

Chemical Factsheet

Synthetic Pyrethroids

(General Chemical Class)

General Information

- Fact Sheet: [Synthetic Pyrethroids Factsheet \(updated\).pdf](#)
- Product Names:
 - [Allethrin](#)
 - [Bifenthrin](#)
 - [Cypermethrin](#)
 - Flumethrin
 - [Permethrin](#)
 - [Resmethrin](#)
 - Sumithrin (d-phenothrin)
 - Tau-fluvalinate
 - [Tetramethrin](#)
- Chemical Class: Synthetic Pyrethroids
- Uses: Insecticide
- Alternatives: [Least-Toxic Insecticide](#)
- Beyond Pesticides rating: [Toxic](#)

Health and Environmental Effects

See citations at end of document.

- Cancer: Probable (1, 2, 3, 4)
- Endocrine Disruption: Possible (1)
- Reproductive Effects: Probable (5)
- Neurotoxicity: Yes (6, 5)
- Kidney/Liver Damage: Yes (6, 5)
- Sensitizer/ Irritant: Yes (6)
- Birth/Developmental: Yes (5)
- Detected in Groundwater: Not documented
- Potential Leacher: Not documented
- Toxic to Birds: Possible (7)
- Toxic to Fish/Aquatic Organisms: Yes (6)
- Toxic to Bees: Yes (6)

Additional Information

- Regulatory Status:
 - [EPA's Pyrethrins and Pyrethroids Reregistration and Labeling](#) (1/2023)
 - EPA's [Pyrethroids and Pyrethrins Ecological Risk Mitigation Proposal for 23 Chemicals Final](#) (11/2019)
- Studies [compiled from the [Pesticide-Induced Diseases Database](#)]
 - [Acute Illnesses Associated With Pesticide Exposure at Schools](#), Alarcon, W. et. al.

2005. *Journal of the American Medical Association*. 294 (4):455-465

- [A Longitudinal Approach to Assessing Urban and Suburban Children's Exposure to Pyrethroid Pesticides](#). Lu C, Barr DB, Pearson M, Bartell S, Bravo R.. 2006. *Environ Health Perspect*. 114(9):1419-23.
- [Oxidative stress of glyphosate, AMPA and metabolites of pyrethroids and chlorpyrifos pesticides among primary school children in Cyprus](#). Makris, K.C., Efthymiou, N., Konstantinou, C., Anastasi, E., Schoeters, G., Kolossa-Gehring, M. and Katsonouri, A., *Environmental Research*, 212, p.113316.
- [Effects of prenatal and infant daily exposure to pyrethroid pesticides on the language development of 2-year-old toddlers: A prospective cohort study in rural Yunnan, China](#). Chen, S., Xiao, X., Qi, Z., Chen, L., Chen, Y., Xu, L., Zhang, L., Song, X. and Li, Y. *NeuroToxicology*.
- [Gut microbiota dysbiosis involves in host non-alcoholic fatty liver disease upon pyrethroid pesticide exposure](#). Li, M., Liu, T., Yang, T., Zhu, J., Zhou, Y., Wang, M. and Wang, Q., 2022. *Environmental Science and Ecotechnology*, 11, p.100185.
