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INSECTICIDAL ACTIVITY OF CERTAIN FERMENTED PLANT EXTRACT AGAINST *SPODOPTERA LITURA* (FAB.) (LEPIDOPTERA: NOCTUIDAE)

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ABSTRACT

The effect of fermented extracts of *Acorus calamus*, *Coriandram sativam* and *Zingiber officinale* and their combinations (AC, AZ and ACZ) were tested against Asian army worm *Spodopteralitura*(Fab.)(Lepidoptera:Noctuidae). The results revealed that tested fermented plant extracts and their combinations caused larval mortality, life period and relative growth rate. Among the plant extracts and their combinations were tested, ACZ fermented extracts caused maximum mortality (100%), high toxicity ($LC_{50}=0.8589$), minimum larval period (12.0 ± 1.15) and minimum relative growth rate (RGR) (-0.80 ± 0.98) against *S.litura*. Hence ACZ fermented extracts could be used for the development of a new and a viable fermented botanical formulation in pest management programmes.

INTRODUCTION

The insect pests have developed resistance to a variety of insecticides due to the indiscriminate usage of chemical pesticides. Insecticides affect the non target organism and human beings directly or indirectly. Plant materials are effective against a variety of insect pest and they are easily degradable. Botanicals are beneficial for both the environment and agricultural product consumers. (Rishvi and Shammel, 2004; Vendamet *et al.*, 2008).

Asian armyworm *Spodopteralitura*(Fab.) is one of the important polyphagous crop pests distributed throughout South Asia and Eastern countries (Baskeret *et al.*, 2011). It attacks more than 112 species of cultivated crops and causes severe losses (Ferry *et al.*, 2004; Deshmukheet *et al.*, 2010). Fermented plant products have been traditionally used in sugarcane, onion and brinjal pest management in India (Greetha Rani, 2005). The fermented plant extracts played a significant role in the development of *Spodopteralitura*(Fab.) by disrupting the development process and also it reduced larval life span and food consumption (Sahayarajet *et al.*, 2011, Sumitraet *et al.*, 2012).

In this study assessing the potential and toxicity of selected fermented plant extracts against the crop pest *Spodopteralitura*(Fab.) and formulate as a commercial pesticides.

MATERIALS AND METHODS

Pest collection and rearing:

Various life stages and egg masses of *spodopteralitura* (Fab.) were collected from the *Recinuscommunis* field in and around Alangulam and Surandai (NO8⁰54'03.2'', E077036.5'') Tirunelveli district, Tamilnadu, India. The egg was surface sterilized with 0.02% sodium hypochloride solution, dried and allowed to hatch. After hatching, the neonate larvae were reared on leaves of *Recinuscommunis*, till prepupal stage. Sterilized soil (autoclaved method) was provided for pupation at known temperature (27.0±2⁰C) with 14-10L: D photo period and 70±5% RH in insectory. After pupation, the pupae were collected from soil and placed inside the oviposition chamber. After adult emergence, cotton soaked with 10% (W/V) honey solution with few drops of multivitamins was provided for adult feeding to increased fecundity. Castor leaves were kept inside adult emergence glass cage for egg laying (30cm × 30cm × 45cm). After hatching, the larvae were used for bioassay (Jeyasankaret *et al.*, 2010, 2011; Baskaret *et al.*, 2011;).

Collection and preparation of plant extracts:

Acoruscalamus, *Coriandrumsativam* and *Zingiberofficinales* off were collected from commercial shop in Nagercoil, Kanyakumari District, Tamilnadu, India and were washed twice with tap water and once with distilled water. 300gm leaves of *C.sativum* and Rhizome of *A.calamus* and *Z.officinales* were separately ground in a domestic blender and these and their combinations (A,

C, Z, AC, AZ and ACZ) were mixed with 1lit tap water in a clean earthen pot to which 5ml citrus fruit juice was added separately. After firmly wrapping the open end of the earthen pot with muslin cloth, these were buried at a depth of 1-2feet under the shade of trees and to ferment for 4, 8, 12, 16 and 20 days. After the stipulated period, the fermented mixture was taken out and filtered through muslin cloth. The filtrate was used as stock extract. For the insecticidal activity study 50ml of fermented plant extracts and their combinations was taken to which 1ml of 0.1% Teepol solution was added as adjuvant. A control treatment without any leaf extracts was also taken for comparisons.

