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Determination of residues of lambda cyhalothrin in Alphonso mango by HPLC

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Abstract
Residues of lambda cyhalothrin, a pyrethroid insecticide has been determined in Alphonso mango by high -performance liquid chromatography (HPLC). Lambda cyhalothrin was sprayed at recommended (6 ml/10 lit) and double recommended (12 ml/10 lit) doses on Mango trees. Mangoes harvested at 1, 5, 10, 15 and 25 days after spraying revealed that recommended dose showed residue of 0.84 ppm which was reduced to 0.48, 0.21 and 0.04 ppm on 5, 10 and 15 days after spray, respectively. Mangoes of double than recommended dose showed residue of 1.40 ppm which was reduced to 0.95, 0.53 and 0.10 ppm on 5,10 and 15 days respectively after spraying. On 25th day the residue of lambda cyhalothrin was below detectable level in the both doses.

Keywords: Lambda cyhalothrin, residue, Alphonso, HPLC

Introduction
Mango (*Mangifera indica* L.) is appropriately called as "King of fruits" and also considered as "National fruit of India". The mango is a fleshy stone fruit belonging to the genus *Mangifera* from family Anacardiaceae. It is native to south Asia, from where it has been distributed worldwide to become one of the most cultivated fruit in the tropics. Its fame is mainly due to its excellent flavor, delicious taste and high nutritive value and became the choicest fruit of sub-continents. Native to southern Asia, especially eastern India, Burma, and the Andaman Islands, the mango has been cultivated, praised and even revered in its homeland since ancient time, where it has been cultivated for the last four thousand years.

Maharashtra ranks 10th in production of mango which occupies an area of 166.76 thousand ha with the production of 791.36 metric tons in the year 2017-18. In Maharashtra, Alphonso, Kesar, Banganpalli, Dashehari, Amrapali, Rajapuri, Neelam, Totapuri and Langra are the leading varieties of mango which are grown commercially.

The Konkan region is famous and well known for mango production with an area of about 111.715 thousand ha with the production of 353.066 metric tons and productivity of 3.16 metric tons ha^{-1} (Salvi *et al.*, 2018) [3].

The injudicious and indiscriminate application of insecticides to crops result in residues in food and food commodities with consequential hazards. Since most insecticides are toxic in nature, their continuous ingestion by human even in trace amounts, can result in accumulation in body tissues with serious adverse effects on health (Handa *et al.*, 1999) [1].

Many insecticides being highly stable continue to kill insect for long period after their application. This ability of insecticide is called as "residue" which is both advantageous and disadvantageous. Advantageous because a single application achieve more kill, leave over a longer period covering even those insects which may not have been there at the time of application and disadvantageous because along with the harmful insects, the beneficial insects like parasitoids, predators and pollinators also run the risk of being killed due to prolonged residual action of toxicants (Shrivastava, 1988) [5]. The disadvantages of insecticide use are known as 4Rs (Resistance, Resurgence, Risk and Residue), are well known. Insecticide residues are also becoming a major obstacle in reducing India's export to international market. Among different varieties of mango, Alphonso variety of Konkan region is not only being famous in Maharashtra but also gaining more importance in many countries in view of export potential. Mango growers are therefore more worried about the damage inflicted by insect pests. To minimize the economic losses caused by these noxious pests, various pesticides are being used over the mango crop on massive scale. Due to lack of awareness, the farmers of our country do not follow the prescribed dosage and use pesticides at any stage of crop which results in accumulation of residue in fruits.

For the management of mango hoppers, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli has recommended a schedule of six sprays. Though recommended schedule consist of six sprays, the farmers of Konkan region are taking indiscriminate sprays of insecticides to get higher yield. But the overdoses of insecticides make the residue problem, which might poison the fruits and are harmful for human health. Therefore, pesticide residue is becoming a major food safety concern of consumers and government.

The delicious Alphonso mango fruit is highly appreciated in many countries. Thus it opens tremendous opportunities for its export and fetch premium price in the world markets. Today market demands not only quality agricultural produce but also the safe and environment friendly production. To cope with the contemporary international market there is need to carry out systematic research on pesticide residue in mango fruits. In view of the importance of Mango and hazards caused by the insecticide residue, the research experiment was conducted for determination of residues of lambda cyhalothrin in Alphonso mango by HPLC.

Materials and methods

HPLC, vortex, centrifuge and weighing balance.

