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National Organic Standards Board
USDA-AMS-NOP
1400 Independence Ave. SW
Room 2648-S, Mail Stop 0268
Washington, DC 20250-0268

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Docket ID # AMS-NOP-24-0023

Re. CS: Pear ester DD

These comments to the National Organic Standards Board (NOSB) on its Fall 2024 agenda are submitted on behalf of Beyond Pesticides. Founded in 1981 as a national, grassroots, membership organization that represents community-based organizations and a range of people seeking to bridge the interests of consumers, farmers, and farmworkers, Beyond Pesticides advances improved protections from pesticides and alternative pest management strategies that eliminate a reliance on pesticides. Our membership and network span the 50 states and the world.

Pear ester is a chemical (Ethyl-2E,4Z-Decadienoate) synthesized to be structurally and functionally identical to a volatile substance emitted by mature and ripening pears and other fruits. It is attractive to codling moths and is used in various ways to control them. Pear ester is described as a "kairomone," which is defined as "a chemical that is pertinent to the biology of an organism (organism 1) and that when it contacts an individual of another species (Organism 2) evokes in the receiver a behavioural or physiological response that is adaptively favourable to organism 2 but not to organism 1."[1] Our comments below address both pear ester *per se* and delivery mechanisms.

Kairomones, Pheromones, and Compatibility with Organic Practices

The Organic Foods Production Act (OFPA) says a synthetic substance is eligible for use in organic production if:

> [T]he substance—
> (i) is used in production and contains an active synthetic ingredient in the following categories: copper and sulfur compounds; toxins derived from bacteria; pheromones, soaps, horticultural oils, fish emulsions, treated seed, vitamins and minerals; livestock parasiticides and medicines

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[1] Ruther, J., Meiners, T. & Steidle, J. Rich in phenomena-lacking in terms. A classification of kairomones. *Chemoecology* **12**, 161–167 (2002). https://doi.org/10.1007/PL00012664. https://link.springer.com/article/10.1007/PL00012664.

and production aids including netting, tree wraps and seals, insect traps, sticky barriers, row covers, and equipment cleansers; or
(ii) is used in production and contains synthetic inert ingredients that are not classified by the Administrator of the Environmental Protection Agency as inerts of toxicological concern.[2]

The Crops Subcommittee (CS) states, "Pear ester was previously allowed for use in organic crop production under the synthetic pheromone classification until its correct reclassification as a kairomone." The petitioner would like pear ester to be added to the National List as a pheromone.

Kairomones are completely different from pheromones. Pheromones are used "purposely" by one organism to communicate with another (of the same species). (In less anthropomorphic terms, the organism that emits the pheromone has evolved this way of communicating.) Kairomones are not produced by an organism to communicate. Rather, a kairomone is something humans have identified that attracts other organisms. It would be like isolating a component of mouse that is attractive to cats. It is like mosquitoes zeroing in on CO_2 or ticks on body temperature. Mice certainly do not produce a scent in order to attract cats. Obviously, we can--and do--use the fact that "pests" use these chemicals to find prey as attractants in traps (etc.), but they should not be considered to have been included in the category of pheromones by the authors of OFPA.

Where does this leave pear ester (and kairomones in general) with regard to OFPA categories? Pear ester can be used as a component of traps, but they are also registered for use microencapsulated in polyamide and sprayed. The CS document states, "The 2024 technical report on pear esters found no publications indicating harm to humans from pear ester or polyamide particulates." However, the polyamide particulates are microplastics and should be considered as such in evaluating them. Alijagic et al. (2024) find that "the increasing use of polyamide microplastics may pose a potential health risk for the exposed individuals, and it merits more attention."[3]

Given these facts, the CS must consider an annotation restricting the use to traps.

Environmental Effects

Treatment of environmental risk by the technical review (TR) is disappointing. It relies heavily on Environmental Protection Agency (EPA) registration documents, citing EPA conclusions, rather than data on environmental risk:

- "The EPA evaluated pear ester and had few concerns about environmental toxicity. According to the EPA, "little or no exposure is expected for non-target species," and "it is not known to be toxic to any insect species or other non-target organism" (US EPA, 2013). When used at label application rates, adverse, non-target effects are not expected (US EPA, 2013)."
- "The EPA did not require testing for bird, fish, and aquatic invertebrate toxicity because pear ester is expected to quickly disperse and degrade in the environment (US EPA, 2013)."
- "Pear ester has moderate chemical stability in the field, which makes it useful as a pest control product (Light et al., 2001), but it does not persist in the environment away from treated areas. It dissipates and

[2] §6517(c)(1)(B).
[3] Alijagic A, Kotlyar O, Larsson M, Salihovic S, Hedbrant A, Eriksson U, Karlsson P, Persson A, Scherbak N, Färnlund K, Engwall M, Särndahl E. Immunotoxic, genotoxic, and endocrine disrupting impacts of polyamide microplastic particles and chemicals. Environ Int. 2024 Jan;183:108412. doi: 10.1016/j.envint.2023.108412. Epub 2023 Dec 29. PMID: 38183898. https://www.sciencedirect.com/science/article/pii/S0160412023006852.