- [Exploratory analysis of the association between pyrethroid exposure and rheumatoid arthritis among US adults: 2007-2014 data analysis from the National Health and Nutrition Examination Survey \(NHANES\)](#). Guo, X., Li, N., Wang, H., Su, W., Song, Q., Liang, Q., Sun, C., Liang, M., Ding, X., Lowe, S. and Sun, Y., 2022. *Environmental Science and Pollution Research*, pp.1-11.
- [Developmental pyrethroid exposure causes a neurodevelopmental disorder phenotype in mice](#). . Curtis, M.A., Dhamsania, R.K., Branco, R.C., Guo, J.D., Creeden, J., Neifer, K.L., Black, C.A., Winokur, E.J., Andari, E., Dias, B.G. and Liu, R.C., 2023. *PNAS nexus*, 2(4), p.pgad085.
- [Effects of pyrethroids on the cerebellum and related mechanisms: a narrative review](#). Hao, F., Bu, Y., Huang, S., Li, W., Feng, H. and Wang, Y., 2023. *Critical Reviews in Toxicology*, pp.1-15.
- [Association between pyrethroid exposure and osteoarthritis: a national population-based cross-sectional study in the US](#). Liang, Z., Sun, X., Lan, J., Guo, R., Tian, Y., Liu, Y. and Liu, S., 2023. *BMC Public Health*, 23(1), p.1521.
- [Association of Prenatal Exposure to Organophosphate, Pyrethroid, and Neonicotinoid Insecticides with Child Neurodevelopment at 2 Years of Age: A Prospective Cohort Study](#). Wang, A., Wan, Y., Mahai, G., Qian, X., Li, Y., Xu, S. and Xia, W., 2023. *Environmental Health Perspectives*, 131(10), p.107011.
- [Risk assessment of a Brazilian urban population due to the exposure to pyrethroid insecticides during the COVID-19 pandemic using wastewater-based epidemiology](#). Lizot LLF, Bastiani MF, Hahn RZ, Meireles YF, Freitas M, Bondan AP, do Nascimento CA, Quevedo DM, Linden R. 2023. *Chemosphere*.
- [Pre-Conception And First Trimester Exposure To Pesticides And Associations With Stillbirth](#). Furlong, M. et al. (2024) Pre-conception and first trimester exposure to pesticides and associations with stillbirth, *American Journal of Epidemiology*. Available at: <https://academic.oup.com/aje/advance-article-abstract/doi/10.1093/aje/kwae198/7714541>.
- [Gestational Exposure to Cyfluthrin through Endoplasmic Reticulum \(ER\) Stress—Mediated PERK Signaling Pathway Impairs Placental Development](#). Ni, W. et al. (2022) Gestational exposure to cyfluthrin through endoplasmic reticulum (ER) stress-mediated perk signaling pathway impairs placental development, *Toxics*. Available at: <https://www.mdpi.com/2305-6304/10/12/733>.
- [A Comprehensive Review on Pesticide Residues in Human Urine](#). Hakme, E., Poulsen, M. and Lassen, A. (2024) A Comprehensive Review on Pesticide Residues in Human Urine, *Journal of Agricultural and Food Chemistry*. Available at:

<https://pubs.acs.org/doi/abs/10.1021/acs.jafc.4c02705>.

- [Thyroid under Attack: The Adverse Impact of Plasticizers, Pesticides, and PFASs on Thyroid Function](#). Rodrigues, V.G. et al. (2024) Thyroid under Attack: The Adverse Impact of Plasticizers, Pesticides, and PFASs on Thyroid Function, *Endocrines*. Available at: <https://www.mdpi.com/2673-396X/5/3/32>.
- [Respiratory and allergic outcomes among 5-year-old children exposed to pesticides](#). Islam, J.Y. et al. (2023) Respiratory and allergic outcomes among 5-year-old children exposed to pesticides, *Thorax*. Available at: <https://thorax.bmj.com/content/78/1/41.abstract>.
- [Maternal exposure to pyrethroid insecticides during pregnancy and respiratory allergy symptoms among children participating in the Venda Health Examination of Mothers, Babies and their Environment \(VHEMBE\)](#). Elsiwi, B. et al. (2024) Maternal exposure to pyrethroid insecticides during pregnancy and respiratory allergy symptoms among children participating in the Venda Health Examination of Mothers, Babies and their Environment (VHEMBE), *Environmental Research*. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0013935123024088>.
- [An update of the impact of pesticide exposure on memory and learning](#). Honatel, K.F. et al. (2024) An update of the impact of pesticide exposure on memory and learning, *Discover Toxicology*. Available at: <https://link.springer.com/article/10.1007/s44339-024-00011-9>.
- [Air contamination by legacy and current-use pesticides in Brazilian mountains: An overview of national regulations by monitoring pollutant presence in pristine areas](#). de Souza Guida, Y. et al. (2018) Air contamination by legacy and current-use pesticides in Brazilian mountains: An overview of national regulations by monitoring pollutant presence in pristine areas, *Environmental Pollution*. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0269749118314441>.
- [Immune response of Brazilian farmers exposed to multiple pesticides](#). Jacobsen-Pereira, C.H. et al. (2020) 'Immune response of Brazilian farmers exposed to multiple pesticides', *Ecotoxicology and Environmental Safety*, 202, p. 110912. doi:10.1016/j.ecoenv.2020.110912.
- [Mechanisms of pyrethroid neurotoxicity: implications for cumulative risk assessment](#). David M Soderlund, John M Clark, Larry P Sheets, Linda S Mullin, Vincent J Piccirillo, Dana Sargent, James T Stevens, Myra L Weiner, *Mechanisms of pyrethroid neurotoxicity: implications for cumulative risk assessment*, *Toxicology*, Volume 171, Issue 1, 2002, Pages 3-59, ISSN 0300-483X, [https://doi.org/10.1016/S0300-483X\(01\)00569-8](https://doi.org/10.1016/S0300-483X(01)00569-8).
- [The relation between urinary metabolite of pyrethroid insecticides and semen quality in humans](#). Xia, Y., Han, Y., Wu, B., Wang, S., Gu, A., Lu, N., Bo, J., Song, L., Jin, N., & Wang, X. (2008). The relation between urinary metabolite of pyrethroid insecticides and semen quality in humans. *Fertility and sterility*, 89(6), 1743–1750. <https://doi.org/10.1016/j.fertnstert.2007.05.049>
- [Behavioral and endocrine changes induced by perinatal fenvalerate exposure in female rats](#). Moniz, A. C., Cruz-Casallas, P. E., Salzgeber, S. A., Varoli, F. M., Spinosa, H. S., & Bernardi, M. M. (2005). Behavioral and endocrine changes induced by perinatal fenvalerate exposure in female rats. *Neurotoxicology and teratology*, 27(4), 609–614. <https://doi.org/10.1016/j.ntt.2005.05.005>
- [Exposure to pyrethroid pesticides and ovarian reserve](#). Jurewicz, J., Radwan, P., Wielgomas, B., Radwan, M., Karwacka, A., Kałużny, P., Piskunowicz, M., Dziewirska, E., & Hanke, W. (2020). Exposure to pyrethroid pesticides and ovarian reserve. *Environment international*, 144, 106028. <https://doi.org/10.1016/j.envint.2020.106028>
- [In utero and lactational exposure to fenvalerate disrupts reproductive function in female rats](#). Guerra, M. T., de Toledo, F. C., & Kempinas, W.deG. (2011). In utero and lactational

exposure to fenvalerate disrupts reproductive function in female rats. *Reproductive toxicology* (Elmsford, N.Y.), 32(3), 298–303.

