of *Furcraea hexapetala* (Jacq.) Urban *Myzus persicae* Sulzer reared on potato under laboratory conditions.

Variants	Technical effectiveness (%)		
Time of exposition	**24 h**	**48 h**	**72 h**
Extract of *F. hexapetala* 100%	60 ns	82.25 ns	84.0 ns
Extract of *F. hexapetala* 50 %	56 ns	75.0 ns	80.0 ns
Extract of *F. hexapetala* 25 %	53 ns	73.0 ns	76.0 ns
Extract of *F. hexapetala* 12.5 %	47 ns	69.0 ns	73 .0 ns
Standard error *	0.632	0.038	0.080
Coefficient of variation (%)	3.81	1.84	3.54

* n/s - Not statistically significant.

4.2 Evaluation of the vegetable extract of *Furcraea hexapetala* (Jacq.) Urban for the control of *Myzus persicae* Sulzer in the cultivations of the potato (*Solanum tuberosum* L.) and the pepper (*Capsicum annuum* L.): The populations of *M. persicae* in the cultivation of the pepper in the variants sprayed with vegetable extract of *F. hexapetala* differed of the control without treatments at the 24, 48 and 72 hours of having carried out the assay (Table 3), and not statistical difference was observed among the variants with the vegetable extract to concentrations from 12.5 up to 100%. The technical effectiveness varied between 37% and 51% at the 24 hours, between 65% and 72.0% at the 48 hours and between 71% and 83 at the 72 hours, although these values were lightly inferior to those observed in the laboratory assay for this group of insects raised on pepper leaves, the results are encouraging since the effectiveness at the 72 hours with concentrations of the extract between 12.5% and 25% varied between 71% and 77% and they didn't differ of those of higher concentrations. The fact that the lowest concentrations obtained effectiveness above 70%, accepted by the Manual of Functions of Plants Protection (CNSV, 2008), without difference with other variants of more concentrations have a great value, since it implies that the natural population of *F. hexapetala* can be exploited rationally.

Table 3: Technical effectiveness of the vegetable extract *Furcraea hexapetala* (Jacq.) Urban on the populations of *Myzus persicae* Sulzer in pepper under field conditions.

Variants	Population level (aphids/plant)			Technical effectiveness (%)		
	24 h	**48 h**	**72 h**	**24 h**	**48 h**	**72 h**
Extract of *F. hexapetala* 100%	1.96 b	1.12 b	0.68 b	51	72.0	83
Extract of *F. hexapetala* 50 %	2.32 b	1.32 b	0.84 b	42	67.0	79
Extract of *F. hexapetala* 25 %	2.44 b	1.32 b	0.92 b	39	67.0	77
Extract of *F. hexapetala* 12.5 %	2.50 b	1.40 b	1.16 b	37	65	71
Control	4.0 a	4.0 a	4.0 a			

Journal of Animal & Plant Sciences, 2011. Vol. 10, Issue 2: 1300- 1305.
Publication date: 30/5/2011, http://www.biosciences.elewa.org/JAPS; **ISSN 2071 - 7024**

Standard error *	0.064	0.078	0.081			
Coefficient of variation (%)	8.91	12.91	14.89			

*Media with unequal letters defers for p <0.05 according to the test of multiple ranges of Duncan.

The populations of *M. persicae* in the assay developed in potato's field also manifested a sensitive reduction in the variants sprayed with the extract of *F. hexapetala* with regard to the control without treatment, observing statistic differs in all the evaluation moments (24, 48 and 72 hours), however differences were not observed among the treated variants (Table 4). The technical effectiveness was increasing with the time varying between 34% and 52.0% to the 24 hours, 68% and 74% to the 48 hours and 80% and 88.0% at the 72 hours. It should stand out that in this case the variants of 12.5% and 25% of the vegetable extract manifested 80% and 81.30% of effectiveness respectively, being similar with the results obtained on the insects in the field assay in pepper.

Table 4: Technical effectiveness of the vegetable extract of *Furcraea hexapetala* (Jacq.) Urban on populations of *Myzus persicae* Sulzer in potato under field conditions.

Variants	Population level (aphids/plant)			Technical effectiveness (%)		
	24 h	48 h	72 h	24 h	48 h	72 h
Extract of *F. hexapetala* 100%	4.0 b	1.5 b	0.9 b	52.0	74	88.0
Extract of *F. hexapetala* 50 %	4.0 b	2.2 b	1.3 b	42.6	70.6	82.6
Extract of *F. hexapetala* 25 %	4.3 b	2.2 b	1.4 b	38.25	70.6	81.3
Extract of *F. hexapetala* 12.5 %	4.5 b	2.4 b	1.5 b	34.0	68	80.0
Control	7.5 a	7.5 a	7.5 a			
Standard error *	0.056	0.075	0.075			
Coefficient of variation (%)	7.86	11.97	14.03			

*Media with unequal letters defers for p <0.05 according to the test of multiple ranges of Duncan.