degrades and does not accumulate (US EPA, 2013)." **This is remarkable! It knows where to persist and where to dissipate and degrade.**

- "It is moderately volatile in the environment, and because of this volatility the EPA has exempted pear ester from a number of key environmental toxicity tests (Boudakian Research, 2023; US 607 EPA, 2013)."
- "The EPA evaluated pear ester and had few concerns about environmental toxicity. According to the EPA, 'little or no exposure is expected for non-target species,' and 'it is not known to be toxic to any insect species or other non-target organism' (US EPA, 2013). When used at label application rates, adverse, non-target effects are not expected (US EPA, 2013)."
- "Furthermore, pear ester is not known to be toxic (US EPA, 2013). Therefore, production and use of pear ester is not likely to lead to widespread environmental contamination."
- "It is volatile and dissipates quickly in the environment. When it volatilizes, it readily undergoes oxidative photodegradation. Non-target effects are not expected from label application rates. The rate of environmental exposure from dispensers and microencapsulated sprays is a key factor in pear ester's low risk for environmental contamination (US EPA, 2013).
- "These amounts are likely too small to affect microbe survival or distribution, especially since pear ester is very volatile and degrades quickly (US EPA, 2013)."
- "Emissions from pear ester treatments are similar to natural emissions in a pear orchard. Therefore, treated areas should not produce unexpected consequences for natural flora and fauna (US EPA, 2013)."
- "Environmental damage is likely small, because small amounts are generally used (3 mg pear ester/tree; 600 mg pear ester/acre), and usage is confined to orchards. However, we cannot provide a thorough analysis because the EPA exempted pear ester and the formulations from many of the usual environmental toxicity tests (US EPA, 2013), and other studies detailing pear ester toxicity are limited."
- "Pear ester applications are generally expected to have benign effects on the environment (US EPA, 2013)."
- "Polyamide microencapsulated formulas of pear ester such as Cidetrak® DA MEC™ (EPA Reg. No. 51934-12) can be sprayed about every two weeks, and up to 8 times a year. The average pear ester emission rate of 42.8 mg/acre/day over a two-week period should not cause environmental toxicity. According to the EPA, pear ester is dispersed and destroyed quickly (Light & Beck, 2010; US EPA, 2013)."
- "According to the EPA, pear ester also has low chronic toxicity, and is not a likely developmental toxicant, or a mutagen. It is not on the EPA list of carcinogens, or on the IARC carcinogen list. It has not been tested for endocrine disruption (US EPA, 2013)."

EPA's failure to protect humans and the biosphere from negative impacts of pesticides and reliance on them has left us with a world that is much more contaminated than it might be if EPA were doing its job. The NOSB cannot rely on EPA's judgment concerning environmental and health effects of pesticides.

Packaging/Delivery Matters

Pear ester is used as an attractant in traps, from which it is released in small concentrations. It is also broadcast as a spray in polyamide microcapsules. The polyamide microcapsules are microplastics, which have received much attention recently in NOSB meetings, as well as in research. Beyond Pesticides, among others, has commented that the NOSB should devise a strategy for eliminating the use of plastics in organic production and handling. We assume that the trap components that emit pear ester are constructed mostly of plastic but could be made of other materials. However, microplastics are essential to the microencapsulated formulations. For that reason, the delivery mechanism must be considered by the NOSB in deciding whether to list pear esters.

Plastics in organic

Plastic is found in every facet of organic production and handling. Yet, the human and environmental health implications of plastic are becoming increasingly well documented. Scientists are increasingly concerned about the impacts of microplastics—plastic fragments less than 5 mm in size—on a wide range of organisms. Microplastics can cause harmful effects to humans and other organisms through physical entanglement and physical impacts of ingestion. They also act as carriers of toxic chemicals that are adsorbed to their surface. Some studies on fish have shown that microplastics and their associated toxic chemicals bioaccumulate, resulting in intestinal damage and changes in metabolism.[4] Microplastics can increase the spread of antibiotic resistance genes in the environment.[5]

Soil organisms and edible plants have been shown to ingest microplastic particles.[6] Earthworms can move microplastics through the soil, and microplastics can move through the food chain to human food.[7] Microplastics can have a wide range of negative impacts on the soil, which are only beginning to be studied, but include reduction in growth and reproduction of soil microfauna.[8] When looking at the impact of microplastics, it is important to include the impact of associated substances. As noted above, they can carry toxic chemicals. A review by Zhu et al. cites several studies showing, "[M]icroplastics can serve as hotspots of gene exchange between phylogenetically different microorganisms by introducing additional surface, thus having a potential to increase the spread of ARGs [antibiotic resistance genes] and antibiotic resistant pathogens in water and sediments." [9]

Research continues to raise alarms about the hazards associated with the use of plastic, including the microplastic particles that are distributed in alarming amounts throughout the environment and taken up by organisms, including humans. A study published by researchers at Columbia and Rutgers universities in the January 2024 Proceedings of the National Academy of Sciences reports that the average liter of three brands of bottled water in the U.S. contains almost a quarter of a million bits of microplastics, of which 90 percent are at the nanoscale.[10] The other ten percent are slightly larger, at microscale.