<https://doi.org/10.1016/j.reprotox.2011.08.002>

- [Occurrence of pyrethroids in the atmosphere of urban areas of Southeastern Brazil: Inhalation exposure and health risk assessment](#). Guida, Y., Pozo, K., Carvalho, G. O., Capella, R., Targino, A. C., Torres, J. P. M., & Meire, R. O. (2021). Occurrence of pyrethroids in the atmosphere of urban areas of Southeastern Brazil: Inhalation exposure and health risk assessment. *Environmental pollution* (Barking, Essex : 1987), 290, 118020. <https://doi.org/10.1016/j.envpol.2021.118020>
- [Characterizing pyrethroid and fipronil concentrations in biosolids](#). Wheeler, J., Black, G. P., Hladik, M. L., Sanders, C. J., Teerlink, J., Wong, L., Zhang, X., Budd, R., & Young, T. M. (2025). Characterizing pyrethroid and fipronil concentrations in biosolids. *The Science of the total environment*, 969, 178954. <https://doi.org/10.1016/j.scitotenv.2025.178954>
- [The dead can talk: Investigating trace element and organic pollutant exposure in mammalian roadkill under contrasting habitats](#). Molbert, N., Alliot, F., Goutte, A., & Hansson, M. C. (2025). The dead can talk: Investigating trace element and organic pollutant exposure in mammalian roadkill under contrasting habitats. *Environmental pollution* (Barking, Essex : 1987), 367, 125648. <https://doi.org/10.1016/j.envpol.2025.125648>
- [The association between prenatal pyrethroids exposure and children's health - current research](#). Jankowska, A., Ścieszko, M., Polańska, A., Jerzyńska, A., Dominowska, J., & Brzozowska, A. (2024). The association between prenatal pyrethroids exposure and children's health - current research. *International journal of occupational medicine and environmental health*, 37(4), 381–402. <https://doi.org/10.13075/ijomeh.1896.02445>
- [Exposure to multiple pyrethroid insecticides affects ovarian follicular development via modifying microRNA expression](#). Song, J., Ma, X., Li, F., & Liu, J. (2022). Exposure to multiple pyrethroid insecticides affects ovarian follicular development via modifying microRNA expression. *The Science of the total environment*, 828, 154384. <https://doi.org/10.1016/j.scitotenv.2022.154384>
- [Pyrethroids cypermethrin, deltamethrin and fenvalerate have different effects on in vitro maturation of pig oocytes at different stages of growth](#). Petr, Jaroslav & Chmelíková, Eva & Žalmanová, Tereza & Tumova, Lenka & Kheilova, Katerina & Kučerová-Chrpová, V & Jílek, F. (2012). Pyrethroids cypermethrin, deltamethrin and fenvalerate have different effects on in vitro maturation of pig oocytes at different stages of growth. *Animal : an international journal of animal bioscience*. 7. 1-9. [10.1017/S1751731112001140](https://doi.org/10.1017/S1751731112001140).
- [Enantioselective endocrine-disrupting effects of bifenthrin on hormone synthesis in rat ovarian cells](#). Liu, J., Yang, Y., Zhuang, S., Yang, Y., Li, F., & Liu, W. (2011). Enantioselective endocrine-disrupting effects of bifenthrin on hormone synthesis in rat ovarian cells. *Toxicology*, 290(1), 42–49. <https://doi.org/10.1016/j.tox.2011.08.016>
- [Disrupting effects of bifenthrin on ovulatory gene expression and prostaglandin synthesis in rat ovarian granulosa cells](#). Liu, J., Yang, Y., Yang, Y., Zhang, Y., & Liu, W. (2011). Disrupting effects of bifenthrin on ovulatory gene expression and prostaglandin synthesis in rat ovarian granulosa cells. *Toxicology*, 282(1-2), 47–55. <https://doi.org/10.1016/j.tox.2011.01.007>
- [Meta-analysis reveals that seed-applied neonicotinoids and pyrethroids have similar negative effects on abundance of arthropod natural enemies](#). Douglas MR, Tooker JF. 2016. Meta-analysis reveals that seed-applied neonicotinoids and pyrethroids have similar negative effects on abundance of arthropod natural enemies. *PeerJ* 4:e2776 <https://doi.org/10.7717/peerj.2776>
- [Species at Risk \(SPEAR\) index indicates effects of insecticides on stream invertebrate communities in soy production regions of the Argentine Pampas](#). Hunt, L., Bonetto, C.,

