Efficacy of methyl eugenol and cuelure traps for monitoring of cucurbit fruit fly(*Bactrocera spp.*) in different doses in pumpkin

Abstract

The present study on the "Efficacy of methyl eugenol and cueluretraps for monitoring of cucurbit fruit fly (*Bactroceraspp.)* in different doses in pumpkin" was conducted in the Department of Entomology, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, during 2020-21.Among the 3 different doses tested, methyl eugenol rakshak trap with 1.5ml +2 ml (methyl eugenol +malathion 50 % E.C. were significantly superior in attracting highest number of fruit flies *B.zonata* and *B. dorsalis* with trap catches of 69.39 fruit flies /trap/week followed by 2ml +2ml doses (49.36 fruit flies/trap/week). 1ml + 2ml (methyl eugenol +malathion 50% E.C. performance was significantly lower to other doses (42.47 fruitflies/traps/week) and other three doses tested, cue lure rakshak trap with 2 ml + 2ml (cue lure + malathion 50% E.C) were significantly superior in attracting highest number of fruit flies *B.cucurbitea* and (19.92 fruit flies /trap/week) followed by 1.5 ml +2ml doses (13.69 fruit flies/trap/week). 1ml + 2ml (cue lure +malathion 50% E.C. 50 % E.C performance was significantly lower to other doses (7.42 fruitflies/traps/week).

Keyword. Methyl eugenol, Cue lure, Malathion, Fruitflies, Rakshak trap

Introduction

Pumpkin (*Cucurbita moschata)* is one of the main vegetable crop cultivated since prehistoric times and is now the most common cucurbit in Asia and the United States of America. *C. moschata* is grown in approximately in all the regions of India (Nath *et al* 1979). The fresh pumpkin fruit contains 92.2 % moisture, 0.15 % fat, 0.98 % protien, 0.76% ash, 0.56 % crude fiber and 5.3% corbohydrates (See et al. 2007) Pumpkin fruit is rich in carotenoid, vitamins, minerals, and dietary fibers. (Dhiman *et al* 2007). The pumpkin fruit contains 78-86 % edible portions. The seed of pumpkins contains 3.1% of total fruit weight, are abundant in protein 33%, high in S-containing amino acids, and low in phytic acids and trypsin inhibitors.Two compounds, methyl eugenol (4-allyl-1, 2-dimethoxybenzene) and cue-lure [4-(pacetoxyphenyl)- 2-butane one, play significant roles as attractants for male tephritid fruit flies (Metcalf 1990). These pheromones are plant-related products derived from phenylpropanoid and related compounds. Methyl eugenol occurs mostly as a natural product in the plant kingdom, is a highly dominant attractant for the males of B. dorsalis. Due to its strong attractant properties, it has been used as a pheromone that captures male fruit flies for monitoring and management. Outbreak of fruit fly is happening regularly in Eastern Uttar Pradesh, India. For monitoring of insect pests in crop, various techniques are used but pheromone traps are most effective. Methyl eugenol and cue-lure were used by Khoo and Tan for monitoring the fruit flies. Hardy (year?)also reported that at least 90 percent of the Dacinae species were strongly attracted to either methyl eugenol or to cue-lure-raspberry ketone. Paw et al. found that cuelure was more attractant than tephrite lure. All these

findings relate to foreign studies, and very meager work is done in India on semiochemicals-based management of fruitflies in pumpkin crops. These pheromones are very expensive, so it is important to know how much dose is most effective in one trap; so, this study was designed for field evaluation of traps, methyl eugenol, and cue-lure with the objective of finding the most efficient dose of the two attractants for the attract-and-kill strategy of the pest.

