Application of Pheromone trap against the melon fly *(Miopardalis pardalina Big.)* in Agriculture

Laziz Yuldashev[1], *Turgunboy* Djumakulov[1], *Zhakhongir* Turdibaev[1], and *Mohamed* Rifky[2,*]

[1]Almalyk branch of Tashkent State Technical University named after Islam Karimov, 100000, Almalyk, Uzbekistan.
[2] Eastern University, 30350, Chenkalady, Sri Lanka

Abstract. The intensive development of agricultural production currently requires an expansion of the use of chemicals to protect plants from insect pests, which in turn leads to environmental pollution and irreparable losses in biocenosis. The use of sex pheromones in integrated plant protection systems requires the development of a convenient pheromone trap. This article describes a method of controlling the melon fly using the pheromone component 4 (4-methoxyphenyl)-2-butanone, 1,4-benzyl dicarboxylate. A pheromone trap is a design with bait and a rubber capsule dispenser treated with a mixture of pheromone substances. The results of using pheromone traps to monitor the melon fly in open ground are presented.

1 Introduction

The Melon fly (*Miopardalis pardalina Big*) is prevalent in various Asian countries and certain European nations, including Azerbaijan, Georgia, Cyprus, Armenia, Turkey, Ukraine, Israel, India, Afghanistan, Jordan, Iran, Kazakhstan, Iraq, Kyrgyzstan, Pakistan, Saudi Arabia, Lebanon, Syria, Turkmenistan, Tajikistan, and Uzbekistan. Primarily, it causes harm to both wild and cultivated plants belonging to the pumpkin family (Cucurbitaceae) [1].

The melon fly inflicts harm upon plants belonging to the nightshade family at any stage, ranging from the initial germination to the complete maturation of the harvest. Throughout the year, the insect undergoes 3-4 reproductive cycles. Flies emerge as the melon flowers. Female flies deposit eggs in the epidermis of ovaries and immature fruits, as well as on plant foliage. The larvae enter the inner part of the fruit, known as the pulp, and consume both the seeds and juice. Afterward, they exit the fruit and proceed to undergo pupation in the soil. The seasons of spring and summer align with the time when forage plants undergo fruit formation. Currently, the soil temperature where the insect hibernates exceeds +20°C. The pest's lifespan is monitored from early June to mid-October. Insects consume fruit juice as their source of nourishment.

* Corresponding author: rifkyalm@esn.ac.lk

An image has a duration of two months. Open wounds can provide an optimal environment for the proliferation of viral and fungal infections [2,3]. Initial indications of melon fly damage manifest as the emergence of little tuberculate patches, sometimes referred to as tubercles, in areas where the fruit has been bitten. Subsequently, once the larvae have fully developed, the fruit starts to undergo internal decay. Consequently, the damaged fruits become unfit for any further utilization [4]. The investigations successfully isolated and identified the appealing compounds of the melon fly Myiopardalis Pardalina large.

Their biological activity was determined depending on the composition and amount of substances present, and the preparative doses and compositions of attractive substances characterized by the greatest response of insects were studied. The best design of a pheromone trap was identified, and recommendations for pheromone monitoring were also developed for practical use in the system of protective measures against harmful insects [5,6].

This study focuses on analyzing the structural characteristics of individual chemicals derived from the melon fly species *Myiopardalis Pardalina* large. The research was conducted at the Institute of Biochemical Ecology, which is part of the Academy of Sciences of the Republic of Uzbekistan. To achieve this objective, the sternal glands of the melon fly were subjected to analysis using electroantennography (EAG) and gas chromatography-mass spectroscopy to examine the methylene extracts. As a result of the studies, EAG responses of males of one-minute fractions of females of *Myiopardalis Pardalina* big., and GC-MS chromatograms (Fig.1) on an Agilent 8890 GC gas chromatograph were obtained.

