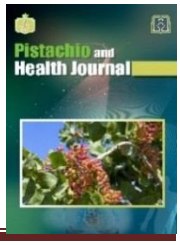

Effects of Pesticides Used in Controlling Pistachio Psyllid on Human Health, and Control Strategies

Hadi Eslami (PhD)[1], Maryam Dolatabadi (MSc)[*2]

[1] *Department of Environmental Health Engineering, School of Health, Pistachio Safety Research Center, Rafsanjan University of Medical Sciences, Rafsanjan, Iran*

[2] *Environmental Science and Technology Research Center, Department of Environmental Health Engineering, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran*

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Due to the ever-increasing population growth, the need for agricultural and food products has increased. In this respect, the use of pesticides has increased significantly in the agricultural sector to control agricultural pests. In in the world's agricultural sector, about 0.08 kg of pesticides is consumed per hectare, with this amount being about 7 kg in Iran [1]. The global consumption of pesticides, in 2017, was estimated at 4.11 million tons, which increased by 80% as against 1990. Due to the unfamiliarity with correct spraying principles, spraying operations are performed incompletely or irregularly [2- 4].

Pistachios are among the most important agricultural products in Iran, which are exported and consumed to a considerable extent. The majority of crops become infected with some pests in various periods. Pistachio psyllid is one of the most damaging pests of pistachios. This insect uses the plant's leaves and sap and makes the leaves dry and fall off. In case this pest, i.e. pistachio psyllid, is not controlled and its population increases, it will damage the plant's buds and fruit, thereby causing pistachios to become blank (hollow) [5]. Thus far, various insecticides have been used in controlling pistachio psyllid, namely Amitraz, Chlorpyrifos, Acetamiprid, Imidacloprid, Spirotetramat, Lufenuron, Hexaflumuron, Thiamethoxam, etc. [6- 8]. However, the use of some of these pesticides, such as Chlorpyrifos, has been restricted in recent years. From among the aforementioned pesticides, Acetamiprid and Imidacloprid are the most widely used pesticides in the world, which are utilized in controlling pistachio psyllid [9- 11].

Additionally, Acetamiprid and Imidacloprid are systemic, contact, and digestive pesticides of high local penetration, which belong to a new group of pesticides named Neonicotinoids. These pesticides are highly soluble in water and are highly capable of controlling sucking pests, such as aphids, psylla, and weevils

[12- 14]. It is estimated that this group of insecticides form more than 20% of the share of the global market [15]. Given the high stability of this group of pesticides in water and soil resources, as well as various environmental problems they pose, they were covered by strict environmental laws in the late 1990s. Accordingly, the use of Neonicotinoids was restricted by the European Union as well as some other countries, yet many countries are still using them. Continuous and unsystematic use of these pesticides over the period of several years creates pesticide resistance, destroys natural enemies of pests, leads to the more severe prevalence of pests, and endangers human health. If pesticides are used inappropriately and irresponsibly for agricultural purposes, they cause problems directly and indirectly for human health and other organisms.

Direct effects of pesticides are exerted through skin contact with and inhalation of pesticide aerosols in humans during spraying operations, which affect the skin and lungs, thereby disrupting their function; besides, indirect effects of pesticides are exerted through the washing of pesticides from the plant surface, which results in the contamination of soil as well as surface water and groundwater. Under such conditions, some toxins can be transferred to the pistachio crop. One of the most serious environmental problems in the world is the contamination of water resources and agricultural products with pesticides [4]. The European Union has declared the allowable limit of insecticides in potable water to be 0.1µg/L for the main compounds and some products produced by their decomposition, and 0.5µg/L for all compounds [16].

Consumption of contaminated water and agricultural products could create some problems for the users. Such effects vary based on the type and concentration of the pesticide. Epidemiological and toxicological studies have reported a relationship between the use of agricultural products and water contaminated with pesticides with problems, such as DNA damage, endocrine disruptors, fertility disorders, precocious puberty, cancer, liver problems, cardio-renal disease, weakened immune system, allergies, headaches, and dizziness [17-20]. Thus, a variety of solutions are proposed for controlling these problems. Accordingly, giving training to farmers in the basic principles of spraying, preventing irregular spraying, choosing the right pesticide for controlling pests, observing requirements of the pre-harvest interval (the allowed time between the last spraying operation to the harvest time), choosing the right spraying time (spraying should not be done before pests are seen), using high quality pesticides at standard concentrations in controlling pests, and utilizing spraying tools can reduce complications and problems caused by pesticides to a great extent.

Reference

1- Akoto O, Azuure AA, Adotey K. Pesticide residues in water, sediment and fish from Tono Reservoir and their health risk implications. Springer Plus. **2016**;5(1):*1849*.