Materials and methods

This experiment was conducted in RBD with 7 treatment and 3 replications at Students' Instruction Farm, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya during February to June 2020. A distance of 2 m was maintained between each treatment. Mainly Rakshak fruit fly traps were used during the study. Commercial grade methyl eugenol, cuelure, malathion 50 EC were procured. These pheromones and insecticide were impregnated in cotton wicks with the help of a 5ml syringe. In each traps cotton wicks (size: 3cm x 1cm) impregnated with different amounts of methyl eugenol and cuelure, viz., 2 ml, 1.5 ml and 1 ml along with and 2ml malathion were put. These traps were installed in the field at the time of crop germination by hanging with the help of string on the branches of trees. The old pheromone traps were replaced with fresh traps every month. Data on attracted and trapped male pumpkin fruit fly were collected on daily basis. The trapped male pumpkin fruit flies were identified on the basis of morphological character.

Table 1: Details of treatments for the efficacy of methyl eugenol and cuelure

Treatment	Chemical mixture	Dose
T1	Methyl Eugenol +Malathion50EC	1ml+2ml
T2	Methyl Eugenol +Malathion50EC	1.5ml+2ml
T3	Methyle Eugenol + Malathion 50EC	2ml+2ml
T4	Cuelure+Malathion50EC	1ml+2ml
T5	Cue lure + Malathion 50EC	1.5ml+2ml
T6	Cue lure + Malathion 50EC	2ml+2ml
T7	Untreated Control	

Result and Discussion

The data of efficacy of methyl eugenol and cue lure in different doses has been given in table -2

Response of *B.dorsalis*+*B.zonata*in different dose of methyl eugenol Rakshak traps

During the first Month of test period fruitfly captures varied significantly among different dose of methyl eugenol rakshak traps with greater catches in 1.5ml (methyl eugenol) + 2ml Malathion 50% EC Rakshak traps (68.00 fruitfly/trap/week) it was significant difference with 2ml (methyl eugenol) + 2ml Malathion 50% EC Rakshak traps (49 fruitflies/trap/week) whereas, the lowest catches was recorded in 1ml (methyl eugenol) +2ml Malathion 50% EC Rakshak traps (41 fruitflies /trap/week). The same trend was observed at the second month of test period fruitfly captures varied significantly among different dose of methyl eugenol rakshak traps with greater catches in 1.5 ml (methyl eugenol) +2 ml Malathion 50% EC Rakshak traps (59.25 fruitfly/trap/week) it was significant difference with 2 ml (methyl eugenol) +2 ml Malathion 50% EC Rakshak traps (45.50 fruitflies/trap/week) whereas, the lowest catches was recorded in 1 ml (methyl eugenol) +2 ml Malathion 50% EC Rakshak traps (37.33 fruitflies /trap/week). At third month of test period, 1.5ml (methyl eugenol) + 2ml Malathion 50% EC Rakshak traps attracted significantly more fruit flies with highest trap catches of 80.0 fruitfly/trap/week. 1.5 ml dose was superior than 2 ml dose of methyl eugenol Rakshak traps. 2ml (methyl eugenol) + 2ml Malathion 50% ECRakshak traps was attracted 53.00 fruitflies/trap/week whereas, the lowest catcheswere recorded in 1 ml (methyl eugenol) + 2ml Malathion 50% EC Rakshak traps (48.92 fruitflies /trap/week).

Comment [Ameilia Z1]: Please compare your data and other data journals with detail discussion.

Response of *B.cucurbiteae*+ *B.tau*in different dose of cue lure Rakshak traps

During the first Month of test period fruitfly captures varied significantly among different dose of cue lure rakshak traps with greater catches in 2 ml (cue lure) + 2ml Malathion 50% EC Rakshak traps (6.50 fruitfly/trap/week) it was at par with 1.5ml (cue lure) +2ml Malathion 50% EC Rakshak traps (4.67 fruitflies/trap/week) whereas, the lowest catches was recorded in 1ml (cue lure) + 2ml Malathion 50% EC rakshak traps (3.42 fruit flies /trap/week). During the second Month of test period fruitfly captures varied significantly among different dose of cue lure rakshak traps with greater catches in 2 ml (cue lure) +2ml Malathion 50% EC Rakshak traps (21.42 fruitfly/trap/week) which was significant difference with 1.5ml (cue lure) + 2ml Malathion 50% EC Rakshak traps (15.33 fruitflies/trap/week) whereas, the lowest catches was recorded in 1ml (cue lure) + 2ml Malathion 50% EC Rakshak traps (8.0 fruitflies /trap/week). At third month of test period, 2 ml (cue lure) +2ml Malathion 50% EC Rakshak traps attracted significantly more fruit flies with highest trap catches of 31.83 fruitfly/trap/week. 2 ml dose was superior than 1.5 ml dose of cue lure Rakshak traps. 1.5 ml (cue lure) + 2ml Malathion 50% EC Rakshak trapswas attracted 21.08 fruitflies/trap/week whereas, the lowest catches was recorded in 1ml (cue lure) + 2ml Malathion 50% EC Rakshak traps (10.83 fruitflies /trap/week).