Insecticidal activity:

Different days fermented extracts (8, 4, 12, 16 and 20) of *Acoruscalamus*, *Coriandramsativam*, *Zingiberofficinales* and their combinations AC, AZ and ACZ were applied using leaf dip method. The treated leaves were exposed to the 3rd instars larvae in 96hrs (every 24hrs). After 96 hrs treatments, the larvae were continuously maintained on the non-treated fresh castor leaves. Fresh castor leaves were provided daily, larval mortality was recorded at 24, 48, 72 and 96 hours. These replicates were maintained for each treatment with 10 larvae per replicates. Percent mortality was calculated and mortality in control was corrected by Abbott's formula (Abbott, 1925). LC₅₀ was recorded (Finney, 1971) by using SPSS (11.5) software.

$$\text{Abbott's corrected mortality} = \frac{\% \text{ mortality in treatment} - \% \text{ mortality in control}}{100 - \% \text{ mortality in control}} \times 100$$

The daily weight gain of *Spodopteralitura*(Fab.) was recorded at the experimental duration. The relative growth rate (RGR) (Isikiber and Copland, 2002) of *S.litura* was calculated in each of its 24, 48, 72 and 96 hours respectively by the following formula:

$$\text{RGR} = \frac{(\text{FWT} - \text{IWT})}{[(\text{FWT} + \text{IWT}) / 2] \times 100}$$

RGR -Relative growth rate, FWT-final weight and IWT-initial weight

Larval, pupal and adult period:

The survival larvae were continuously fed with castor leaf. The larval durations were calculated after treatment when the larvae become pupae. Pupal duration was calculated from pupation to the day of emergence of adults. Adult longevity was calculated from the day of the emergence of adults to till death of adult.

RESULTS

Insecticidal property of A, C, Z, AC, AZ and ACZ fermented extracts were tested on *Spodopteralitura*(Fab.) were presented Table.1. The results shows among the six fermented extracts ACZ extracts of 20 days after fermentation showed to be most effective and caused

(100% mortality) of 96hrs ($p > 0.0005$), than the AZ ($P > 0.048$), A ($P > 0.0518$) and AC ($P < 0.393$). The LC_{50} concentrations of A, C, Z, AC, AZ and ACZ fermented extracts against *S. litura* are present in the Table.2. ACZ extracts was highly toxic ($LC_{50} = 0.8589$) than the AZ ($LC_{50} = 3.239$) and A ($LC_{50} = 2.8089$). When the days of fermentation increased the larval, pupal and adult period were gradually decreased (fig.2.). *Spodopteralitura* larvae, pupae and adult period developed with 18.95±0.5 days, 7.7±1.5 and 6.2±2.0 days respectively, ACZ fermented extracts was given minimum larval period (12.0±1.15) and no pupal period and adult period was observed at 20 days after fermentation. Followed by the AZ was given minimum larval period (11.5±2.4) and A (15.08±1.7) and AZ and A was given nil pupal period and adult period at 20 days after fermentation. Compare the six fermented extracts the ACZ fermented extracts was superior growth disturbing response. When the days of fermentation increased the relative growth rate (RGR) was gradually decreased, higher duration of fermented extracts were given no growth rate during the experimental period. ACZ and AZ extract were given minimum RGR value was observed (fig.1.). ACZ extracts in 20 days extracts product (-0.80±0.95) at 96hrs and AZ extracts in 20 days extracts product (1.11±0.11) at 96hrs observed minimum RGR when compared to other.

DISCUSSION

Irrespective of the treatments, the corrected percent mortality gradually increased when the fermentation period was increased from 8 to 23 days and this was conformed to the findings of Sahayaraj and Paulraj (1998). Botanicals were highly disruptive on *Spodopteralitura* larvae, pupae (Paulraj, M.G., 2001). Appreciate larval mortality was also noticed with 23 days FPE of *V. negundo* (90.0%) and *T. procumbens* (100.0%). Higher days after fermentation (23 days) of FPE were highly disruptive in the larval period, pupal period and adult longevity. Emergence of adults gradually decreased with the increase in duration of fermentation of the test botanicals (Sahayaraj et al., 2011). Balasubramanian et al., (2008) reported that FPE treatments reduced the larval, pupal and adult longevity of *Spodopteralitura*. Higher larval mortality was found in essential oils of *Acarus calamus*, *Zingiber officinale* and *Coriandrum sativum* ($LC_{50} = 36.13$, 15.0 and 38.2).