It is important to highlight that in the Manual of the Urban Agriculture (MINAGRI, 2007) there are only ten plants recommended for phytosanitary use, and of course *F. hexapetala* is not considered an alternative for the pest control.

The present obtained result regard to the technical effectiveness in field of *F. hexapetala*, on aphids is novel even in Cuba where this is a native plant. Moreover it must be taken into account that de figures of effectiveness obtained on this pest are higher than others authors like Martínez *et al.* (2008) in field assay, who tested eight species of plants against aphids in bean, and they achieved the best results with the eucalyptus (*Eucalyptus* sp) with 79% of effectiveness. Nevertheless, these were superior to those obtained by Tarqui (2007) against aphids in lettuce, which sprayed spicy pepper (*Capsicum frutescens* L.) and paradise (*Melia azedarach* L.) and the highest effectiveness reached was 69%. Although the extracts of *F. hexapetala* don't reach 100% of technical effectiveness as it would make a chemical insecticide, it is necessary to keep in mind the decrease of the risk of contamination of the environment and the risk of insect - resistance, aspect that has been considered by Sánchez (1994). Even the employment for the farmers of *F. hexapetala* to phytosanitary purpose had not been approached previously in scientific investigations, it cannot be considered casual, neither the effectiveness reached with the extracts of this plant, against aphids like *M. persicae* in laboratory and in field conditions, so it is known by the literature that in the family Agavaceae where the genus *Furcraea* is located they are many species of plants that contain saponins that have sanitary use (Wikipedia, 2007), although Pino (1996) doesn't make reference to that as insecticide, since in Peru he refers that starting from species of the genus *Furcraea* some products are obtained that are used with fungicidal and anti parasitic action, besides as molluscide.

4.3 Determination of the effect of different fractions of the extract of *F. hexapetala* on *Myzus persicae* Sulzer under laboratory conditions: The results with the different fractions of the extract of the leaves of *F. hexapetala* showed that the biggest technical effectiveness were obtained with the hydro alcoholic extract (70%) and with n butanol one (75%) at the 24 hours without statistical difference between those figures. At the 48 hours the best variant was the extract n butanol that reached 100% of effectiveness, fraction in which according to for the followed procedure

Journal of Animal & Plant Sciences, 2011. Vol. 10, Issue 2: 1300- 1305.
Publication date: 30/5/2011, http://www.biosciences.elewa.org/JAPS; **ISSN 2071 - 7024**

(Guerra, 2009) it is where there is bigger saponins presence, and in second place it was the hydro alcoholic extract (Table 5). During the observations carried out in the assay it could be appreciated that the aphids (*M. persicae*), exposed to the extracts, mainly n butanol, they increased of size with the time, until they secreted drops of a substance and later on they died.

Table 5: Technical Effectiveness on *M. persicae* of the different fractions obtained in the laboratory of the vegetable extract of *Furcraea hexapetala* (Jacq.) Urban

Variants	Technical effectiveness (%)		
Time of exposition	24 h	48 h	72 h
Hydro alcoholic extract	70 a	70 b	80 b
Chloroform extract	40 b	70 b	70 bc
Ethyl acetate extract	30 b	50 c	60 c
N butanol extract	75 a	100 a	100 a
Standard error *	0.110	0.147	0.132
Coefficient of variation (%)	13.41	13.67	11.68

*Media with unequal letters defers for p <0.05 according to the test of multiple ranges of Duncan.

Starting from these results it was confirmed that the insecticide effect of this plant is due to the present saponins in the hydro alcoholic extract and concentrated through successive extraction processes in the n butanol solvent, fraction that is denominated crude of saponins (Guerra *et al.,* 2008; Guerra, 2009). The fact that the extract of n butanol in the proportion of 1g in 100 ml of water (100 mg kg^{1}) manifested an effectiveness of 100% at the 48 hours, it suggests the necessity to continue the investigations to know what concentration of the crude of saponins achieves 95% of mortality on the aphid population. At the same time it becomes necessary to continue the division of this extract of n butanol as is recommended by Guerra (2009) to identify the type of the saponin present, since for the case of *Agave brittoniana* Trel. ssp.brachypus, endemic species of Cuba eight types of steroidal saponins were identified of which four were new molecules (Macias *et al.,* 2007).

5 CONCLUSIONS

The extract of *Furcraea hexapetala* (Jacq.) Urban manifested technical effectiveness on *Myzus persicae* Sulzer higher than 73% "in vitro" and 71% under field conditions as much in pepper as in potato. The butanolic fraction of the extract of *F. hexapetala* reached 100% of effectiveness on *M. persicae* confirming that the insecticide effect of the plant is due to the saponins present.