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Effect of pumpkin fruitsYield in various dose of methyl eugenol and cue lure

The data are presented in table 3 revealed that the all treatment produce significantly higher yield than control (144q/ha). The Treatment 6 (T6) where cuelure2ml + malathion 2ml was trapped produced maximum yield (236 q/ha) it was significant difference withT5where cuelure 1.5 ml +malathion 2ml was trapped produced yield (223 q/ha). Followed by T2 where was methyl eugenol 1.5 ml + malathion 2 ml was trapped produced yield (217q/ha) it was at par with T3where methyl eugenol 2 ml +malathion 2ml was trapped produced yield (212 q/ha). Followed by T4 where was cue lure 1 ml + malathion 2 ml was trapped produced yield (209 q/ha) it was significant difference with T1 where methyl eugenol 1 ml +malathion 2ml was trapped produced yield (196 q/ha). The minimum yield produced in T7 produced 144 q/ha.

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Table 2: Efficacy of methyl eugenol and cue lure in different doses

Treatments	Chemicals	Dose	Fruitflies/trap/week			
			First month	Second month	Third month	Mean
T1	Methyl Eugenol+Malathion 50% EC	1ml+2ml	41.17 (6.45)	37.33 (6.15)	48.92 (7.03)	42.47
T2	Methyl Eugenol+Malathion 50% EC	1.5ml+2ml	68.00 (8.27)	59.25 (7.73)	80.92 (9.02)	69.39
T3	Methyl Eugenol+Malathion 50% EC	2ml+2ml	49.58 (7.07)	45.50 (6.78)	53.00 (7.30)	49.36
T4	Cue lure+ malathion 50% EC	1ml+2ml	3.42 (1.98)	8.00 (2.98)	10.83 (3.37)	7.42
T5	Cue lur+ malathion 50% EC	1.5ml+2ml	4.67 (2.27)	15.33 (3.98)	21.08 (4.64)	13.69
T6	Cue lure+ malathion 50% EC	2ml+2ml	6.50 (2.65)	21.42 (4.68)	31.83 (5.69)	19.92
T7	Untreated Control		5.92 (2.53)	5.92 (2.53)	6.00 (2.53)	5.94