Last December, researchers at Norway's MicroLEACH project published a study that analyzes the components of 50 items in common use—plastic bags, disposable cups, dishwashing gloves, car tire granules, children's toys and balloons.[11] The researchers found, as in previous studies, that many hazardous chemicals are in the plastics as well as many that **could not be identified** because they were not listed in the major chemical substance databases. Only 30 percent of the chemical compounds identified in the study were present in two or more products. This suggests that most plastics contain

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[4] Li, J., Liu, H. and Chen, J.P., 2018. Microplastics in freshwater systems: A review on occurrence, environmental effects, and methods for microplastics detection. *Water Research*, *137*, pp.362-374.

[5] Shi, J., Wu, D., Su, Y. and Xie, B., 2020. (Nano) microplastics promote the propagation of antibiotic resistance genes in landfill leachate. *Environmental Science: Nano*, *7*(11), pp.3536-3546.

[6] Zhu, F., Zhu, C., Wang, C. and Gu, C., 2019. Occurrence and ecological impacts of microplastics in soil systems: a review. *Bulletin of environmental contamination and toxicology*, *102*(6), pp.741-749.

[7] He, D., Luo, Y., Lu, S., Liu, M., Song, Y. and Lei, L., 2018. Microplastics in soils: analytical methods, pollution characteristics and ecological risks. *TrAC Trends in Analytical Chemistry*, *109*, pp.163-172.

[8] He, D., Luo, Y., Lu, S., Liu, M., Song, Y. and Lei, L., 2018. Microplastics in soils: analytical methods, pollution characteristics and ecological risks. *TrAC Trends in Analytical Chemistry*, *109*, pp.163-172.

[9] Zhu, F., Zhu, C., Wang, C. and Gu, C., 2019. Occurrence and ecological impacts of microplastics in soil systems: a review. *Bulletin of environmental contamination and toxicology*, *102*(6), pp.741-749.

[10] Qian N, Gao X, Lang X, Deng H, Bratu TM, Chen Q, Stapleton P, Yan B, Min W. Rapid single-particle chemical imaging of nanoplastics by SRS microscopy. Proc Natl Acad Sci U S A.

[11] Summary at https://phys.org/news/2023-12-toxicity-standard-plastic-products.html.

many unidentified chemicals, far beyond the known impurities, metabolites and degradation products. Further, it suggests that in the environment plastics are chemically reactive and forming new compounds no one has anticipated and whose toxicity is unknown.

In the Columbia/Rutgers study, the researchers checked for seven types of plastic, but they were only able to identify about ten percent of the nanoparticles they found. Polyethylene terephthalate (PET) was a common ingredient, probably because many water bottles are made of it. However, they also found polyamide, polystyrene, polyvinyl chloride, and polymethyl methacrylate. (Tap water also contains microplastics in many places, although in much lower concentrations.) The team found that the number of individual chemical compounds varied wildly among products, ranging from 114 to 2,456, leading them to conclude that "assessing the toxicity of plastic chemicals present in a product based on testing individual target chemicals has limited value." The Norwegian scientists also exposed cod eggs, embryos and larvae to water containing microplastics. The toxic effects they observed include spinal deformities reminiscent of scoliosis in humans.

In other new studies, out of a total of 257 patients who completed the study, polyethylene was detected in carotid artery plaque of 150 patients (58.4%), with a mean level of 2% of plaque; 31 patients (12.1%) also had measurable amounts of polyvinyl chloride, with a mean level of 0.5% of plaque.[12] Microplastic particles have even shown up in brain as well as placenta.[13]

Conclusion

The CS should separate use of pear ester in traps from the use microencapsulated in sprays. We believe that the use in traps may be consistent with OFPA, but the use in sprays does not fit into any of the OFPA categories and poses unnecessary risks. We were unable to untangle results from the two uses with respect to effectiveness of controlling codling moths, but we encourage the CS to do so.

Thank you for your consideration of these comments.

Sincerely,

Terry Shistar, Ph.D.
Board of Directors

[12] Marfella R, Prattichizzo F, Sardu C, Fulgenzi G, Graciotti L, Spadoni T, D'Onofrio N, Scisciola L, La Grotta R, Frigé C, Pellegrini V, Municinò M, Siniscalchi M, Spinetti F, Vigliotti G, Vecchione C, Carrizzo A, Accarino G, Squillante A, Spaziano G, Mirra D, Esposito R, Altieri S, Falco G, Fenti A, Galoppo S, Canzano S, Sasso FC, Matacchione G, Olivieri F, Ferraraccio F, Panarese I, Paolisso P, Barbato E, Lubritto C, Balestrieri ML, Mauro C, Caballero AE, Rajagopalan S, Ceriello A, D'Agostino B, Iovino P, Paolisso G. Microplastics and Nanoplastics in Atheromas and Cardiovascular Events. N Engl J Med. 2024 Mar 7;390(10):900-910. https://www.nejm.org/doi/full/10.1056/NEJMoa2309822.
[13] https://www.nytimes.com/2024/03/09/health/microplastics-sxsw-health-plastic-people.html.