Extraction of lambda-cyhalothrin

For each sample to be analyzed, about 100 g was chopped and mixed. From this mixture, 1 g was weighed and ground with 1 mL HPLC technical grade acetonitrile. The slurry was vigorously shaken on a vortex for 20 min and centrifuged for 20 min at 10,000 rpm for phase separation. The supernatant was collected and re-centrifuged for 15 min at 10,000 rpm; an aliquot of 75 µL was then loaded into HPLC vials for quantification of lambda cyhalothrin residues.

Analytical method

A suitable volume (50µl) of the extract was injected into the column and eluted with a mobile phase: water: methanol, HPLC grade (10:90, v/v) at a flow rate of 1.0 ml/min. For detection, an absorption wavelength of 226 nm was employed.

Results and Discussion

Data on residue of Lambda cyhalothrin sprayed at recommended and double doses 1,5,10,15 and 25 days after spraying are presented in Table 1. The results revealed that after one day, recommended dose of Lambda cyhalothrin (6 ml/10 lit.) showed residue of 0.84 ppm which was reduced to 0.48, 0.21 and 0.04 ppm on 5, 10 and 15 days after spray. On 25th day the residue of Lambda cyhalothrin was below detectable level. This indicated that the residue of Lambda cyhalothrin at recommended dose of 6 ml/10 litre lasts up to 15 days and thereafter it is not detectable.

Table 1: Residue of Lambda cyhalothrin in mango fruits at periodic interval

Dose ml/10 lit	Average residue (ppm) at periodic interval (days)				
	1	5	10	15	25
6	0.84	0.48	0.21	0.04	N. D.
12	1.40	0.95	0.53	0.10	N. D.
SE ±	0.03	0.02	0.01	0.02	-
CD at 1 %	0.06	0.04	0.02	0.04	-
Significance	Sig.	Sig.	Sig.	Sig.	

ND: Not Detectable

The results of Lambda cyhalothrin sprayed at double than recommended dose (12ml/10 lit.) revealed that after one day, double recommended dose of Lambda cyhalothrin (12 ml/10 lit.) recorded residue of 1.40 ppm which was reduced to 0.95, 0.53 and 0.10 ppm on 5,10 and 15 days after spraying. The residue of Lambda cyhalothrin at 25 days after spraying was below detectable level. This indicated that the residue of Lambda cyhalothrin at double recommended dose of 12 ml/10 litre lasts up to 15 days and thereafter it is not detectable.

The results reported by Sharma *et al.* (2018) [4] revealed that the residue of lambda cyhalothrin was below detectable limit (0.03mg/kg) on 10th day of spray on tomato supports present findings.

Dissipation pattern of lambda cyhalothrin in mango fruits was also studied in the present investigation. Data pertaining to dissipation study are presented in Table 2.

Per cent loss of lambda cyhalothrin residue at a dose of 6 ml/10 litre on 5th day was 42.83 per cent which was reduced to 75.00 and 95.23 per cent at 10 and 15 days after spraying. The residue of lambda cyhalothrin was totally lost at 25 days after spraying. The half-life of lambda cyhalothrin at a dose of 6 ml per 10 litre was observed to be 8.12 days and waiting period was 18 days. The insecticide lambda cyhalothrin at a dose of 12 ml per 10 litre dissipated 32.14 per cent on 5th day then it was reduced to 62.14 and 92.85 per cent at 10 and 15 days after spraying and later on it was totally lost on 25th day. The half-life of lambda cyhalothrin at a dose of 12 ml per 10 litre was recorded to be 8.75 days and waiting period was 19 days. This indicated that the higher dose of lambda cyhalothrin dissipates faster than recommended dose. The results of the present investigation revealed that the insecticide lambda cyhalothrin persist for a longer time, this will be useful as far as management of insect pests for a longer time is concerned but it leaves residue for the longer time. The results stating Lambda cyhalothrin residues in mango peel dissipated at the half-life of 4.8 days by Mohapatra and Ahuja (2010) [2] are in conformity with the present findings.

Table 2: Dissipation pattern of Lambda cyhalothrin from Mango fruits

Dose ml/10 lit	Percent loss of residue at periodic interval (days)					Half-life (days)	Waiting period (days)
	1	5	10	15	25		
6	0.00	42.83	75.00	95.23	100	8.12	18
12	0.00	32.14	62.14	92.85	100	8.75	19
SE ±	-	3.76	4.84	6.32	-	-	-
CD at 1 %	-	8.50	N S	N S	-	-	-
Significance	-	Sig.	Sig.				

N S: Not Significant

Conclusion

From the results of the present investigation it can be concluded that the insecticide lambda cyhalothrin leaves residue for a longer period up to 15 days therefore can be used at early period of the crop and cannot used at later period of the crop.

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