	SEm±	0.12	0.08	0.17	0.37
	C.D. at 5%	0.39	0.27	0.54	1.17

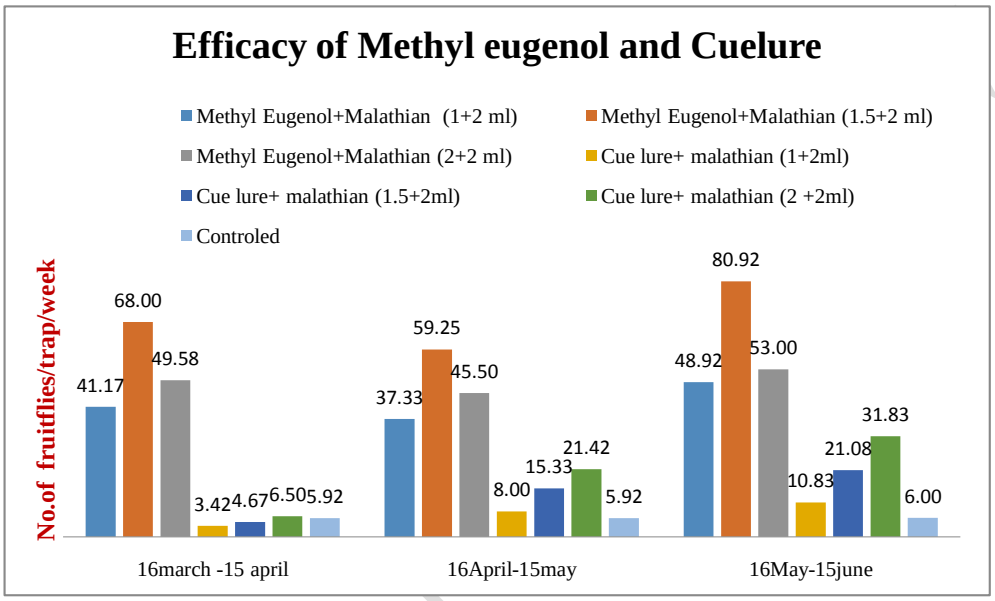

Fig.1: Efficacy of Methyl eugenol and cuelure in different doses.

Table -: 3 Variation of yield in different doses

No. of Treatments	Treatments	dose/trap	Concentration	Demage percent	yield/hec
T1	Methyl Eugenol+Malathion 50% EC	1ml+2ml	12 trap /hec	34.67	196
T2	Methyl Eugenol+Malathion 50% EC	1.5 ml+2ml	12 trap /hec	27.67	217
T3	Methyl Eugenol+Malathion 50% EC	2 ml+ 2ml	12 trap /hec	29.33	212
T4	Cue lure+ malathion 50% EC	1ml+2ml	12 trap /hec	30.33	209
T5	Cue lure+ malathion 50% EC	1.5 ml+2ml	12 trap /hec	25.67	223

T6	Cue lure+ malathion 50% EC	2 ml+ 2ml	12 trap /hec	21.33	236
T7	Untreated Control			52.00	144
	SEm±			1.10	3.37
	CD at 5 %			3.44	10.52

Conclusions

The present research on utilizing the Rakshak trap to attract fruit flies, it was observed that a higher dose of methyl eugenol proved to be less effective compared to a lower dose. Furthermore, in the case of cue lure, a lower dose did not attract more fruit flies but exhibited similar efficacy to a higher dose. Methyl eugenol+ malathion (1.5 ml +2ml) standard dose caught 69.39 fruitflies (*Bactrocera dorsalis* +*Bactrocerazonata).* whereas cuelure+ malathion (2ml+2ml) standard dose caught 19.92 fruitflies (*Bactroceracucurbiteae*+*Bactrocera tau).* According to Nilufar nahar*etal.*(2012), methyl eugenol was quite stable in solution, whereas cuelure was found to degrade slowly, and about 15 % cuelure degraded within 21 days. According to Divya, S. *et al.* (2019) the mean of overall captured of *B. cucurbitae*in Jar trap + Cue lure + ME (DISC) combination were significantly greater than all other treatments (208.5 numbers) and less in treatments Jar trap + AA (Disc) combination (5.75 numbers) respectively fruit fly. Hence, it is imperative for farmers to be cognizant of the recommended dosage of any chemical or insecticide before application. Excessive amounts not only yield inferior results but also pose environmental hazards.

References-

Allwood, A. J. and Drew, R. A. I.(1996) Seasonal abundance, distribution, hosts and taxonomic placemnt of Depterophagusdaci. (Strepsiptera: Dipterophagidae),*Aus.Entomol.* 23(2), 61-72.

Bharathi, T.E., Sathiya nandam, V.K.R. and David, P.M.M. (2004). Attractiveness of some food baits to the melon fruit fly, *Bactroceracucurbitae* (Coq.) (Diptera: Tephritidae) *International Journal of Tropical Insect Science,* 24(2), 125- 134.

Chaudhary, F.K. and Patel, G.M. (2012). Effectiveness of sex attractants in combination with various dispensers against melon flies in pumpkin,*AGRES- An Int. e-J,* 1(2):168-172.