- Marrochi, N., Scalise, A., Fanelli, S., Liess, M., Lydy, M. J., Chiu, M. C., & Resh, V. H. (2017). Species at Risk (SPEAR) index indicates effects of insecticides on stream invertebrate communities in soy production regions of the Argentine Pampas. *The Science of the total environment*, 580, 699–709. <https://doi.org/10.1016/j.scitotenv.2016.12.016>
- [Occurrence of Current-Use Pesticides in Paired Indoor Dust, Drinking Water, and Urine Samples from the United States: Risk Prioritization and Health Implications](#). Xie, Y., Li, J., Salamova, A., & Zheng, G. (2025). Occurrence of Current-Use Pesticides in Paired Indoor Dust, Drinking Water, and Urine Samples from the United States: Risk Prioritization and Health Implications. *Environmental science & technology*, 59(25), 12507–12519. <https://doi.org/10.1021/acs.est.5c00961>
 - [Pyrethroid insecticides implicated in mass mortality of monarch butterflies at an overwintering site in California](#). Cibotti, S. et al. (2025) Pyrethroid insecticides implicated in mass mortality of monarch butterflies at an overwintering site in California, *Environmental Toxicology and Chemistry*. Available at: <https://academic.oup.com/etc/advance-article-abstract/doi/10.1093/etojnl/vgaf163/8177160>.
 - [Interaction of Insecticides and Fungicides in Bees](#). Schuhmann A, Schmid AP, Manzer S, Schulte J and Scheiner R (2022) Interaction of Insecticides and Fungicides in Bees. *Front. Insect Sci.* 1:808335. doi: 10.3389/finsc.2021.808335
 - [Associations of specific pesticides and incident rheumatoid arthritis among female spouses in the Agricultural Health Study](#). Parks, C. et al. (2025) Associations of specific pesticides and incident rheumatoid arthritis among female spouses in the Agricultural Health Study, *Arthritis & Rheumatology*. Available at: <https://acrjournals.onlinelibrary.wiley.com/doi/10.1002/art.43318>.
 - [Current-use pesticide exposures in remote Inuit communities](#). Aker, A. M. et al. (2024) 'Current-use pesticide exposures in remote Inuit communities', *International Journal of Circumpolar Health*, 83(1). doi: 10.1080/22423982.2024.2421048.
 - [Effect of prenatal exposure to organophosphates and pyrethroid pesticides on neonatal anthropometric measures and gestational age](#). Gimenez-Asensio, María José et al. "Effect of prenatal exposure to organophosphates and pyrethroid pesticides on neonatal anthropometric measures and gestational age." *Environmental research* vol. 232 (2023): 116410. doi:10.1016/j.envres.2023.116410
 - [Pesticides residues and metabolites in honeybees: A Greek overview exploring Varroa and Nosema potential synergies](#). Kasiotis, Konstantinos M et al. "Pesticides residues and metabolites in honeybees: A Greek overview exploring Varroa and Nosema potential synergies." *The Science of the total environment* vol. 769 (2021): 145213. doi:10.1016/j.scitotenv.2021.145213
 - [Poisoning due to Pyrethroids](#). Bradberry, S.M., Cage, S.A., Proudfoot, A.T. et al. Poisoning due to Pyrethroids. *Toxicol Rev* 24, 93–106 (2005). <https://doi.org/10.2165/00139709-200524020-00003>
 - [A cumulative dietary pesticide exposure score based on produce consumption is associated with urinary pesticide biomarkers in a U.S. biomonitoring cohort](#). Temkin, A. et al. (2025) A cumulative dietary pesticide exposure score based on produce consumption is associated with urinary pesticide biomarkers in a U.S. biomonitoring cohort, *International Journal of Hygiene and Environmental Health*. Available at: <https://www.sciencedirect.com/science/article/pii/S1438463925001361>.
 - [Global patterns of pesticide residues in seaweeds: A systematic review](#). Azevedo, G. et al. (2025) Global patterns of pesticide residues in seaweeds: A systematic review, *Marine Pollution Bulletin*. Available at: <https://www.sciencedirect.com/science/article/pii/S0025326X25011841>.
 - [Pyrethroids exposure induces obesity and cardiometabolic diseases in a sex-different](#)

