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IMPACT OF PH (HYDROGEN ION CONCENTRATION) ON EFFICACY OF ENDOSULFAN 0.07% AGAINST *SPODOPTERA LITURA*

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Abstract: The bio-efficacy of endosulfan 0.07% with different quality of water as spray fluid was studied against different larval instars of *Spodoptera. litura* in laboratory condition. Among the four different quality of water, rain water and river water as spray fluid proved to be most effective while sea water as spray fluid resulted in low per cent mortality in different instars of *S. litura*, due to of acidic medium and a high electrical conductivity which adversely affected the physical properties and bio-efficacy of endosulfan.

Key words: Endosulfan 0.07%, quality of water, *Spodoptera litura*, pH and electrical conductivity

INTRODUCTION

The pesticide formulations are vulnerable to deterioration due to temperature, light, humidity, quality of water etc. when used and stored at different agro-climatic locations (Jayakumar 1986; Jayaraj *et al*. 1986). In India most of the marginal and small farmers used high volume sprayers for applying pesticides due to economic reasons. In quality control, standard hard water having a hardness of 342 ppm equivalent to 0.53 EC is used for testing physical properties of pesticides for stability. But the water having as high as 3.0 EC equivalent to 1920 hardness is also used for irrigation by the farmers and they have to use the available irrigated water for preparing the spray fluid (Duraipandian and Ragupathy 1989). Jayakumar (1986) indicated that water with acidic medium and with high electrical conductivity (EC) adversely affects the physical properties and bio-efficacy of some pesticides. Hence an experiment was conducted to study the different larval mortality of *Spodoptera litura* by using different quality of water in endosulfan 0.07 % use as spray fluid.

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MATERIALS AND METHODS

The different quality of water as spray fluid with pesticide endosulfan 0.07% used to test the efficacy against different larval instars of *S. litura* in laboratory condition. The castor leaves were sprayed with respective treatments (A,B,C and D) (Table 1) and then they were allowed to dry under ceiling fan for 15 – 20 min. Treatment E was treated as a control (water spray only). Twenty different larval instars(from 1st to 6th instar) were transferred into separate petri dishes (15 cm diameter) containing the treated leaf and thus the treatment was replicated thrice. The leaves were allowed to feed on the treated leaves for 24 h and then they were provided by fresh untreated leaves on next day. Observation on larval mortality was recorded after 1, 2, 3, 4, 5 & 6 days of application until complete mortality was obtained. All the data obtained during the course of investigation were analyzed statistically using appropriate Arc Sin transformation.

Table 1. Effect of pH on endosulfan 0.07% on different instars of *Spodoptera litura*

Treatments	% Larval Mortality						Mean
	I instar	II instar	III instar	IV instar	V instar	VI instar	
A	100.0 (90.0)*	90.0 (71.0)	75.0 (60.0)	76.0 (61.0)	64.0 (53.0)	55.0 (47.0)	76.0 (63.0)
B	100.0 (90.0)	92.0 (73.0)	71.0 (57.0)	82.0 (65.0)	72.0 (58.0)	41.0 (39.0)	76.0 (64.0)
C	100.0 (90.0)	88.0 (69.7)	60.0 (51.0)	68.0 (55.0)	52.0 (46.0)	39.0 (38.0)	67.0 (58.0)
D	94.0 (76.0)	71.0 (57.0)	49.0 (44.0)	40.0 (39.0)	38.0 (38.0)	21.0 (19.0)	52.0 (47.0)
E	00.0 (00.0)	00.0 (00.0)	00.0 (00.0)	00.0 (00.0)	00.0 (00.0)	00.0 (00.0)	00.0 (00.0)
Mean	78.0 (69.0)	68.0 (54.0)	51.0 (42.0)	53.0 (39.0)	45.0 (30.0)	31.0 (29.0)	
S.Em	± 1.80						
C.D. (P = 0.05)	5.86						
CV %	6.22						
Treatment	22.6						
Instar	12.6						
Interaction	5.6						