Darwish, D.Y.A. (2014). Factors affecting the efficacy of trapping system to the peach fruit fly (PFF) males, *Bactrocerazonata* (Saunders),*Archives of Phytopathology and PlantProtection*, 47(4), 490-498

Dhiman.(2007)

Dhiman, S. C. and Garima (2011). Sequential development of cleaning comb on the fore legs of drosophila melanogaster (meign): a new mutation,*J. Exp. Zool. India*,14(2), 673-675.

Divya, A., Sukumaran, S. (2020) An Efficient Vector Quantization Based Image Compression using Fruit Fly Algorithm,*Digital signal processing*,12(1).

Hardy, D. E. (1991). Contribution of taxanomic studies to Integ. Pest management. Fruit flies with emphasis on the Asia pacific region. In:*Proc. First Intern. Symp*. Fruit Flies in Tropics. Vijay segaran, S and A.G. Ibrahim (eds.) MARDI, Serdang, Malaysia. Pp. 430.

Hollingsworth, R.,Vagalo, M. and Tsatsia, F. (1997). Biology of melon fly with special reference to the Solomon Island,*Proc. Aust. Country Ind.Agric*. Res.

Kate, A.O., Bharodia, R.K., Joshi, M.D., Pardeshi, A.M and Makadia, R.R. (2009). Seasonal incidence of fruit fly, *Bactroceracucurbitae*(Coquillet) on cucumber. *Asian Sci*, 4(1, 2), 83-84.

Khoo, C. C. H. and Tan, K. H. (2000). Attraction of both sexes of melon fly, *Bactroceracucurbitae* to conspecific males- a comparison after pharmacophagy of cue-lure and a new attractant Zingerone. *Ent. Experim. Appl*. 97, 317-320.

Mahmood, T., Hussain, S.I., Khokhar, K.M. and Hidayatullah, M.A. (2002). Studies on methyl eugenol as a sex attractant for fruit fly, *Dacus zonatus* (Saund) in relation to abiotic factors in peach orchard. *Asian Journal of Plant Sciences*, 4: 401-402.

Metcalf, R. L. (1990). Chemical ecology of Dacinae fruit flies (Diptera: Tephritidae). *Entomological Society of America*, 83, 1017– 1030.

Mwatawala, M., Maerere, A.P., Makundi, R. and Meyer, M.D. (2010). Incidence and host range of the melon fruit fly *Bactroceracucurbitae*(Coquillett) in Central Tanzania. *Bulletin of Ent. Res.*, 99(6), 629-641.

Nath, P., & Bhushan, S. (2006). Screening of cucurbit crops against fruit fly. *Annals of Plant Protection Science*,14, 472-473

Patnaik, H.P., Sarangi, P.K. and Mahapatra, P. (2004). Studies on the incidence of fruit flies and jassids on summer bittergourd and their control. *Orissa Journal of Horticulture,* 32(2), 87-90.

Paw, D. B., More, U. N. and Lawande, K. E., (1991). Monitoring of fruitfly population in bittergourd crop with the help of cue lure trap. *J. Maharashtra Agri. Univ.* 16(2), 281.

Ram, H.H., Prasad, L., Singh, O.K., Yadav, R.S. and Singh, B. (2009). Screening of cucurbit germplasm against insect-pests and diseases under natural conditions. *Society for Recent Devt. Agric.,* 9(2), 229-234.

Szalay, J. (2017). Cucumbers: Health benefits and nutrition facts. *Live Science Contributor*, 01-03.

See (2007)

Twal, A.S. and Dhaliwal, G.S. (2005). Agricultural Pests of South Asia and Their Management. Kalyani Pub. New Delhi, 110002. 277-278.

Virakthamath, S. and Babu, K.S. (2004). Species composition and population dynamics of fruit flies (Diptera: Tephritidae) on guava. *South Indian Horticulture*, 52(1/6), 317-323.

Comment [Ameilia Z4]: Please check the reffrences, because some cannot find in the introduction,reults,discussions. Thank you