6 REFERENCES

Alfonso M, Avilés R, González N, Cruz X, Villasana. R, Rodríquez V, Alvarez M, Lorenzo. I and Rodriquez I. 2002. The botanical pesticide and their importance in the Organic Agriculture. *Organic agriculture.* ACTAF. Cuba. Vol. 8 No. 2: 26 – 29.

Alvarez de Zayas, A. The genus *Furcraeae* (Agavaceae) in Cuba. Annals Inst. Biol. Autonomic National. University. Mexico. Ser. Bot. 67 (2) 329 -346.

C N S V. 2008. Manual of functions for the Plant Protection Station. National Centre of Plant Protection. MINAG. Cuba. 180 pp.

Ciba Geigy. 1981. Manual of field assay. Basilia. Switzerland. 124 pp.

Cuellar I.; León M.; Gómez A.; Pinion D, Villegas R. and Santana I. 2003. Sugar Cane sustainability paradigm. Publinica Edition. INICA. Cuba. 73 pp.

ETPP Yaguaramas. 2004. Report of potato cultivation season. 2004. Plant Protection Station of Yaguaramas. 35 pp.

García, M; Linares C. and. Ricardo C. 2002. Use of the resin XAD-2 in the pesticide analysis in water. *Fitosanidad* Vol 6. No1 51-54.

Guerra JO. 2009. Monography. The steroidal saponins. www.monografias.com/trabajos55/saponinas-sapogeninas/saponinas-sapogeninas.shtml?monosearch.

Guerra JO, Meneses A, Simonet A, Macias A., Noqueiras C, Gómez A. and. Escario JA. 2008. Sesteroidals Saponins of Agave brittoniana (Agavaceae) with activity against the parasite *Trichomona vaginalis*. Tropical Biology Review. Vol 56 (4): 1645 - 1652.

INISAV.1979. Methodology for forecast and signalling pest and disease. Las Habana. Cuba. 245 pp.

Lerch, G. 1977. The experimentation in the biological and agricultural Sciences. Ed. Scientific - Technique. Cuba. 277 pp.

Macías FA, Guerra JO, Simonet AM. and Nogueira C. 2007. Characterization of the fraction components using 1D TOCSY and 1D ROESY experiments. Four new spirostane saponins from *Agave brittoniana* Trel. Spp. *Brachypus*. Magn. Reson. Chem. 45: 615-620

Martin, C. 2003. Integrated management of insect pest in potato in Horquita Mixed Enterprise. Cienfuegos. Thesis (in option for the academic title of Master in Sustainable Agriculture). Central University of Las Villas. 95 pp.

Martínez Y. 2008 Insecticide effect of extracts of plants for the control of aphids of the Bean (*Vigna Unguiculata*, L.) in the Sugar Company Elpidio Gómez. Agronomic Engineer Thesis. Cienfuegos University. Cuba. 55 pp.

MINAGRI, 2007 Technical manual for Organopónicos and Intensive Orchards. Havana, Cuba. p. 124 – 133.

Martínez E, Barrios G, Robesti L and Santos R. 2007. Integrated pest management. Practice Manual. Cuba. CNSV, Cuba; Between people, Spain, GVT, Italy. 526 p.

Mosquera, M. 2003. Vegetables and health. Tabloid University for all. April Publisher Home. Cuba. 25 pp.

Olano, S, 1999. Moluscide Action of *Furcraea andina* Trel. (Agavaceae) on *Fossaria viatrix* (Orbigny, 1835) and its photochemical components. Thesis (Biology)-mention: Microbiology and Parasitology. National University of San Marcos. Biological Sciences Department.

Ortega, I., Castellanos L, Jiménez R, Soto R, Martín C, Fernández A, Suárez J, González I, Martínez F. and Subit D. 2008. Distribution and Conservation of the repellent and pesticide plants of the urban agriculture of the Cienfuegos province. CITMA Proyect. Final Report. 98 pp.

Pino, G. 1996. Agavaceae cultivated in Peru. *Quepo.* Vol.10. 64-70.

Sanchez, F. 1994, Biological Control of pests in hothouse, Agriculture Guides Mundi Presses, Editions Mundi Presses, Madrid Spain, p.12-14.

Tarqui, J. 2007. Effect of three bio pesticide for the control of aphids (*Aphis* sp) in the lettuce cultivation in protected atmospheres in the Alto city. Diploma Thesis in opinion to the Agricultural Engineer Title. University of San Andrés. Bolivia. 72 pp.

Wikipedia (2007). http://es.wikipedia.org/wiki/Alelopat%C3%ADa.