* Fig. in parenthesis are transformed values

A = Rain water + endosulfan 0.07% (pH = 7.67; EC = 1.6)
B = River water + endosulfan 0.07% (pH = 7.5; EC = 2.4)
C = Tube well water + endosulfan 0.07% (pH = 7.68; EC = 2.9)
D = Sea water + endosulfan 0.07% (pH = 5.76; EC = 15.5)
E = Water spray only (Control) (pH = 7.2 ; EC = 1.0)

RESULTS AND DISCUSSION

A study on effectiveness of endosulfan 0.07% in combination with different source/quality of water against different larval instars of *S. litura* was carried out under laboratory conditions at Junagadh. The results obtained on larval mortality are presented in Table 1. Rain water with endosulfan (pH = 7.67; EC = 1.6) caused 100 to 55 per cent mortality to the larval instars I to VI (Table 1) and the mean mortality of 76% was obtained. Where as river water + endosulfan (pH = 7.5; EC = 2.4) gave 100 to 41% mortality to the larval instars, with a mean of 76% mortality recorded. The third treatment, tube well water + endosulfan (pH = 7.68; EC = 2.9) gave from 100 to 39% larval mortality with a mean of 67% mortality obtained. All this three treatments were at par with each other. Where as treatment with sea water + endosulfan (pH = 5.76; EC = 15.5) gave 94 to 21 % larval mortality with a mean of 52%. The treatment E (water spray only) having all *S. litura* larvae a live. There was 00.0 per cent mortality obtained.

The first and second larval instars where much more susceptible to all the treatments, with a range of 0.00 to 100% mortality obtained. The mean mortality of first, second, third, fourth, fifth and sixth larval instars showed 78%, 68%, 51%, 53%, 45% and 31% respectively were obtained in different treatments.

The first and second treatments were at par with each other and gave similar type of control, the next best is third treatment gave 67% mortality, where as fourth treatment gave 52 per cent mortality, was also effective but gave lower reduction in larval mortality and can be less effective as compared to other treatments. Sea water having pH : 5.76 medium and also having a high electrical conductivity, which adversely affects the physical properties and bio efficacy of endosulfan. So, when the physical properties of endosulfan changed than it will loose it effectiveness against control of insect pests.

Significant variations were observed in the extent of persistence of the 3 chemicals (α-endosulfan, β-endosulfan and endosulfan sulfate) in different non-flooded soils with maximum persistence observed in Alfisol and the least in Mollisol having near neutral pH and higher organic matter and degradation was greater in all the flooded soils than in the non-flooded soils (Shalini et al. 1999). Kaur et al. (1998). reported that in water α- and β-endosulfan decayed at a faster rate with increasing temperature and pH 4 to 5. The persistence of both endosulfans decreased with increasing soil pH. Endosulfan persisted longer in soil than in water.

The major oxidation product of endosulfans I and II, endosulfan sulfate, is less volatile and can persist longer than either of the parent isomers. Endosulfan sulfate would not be formed in aerated waters in the absence of microbial activity or strong chemical oxidants. Since endosulfan sulfate is formed in many environments through biological oxidation, and is only slowly degraded (both chemically in sterile media and biologically), it represents a predominant residue of technical grade endosulfan, which finds its way into aerobic and anaerobic aquatic environments. (Guerin T.F., 2001). Nandita *et al*. (1992) investigated the effects of endosulfan (Thiodan) and/or of solutions of water, sulfuric and nitric acids of pH 5.6, 4.0 and 2.8 (to simulate acid rain) on *Vicia faba* (faba beans) and found that 'Acid rain' and endosulfan both reduced root and shoot lengths and numbers of nodules, except plants treated with 'rain' at pH 5.6, which showed better growth. The presences of endosulfan with the acid rain treat-

ment increased breakdown of chlorophyll. Moustafa (1990) collected water samples from around Egypt and found that the alkalinity of Egyptian water (alkaline and had hardnesses ranging from 160 to 1400 p.p.m. calcium carbonate) resulted in hydrolysis that decreased effectiveness if the insecticide (fenpropathrin, chlorpyriphos and diflubenzuron, chlorpyrifos, fenvalerate, cypermethrin and cyanophos on *Spodoptera littoralis* larvae) was stored mixed with the water.