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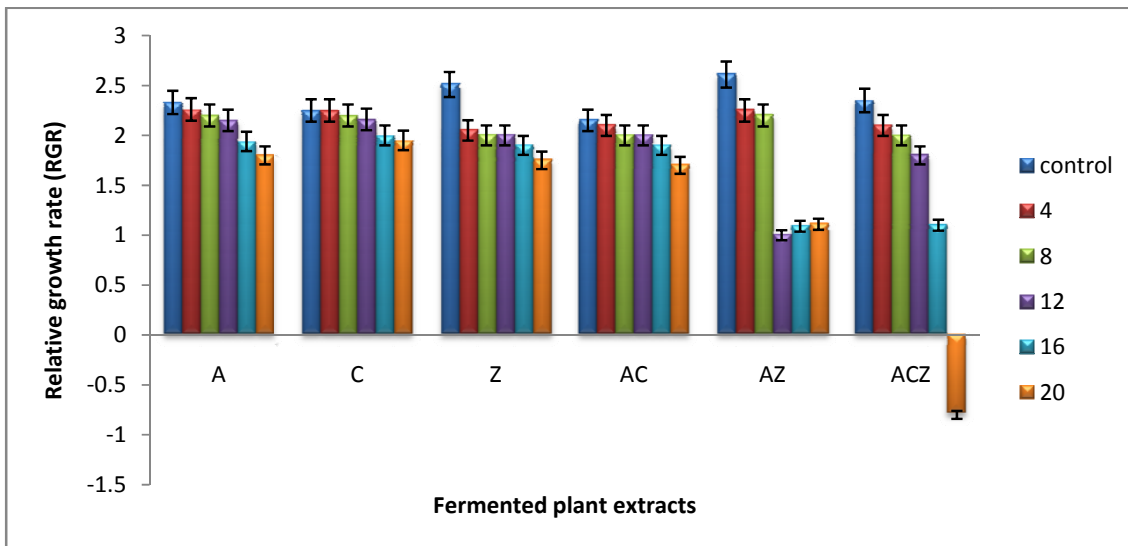
Table.1. Impact of fermented plant extracts A,C,Z,AC, AZ and ACZ on larval mortality (%) of *S.litura*.

Days for fermentation	A	C	Z	AC	AZ	ACZ
4	26.66	0	13.33	16.66	30.0	43.33
8	40.0	16.70	20.0	23.33	36.70	76.66
12	53.33	20.0	30.0	40.0	50.0	90.0
16	66.70	30.0	40.0	50.0	56.70	80.0
20	86.70	33.33	43.33	50.0	90.0	100.0

Table.2. lethal concentrations (LC₅₀) of fermented plant extracts on *Spodopteralitura* at 96 hours after the exposure.

Extracts	LC ₃₀	LC ₅₀	LC ₉₀	Regression coefficient	Intercept	Chi square	df	p
A	1.5844	2.8087	11.3809	2.1089	-0.9459	0.502	3	0.0518
C	3.2343	5.8632	61.5906	1.2516	-0.9614	2.374	3	0.498
Z	2.2343	4.7632	27.9506	5.2216	-4.0145	1.613	3	0.656
AC	3.2388	6.1002	28.6606	1.9072	-1.4978	2.990	3	0.393
AZ	1.9622	3.2396	11.0316	2.4082	-1.2294	7.902	3	0.048
ACZ	1.4097	0.8589	3.7719	1.8021	-0.4471	22.212	3	0.0005

Figure.1. Impact of fermented plant extracts on relative growth rate (RGR) of *Spodopteralitura* at 96 hours of exposure.



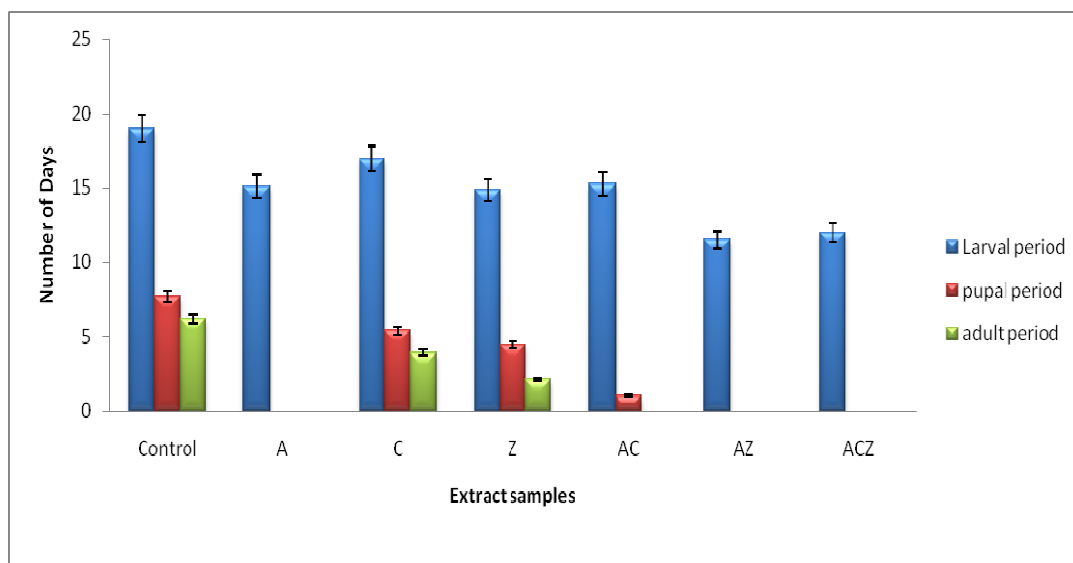


Figure.2. Impact of fermented plant extracts on the life cycle parameter of *Spodopteralitura* at 20 days after fermentation.

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