2- El-Maali NA, Nemr A, El–Wahab MA, Moharram A. Monitoring of Removal of Organochlorine/Fluorine Pesticides from Water Using Graphene Composites by Gas Chromatography/Mass Spectrometry. Journal of Water Chemistry and Technology. **2018**;40(4):*234-40*.

3- Motaharian A, Motaharian F, Abnous K, Hosseini MRM, Hassanzadeh-Khayyat M. Molecularly imprinted polymer nanoparticles-based electrochemical sensor for determination of diazinon pesticide in well water and apple fruit samples. Analytical and bioanalytical chemistry. **2016**;408(24): *6769-79*.

4- Marican A, Duran-Lara EF. A review on pesticide removal through different processes. Environmental Science and Pollution Research. **2018**;25(3):*2051-64*.

5- Dehghani-Yakhdani H, Iranipour S, Mehrnejad MR, Farshbaf-Pourabad R. The role of iron (Fe) in the population dynamics of pistachio psyllid, Agonoscena pistaciae (Hemiptera: Aphalaridae) in Pistacia orchards. European Journal of Entomology. **2019**;116.

6- Emami A, Mousavi Z, Ramezani V, Shoeibi S, Rastegar H, Amirahmadi M, Emami I. Residue levels and risk assessment of pesticides in pistachio nuts in Iran. Iranian Journal of Toxicology. **2017**;11(2):*1-6*.

7- Saour G. Efficacy of kaolin particle film and selected synthetic insecticides against pistachio psyllid Agonoscena targionii (Homoptera: Psyllidae) infestation. Crop Protection. **2005**;24(8):*711-17*.

8- Lababidi M .Effects of Neem Azal T/S and other insecticides against the pistachio psyllid Agonoscena targionii (Licht.) (Homoptera, Psyllidae) under field conditions in Syria. Anzeiger für Schadlingskunde= Journal of pest science. **2002**;75(3):*84-8*.

9- Faraji M, Noorbakhsh R, Shafieyan H, Ramezani M. Determination of acetamiprid, imidacloprid, and spirotetramat and their relevant metabolites in pistachio using modified QuEChERS combined with liquid chromatography-tandem mass spectrometry. Food chemistry. **2018**;240: *634-41*.

10- Mehrnejad M, editor Bionomics of the common pistachio psylla, Agonoscena pistaciae, in Iran. III International Symposium on Pistachios and Almonds 591; **2001**.

11- Abbad M, Besheli BA. Bioassay of the botanical insecticide, tondexir, on two natural enemies of the common pistachio psyllid. International Journal of Agronomy and Plant Production. **2013**;4(6):*1191-96*.

12- Cruz-Alcalde A, Sans C, Esplugas S. Priority pesticides abatement by advanced water technologies: The case of acetamiprid removal by ozonation. Science of the Total Environment. **2017**;599: *1454-61*.

13- Carra I, Perez JAS, Malato S, Autin O, Jefferson B, Jarvis P. Application of high intensity UVC-LED for the removal of

acetamiprid with the photo-Fenton process. Chemical Engineering Journal. 2015; 264:690-96.

14- John S, Soloman PA, Fasnabi PA. Study on removal of acetamiprid from wastewater by electrocoagulation. Procedia Technology. **2016**;24: *619-30*.

15- Calvo-Agudo M, Gonzalez-Cabrera J, Pico Y, Calatayud-Vernich P, Urbaneja A, Dicke M, Tena A. Neonicotinoids in excretion product of phloem-feeding insects kill beneficial insects. Proceedings of the National Academy of Sciences. **2019**;116(34):*16817-822*.

16- Pinto MI, Sontag G, Bernardino R, Noronha J. Pesticides in water and the performance of the liquid-phase microextraction based techniques. A review. Microchemical Journal. **2010**;96(2):*225-37*.

17- Taghizadeh SF, Badibostan H, Hayes AW, Giesy JP, Karimi G. Residues levels of pesticides in walnuts of Iran and associated health risks. Human and Ecological Risk Assessment: An International Journal. **2019**:*1-14*.

18- Upadhayay J, Rana M, Juyal V, Bisht SS, Joshi R. Impact of Pesticide Exposure and Associated Health Effects. Pesticides in Crop Production: Physiological and Biochemical Action. **2020**:*69-88*.

19- Ramakrishnan S, Jayaraman A. Pesticide contaminated drinking water and health effects on pregnant women and children. Handbook of Research on the Adverse Effects of Pesticide Pollution in Aquatic Ecosystems: IGI Global; **2019**. *p. 123-36*.

20- Bhandari G, Atreya K, Scheepers PT, Geissen V. Concentration and distribution of pesticide residues in soil: Non-dietary human health risk assessment. Chemosphere. **2020**:*126594.*