CONCLUSIONS

Rain water and river water as spray fluid proved to be effective in reducing larval population of *Spodoptera litura* and tube well water can be used as an alternative measure. But sea water as spray fluid could not be used because of acidic medium and having high electrical conductivity which adversely affects the physical properties and bio efficacy of endosulfan 0.07% and proved to be less effective as against other treatments. The ascending order of the treatments were rain water + endosulfan 0.07%(pH = 7.67; EC = 1.6) > river water + endosulfan 0.07%(pH = 7.5; EC = 2.4) > tube well water + endosulfan 0.07% (pH = 7.68 ; EC = 2.9) > sea water + endosulfan 0.07% (pH = 5.76 ; EC = 15.5). So water having neutral pH and lower electrical conductivity could increase the effectiveness of endosulfan 0.07%.

REFERENCES

Duraipandian M., Regupathy A. 1989. Effect of storage and quality of water on wettability and shelf-life of some pesticide formulations. Indian J. Agril Sci. 59 (12): 766–770.

Guerin T.F. 2001. Abiological loss of endosulfan and related chlorinated organic compounds from aqueous systems in the presence and absence of oxygen. Environ. Pollut. 115 (2) : 219–230.

Jayakumar S. 1986. Effect of quality of water on pesticides spray fluid. M. Sc. (Agri.) thesis, Tamil Nadu Agricultural University, Coimbtore (unpublished).

Jayaraj S., Rajukkannu K., Regupathy A. 1986. Problems and perspectives of quality control of pesticides. Paper presented at the All India Workshop on Pesticides Residues, held at Tamil Nadu Agril. Universtiy, Coimbtore, 15–17, February,1986.

Kaur I., Mathur R.P., Tandon S.N., Dureja P. 1998. Persistence of endosulfan (technical) in water and soil. Environ. Technol. 19 (1) : 115–119.

Moustafa O.K., El Attal Z.M., El Sisi A.G. 1990. Influence of physico-chemical properties of water on the performance and efficiency of some insecticides. Agricul. Res. Rev. 68 (1) : 127–133.

Nandita Singh, Yunus M., Singh S.N., Ahmad K.J., Singh N., Mohd Yunus. 1992. Performance of *Vicia fabae* plants in relation to simulated acid rain and/or endosulphan treatment. Bull. Environ. Contamin. Toxicol. 48 (2) : 243–248.

Shalini Singh, Prem Dureja, Sushil Kumar, Jain M.C., Singh S., Dureja P. Kumar S. 1999. Persistence of alpha and beta isomers of endosulphan and endosulphan sulphate in diverse soils of India as influenced by flooding. J. Environ. Sci. Health. Part-B, Pesticides, Food Contaminants, and Agricultural Wastes 34 (6) : 965–974.

POLISH SUMMARY

WPŁYW PH NA SKUTECZNOŚĆ ENDOSULFANU 0,07% W ZWALCZANIU *SPODOPTERA LITURA*

W warunkach laboratoryjnych badano skuteczność biologiczną endosulfanu 0,07% w zwalczaniu różnych stadiów larwalnych *Spodoptera litura,* używając jako cieczy do oprysków wody różnej jakości. Spośród czterech wód różnej jakości, deszczówka i woda rzeczna okazały się efektywne, natomiast woda morska powodowała niską śmiertelność różnych stadiów ze względu na kwasowość oraz wysokie przewodnictwo elektryczne, które niekorzystnie wpływały na właściwości fizyczne i skuteczność biologiczną endosulfanu.