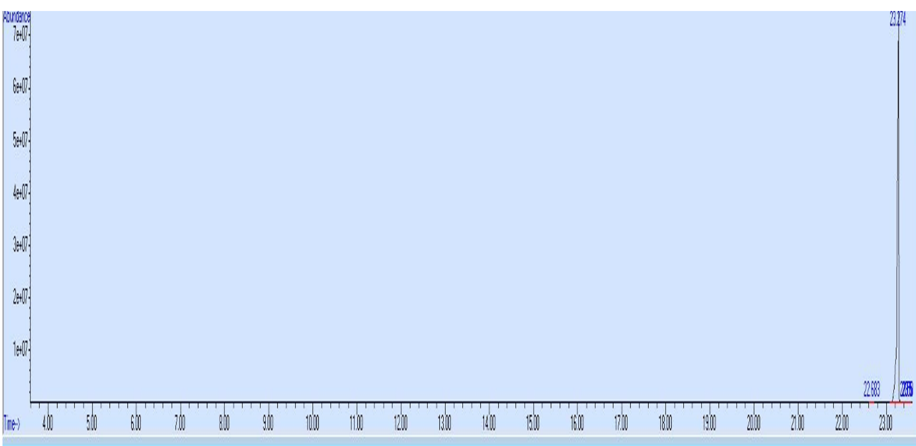

Fig. 1. It has a bacteriostatic and bactericidal effect and is effective against streptococci, staphylococci and other microorganisms.

An inherent drawback of the medicine is its brief duration of action, necessitating repeated administration. During the studies, we utilized the pharmaceutical etonium manufactured by BIOLINE LLC, a company based in Russia. Imidocarb, a pharmacological molecule, has been more popular in veterinary medicine for its wide range of uses in treating cattle [7, 8].

It exhibits a significant chemotherapeutic impact, but its concentration in the animal's body decreases relatively quickly [9]. As a result, the medication needs to be administered every 10-12 days for treatment and every 27-28 days for preventive purposes, which poses challenges, particularly for grazing livestock [8]. Imidocarb has two primary drawbacks: it has a relatively high level of toxicity, with an LD50 value of 87 mg/kg, and its period of effect is brief, lasting only 18-21 days [10, 11]. Functional oils and some of the special antioxidant materials also play a major role in agricultural management, including the bioactivity, and the fly replant ability [12].

The medicine imidocarb, manufactured by Shandong Jiulong Hisince Pharmaceutical Co., Ltd in China, was utilized in the study. In the experiments, we used linear polymethacrylic acid synthesized by radical polymerization and having the following characteristics: average viscosity molecular weight of 150,000-200,000 and an acid number of 412 [13-15], as well as weakly cross-linked PMAA hydrogels produced by Wuhan Dachu Hexing Technology Co, Ltd (China). 99%. Chemical pesticides are a major component of agricultural insect pest management strategies, including irrigation management strategies [16].

However, there are issues related to the use of insecticides, including contamination of harvested agricultural produce, resistance development in pests, and pollution of the environment. Pheromone trapping can offer instruments for tracking the movements and activities of target insects, giving data that will support the control of insect pests. Pheromones can effectively reduce insect pest populations over the long term, something that traditional insecticides are unable to do at low pest population densities [17, 18].

They also have no negative effects on natural enemies. Pheromones can enhance integrated pest management (IPM) tactics by altering insect behaviour, primarily through the capture of adult pest stages. Pheromones have been effectively utilized through various methods. Pheromones have been utilized in pest control through three primary methods: monitoring insect populations using traps baited with pheromones, reducing pest populations through mass trapping with a large number of traps, and disrupting mating by saturating the atmosphere with synthetic pheromones, thereby preventing insects from finding a mate and macromolecules has a major functions in the process of agriculture [19, 20].

This present research was developed to study the Pheromone trap - against melon fly (Miopardalis pardalina Big.)

2 Methods

Based on the results, the structure of one of the food attractants of the melon fly Myiopardalis pardalina was identified, with a signal RT-23.274 (Table 1), which corresponded to the structure of bis (2-ethylhexyl) ester of 1,4-benzene dicarboxylic acid [3, 6]:

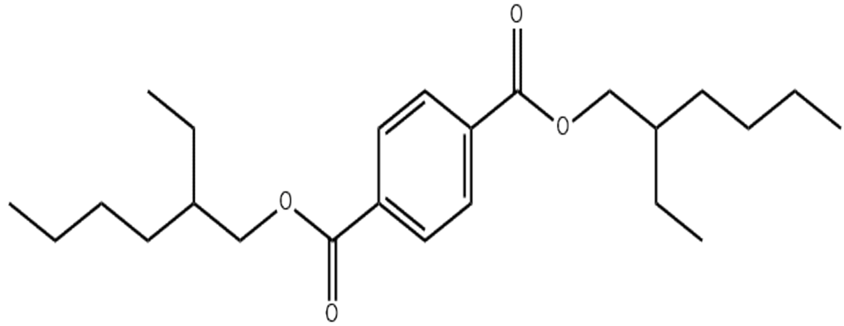

Fig. 2. The structure of bis (2-ethylhexyl) ester of 1,4-benzene dicarboxylic acid

Also, the behaviour of the melon fly in the field was analyzed using various designs of pheromone traps on melon crops in the region of Karakalpakystan. The experiments used two types of traps and two variants of dispensaries.

Adhesive device of the "Delta" type, a triangular structure made of laminated cardboard with a replaceable adhesive liner inside, in the centre of which a rubber capsule with an attractive substance - a pheromone dispenser - was placed on the sticky surface. Traps in quantities of three were suspended above the plants at a height of 20 cm. The adhesive inserts were replaced with new ones as they became dirty.

Table 1. The structure of one of the food attractants of the melon fly Myiopardalis pardalina was identified, with a signal RT-23.274

	RT, min	**Area %**	**Library/ID**	**Ref #**	**CAS #**	**Qual**
1	23.141	0.16	1,4-Benzenedicarboxylic acid,bis(2-ethylhexyl) ether	259638	000137-89-3	70
2	22.683	0.04	1,4-Benzenedicarboxylic acid,bis(2-ethylhexyl) ether	259642	006422-86-2	50
3	23.274	99.94	1,4-Benzenedicarboxylic acid,bis(2-ethylhexyl)ether	259640	006422-86-2	91

3 Results and Discussion

The devices were placed on an area of 160 m2 from the moment the pest appeared on melon fields during the winter-spring and summer-autumn periods, lasting from April 20 to June 10 and from June 11 to October 11, respectively. For biotesting, a mixture of attractive substances with the most significant response was used. Pheromone traps were placed at the rate of one structure per 5 m^2; the dose of the pheromone mixture was 0.5 mg per dispenser.

The experiments assessed the attractiveness of two variants of pheromone structures—a "Delta" type trap and a water trap—taking into account the yield of melons.

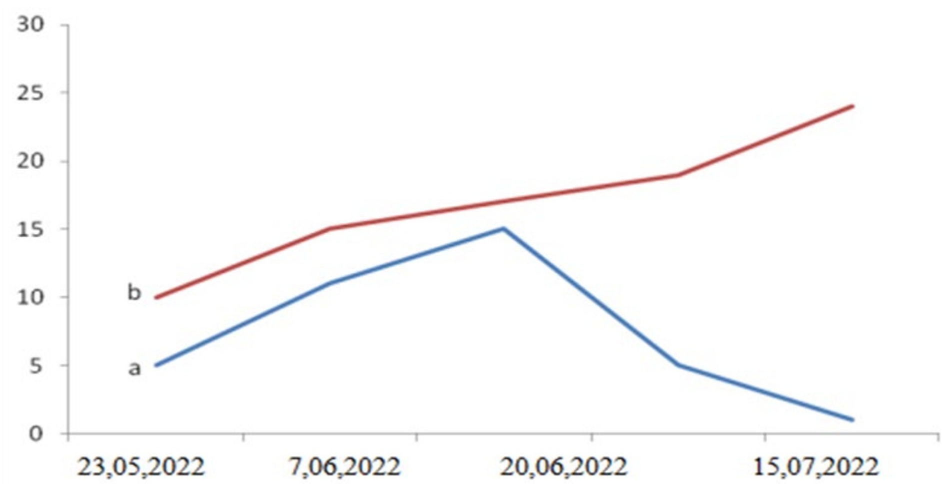

Fig. 3. Dynamics of the capture of male melon flies by pheromone traps of various designs, average values (2023 average)

Tests demonstrated that 54 male melon flies were caught in 10 pheromone traps. With the help of a "Delta" type device, only 7-8 individuals were caught on average, and up to 22 males were observed in the water structure. Thus, the use of pheromone monitoring made it possible to increase the yield volumes and fruit quality significantly.

4 Conclusion

The theoretical basis for the use of insect pheromones in plant protection lies in the historically established chemical relationships between plants and animals through the air. Most nocturnal Lepidoptera, especially the melon fly and tomato moth, have developed a perfect pheromone system, the chemical basis of which bears little resemblance to the component composition of food plants.

Thus, the study characterized the possibility of mass catching the melon fly (Myiopardalis pardalina Big.) in melon crops during two seasonal periods and also provided a comparative assessment of two types of traps and dispensers with high efficiency in attracting insects. The most promising mixture was the 4 (4-methoxyphenyl)-2-butanone; 1,4-benzyldicarboxylate pheromone trap design. All tested options are recommended for identifying and mass-catching the melon fly in open ground conditions

References

1. S. Abdussator, S.S. Nurali, V. K. Nazirov. Pest management practices and strategies in Tajikistan. in Central Asia, **31** (2007).
2. T. Dzhumakulov, A.M. Yuldashev, A.A. Abduvakhabov, Chemistry of Natural Compounds, **18**, 516–517 (1982).
3. I. S. Ortikov, Z. É. Turdibaev, Z. I. Islamova, B. Z. Élmuradov, A. S. Abdurazakov, A. M. Bektemirov, & K. M. Shakhidoyatov, Pharmaceutical Chemistry Journal, **51**, 456-464 (2017).
4. A.O. Nasrullaev, Z. E. Turdibaev, B. Z. Elmuradov, A. Yili, H. A. Aisa, K. M. Shakhidoyatov, Chemistry of Natural Compounds, **48**, 638-642 (2012).
5. S.N. Ahmad, N. Kamarudin, Oil Palm Bulletin, **62**, 12-24 (2011).
6. M. Mirsaidov, A. Nimchik, O. Khodjiyev, M. Jesfar, K.Zokirov, K., Shamatov, S., & A. Kambarov, E3S Web of Conferences, **498**, 02016 (2024).
7. K.M. Cooper, C. McMahon, I. Fairweather, T.E. Christopher, Trends in Food Science & Technology, **44**, 1 (2015)
8. D. Kasun, M. Rifky, K. Nurmukhamedov, J. Makhmayorov, B. Abdullayev, J. Farmanov, M. Samadiy, E3S Web of Conferences, **494**, 04023 (2024).
9. C. Flavio, A. Sacchi, A. Corti, The Journal of Clinical Investigation, **110**, 4 (2002).
10. M. Carla, Effect of multiple doses of imidocarb dipropionate on renal and hepatic function of ponies. University of Pretoria (South Africa) (2010).
11. T.B. Coles, C.L. Randy, Antiparasitic drugs." Georgis' Parasitology for Veterinarians, 10th ed. (WB Saunders Co.: Saint Louis, MO, USA, 2014).
12. R. Mohamed, M. Jesfar, K. Dissanayake, U. Orif, M. Samadiy, E3S Web of Conferences, **480**, 03014 (2024).
13. Z. Daoyi, B. Bai, J. Hou. Energy & fuels, **31**, 12 (2017).
14. W. Tao, R. Liu, L. Zhang, M. Rifky, W. Sui, Q. Zhu, J. Zhang, J. Yin, M. Zhang, Food & Function **13**, (2022).
15. A. Nimchik, G. Pulatov, F. Yusupov, B. Haydarov, A. Kambarov, E3S Web of Conferences, **494**, 02003 (2024).
16. R. Mohamed, M. Jesfar, K. Dissanayake, S. Ermat, M. Samadiy, E3S Web of Conferences, **480**, 03013 (2024).

17. A. Kambarov, I. Shamshidinov, R. Najmiddinov, G. Kodirova, I. Usmanov, D. Absattorov, D, M. Samadiy, IOP Conference Series: Earth and Environmental Science, **1275**, 012002 (2023).
18. L. Ran, X. Ci, L. Liu, X. Wang, M. Rifky, R. Liu, W. Sui, T. Wu, M. Zhang, International Journal of Biological Macromolecules, **260**, 129615 (2024).