- [manner](#). Zuo, L., Chen, L., Chen, X., Liu, M., Chen, H., & Hao, G. (2022). Pyrethroids exposure induces obesity and cardiometabolic diseases in a sex-different manner. *Chemosphere*, 291(Pt 2), 132935. <https://doi.org/10.1016/j.chemosphere.2021.132935>
- [Association between pyrethroids and prostate endpoints; stratified according to renal function](#). Hong, D., Min, J. Y., & Min, K. B. (2021). Association between pyrethroids and prostate endpoints; stratified according to renal function. *Environment international*, 153, 106489. <https://doi.org/10.1016/j.envint.2021.106489>
 - [Prenatal Insecticide Exposure and Adverse Birth Outcomes: Evidence for Mediation via Disruptions in Amino Acid and Acylcarnitine Metabolism](#). Ma, Y. et al. (2025) Prenatal Insecticide Exposure and Adverse Birth Outcomes: Evidence for Mediation via Disruptions in Amino Acid and Acylcarnitine Metabolism, *Environmental Science & Technology*. Available at: <https://pubs.acs.org/doi/10.1021/acs.est.5c13454>.
 - [Pyrethroid pesticide exposure during early pregnancy and birth outcomes in southwest China: a birth cohort study](#). Xu, Q., Zhu, B., Dong, X., Li, S., Song, X., Xiao, X., Zhang, C., Lv, Y., Zhang, X., & Li, Y. (2020). Pyrethroid pesticide exposure during early pregnancy and birth outcomes in southwest China: a birth cohort study. *The Journal of toxicological sciences*, 45(5), 281–291. <https://doi.org/10.2131/jts.45.281>
 - [Prenatal pyrethroid insecticide exposure and thyroid hormone levels and birth sizes of neonates](#). Zhang, J., Yoshinaga, J., Hisada, A., Shiraishi, H., Shimodaira, K., Okai, T., Koyama, M., Watanabe, N., Suzuki, E., Shirakawa, M., Noda, Y., Komine, Y., Ariki, N., & Kato, N. (2014). Prenatal pyrethroid insecticide exposure and thyroid hormone levels and birth sizes of neonates. *The Science of the total environment*, 488-489, 275–279. <https://doi.org/10.1016/j.scitotenv.2014.04.104>
 - [Prenatal exposure to pyrethroid insecticides and birth outcomes in Rural Northern China](#). Ding, G., Cui, C., Chen, L. et al. Prenatal exposure to pyrethroid insecticides and birth outcomes in Rural Northern China. *J Expo Sci Environ Epidemiol* 25, 264–270 (2015). <https://doi.org/10.1038/jes.2014.86>
 - [Association of maternal pyrethroid pesticides exposure during the whole pregnancy with neonate lipid metabolism: A prospective birth cohort, Yunnan, China](#). Chen, S. et al. (2025) Association of maternal pyrethroid pesticides exposure during the whole pregnancy with neonate lipid metabolism: A prospective birth cohort, Yunnan, China, *Journal of Hazardous Materials*. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0304389424031844>.
 - [Associations of maternal exposure to organophosphate and pyrethroid insecticides and the herbicide 2,4-D with birth outcomes and anogenital distance at 3 months in the Odense Child Cohort](#). Dalsager, L., Christensen, L. E., Kongsholm, M. G., Kyhl, H. B., Nielsen, F., Schoeters, G., Jensen, T. K., & Andersen, H. R. (2018). Associations of maternal exposure to organophosphate and pyrethroid insecticides and the herbicide 2,4-D with birth outcomes and anogenital distance at 3 months in the Odense Child Cohort. *Reproductive toxicology (Elmsford, N.Y.)*, 76, 53–62. <https://doi.org/10.1016/j.reprotox.2017.12.008>
 - [Thyroid and reproductive hormones in relation to pesticide use in an agricultural population in Southern Brazil](#). Santos, R., Piccoli, C., Cremonese, C., & Freire, C. (2019). Thyroid and reproductive hormones in relation to pesticide use in an agricultural population in Southern Brazil. *Environmental research*, 173, 221–231. <https://doi.org/10.1016/j.envres.2019.03.050>
 - [Prenatal exposure to the pesticides chlorpyrifos and 2,4-Dichlorophenoxyacetic acid is associated with circulating levels of reproductive hormones in healthy infant girls](#). Iversen, A.-P. et al. (2025) Prenatal exposure to the pesticides chlorpyrifos and 2,4-Dichlorophenoxyacetic acid is associated with circulating levels of reproductive hormones in healthy infant girls, *Reproductive Toxicology*. Available at:

<https://www.sciencedirect.com/science/article/pii/S0890623825002837>.

- [The estrogenic and androgenic potential of pyrethroids in vitro. Review.](#) Saillenfait, A. M., Ndiaye, D., & Sabaté, J. P. (2016). The estrogenic and androgenic potential of pyrethroids in vitro. Review. *Toxicology in vitro : an international journal published in association with BIBRA*, 34, 321–332. <https://doi.org/10.1016/j.tiv.2016.02.020>
- [Prenatal Exposure to DDT and Pyrethroids for Malaria Control and Child Neurodevelopment: The VHEMBE Cohort, South Africa.](#) Eskenazi, B., An, S., Rauch, S. A., Coker, E. S., Maphula, A., Obida, M., Crause, M., Kogut, K. R., Bornman, R., & Chevrier, J. (2018). Prenatal Exposure to DDT and Pyrethroids for Malaria Control and Child Neurodevelopment: The VHEMBE Cohort, South Africa. *Environmental health perspectives*, 126(4), 047004. <https://doi.org/10.1289/EHP2129>
- [Acute effects of binary mixtures of Type II pyrethroids and organophosphate insecticides on *Oreochromis niloticus*.](#) Fai, P.B.A., Tsobgny Kinfack, J.S. & Tala Towa, Y.J. Acute effects of binary mixtures of Type II pyrethroids and organophosphate insecticides on *Oreochromis niloticus* . *Ecotoxicology* 26, 889–901 (2017). <https://doi.org/10.1007/s10646-017-1819-y>
- [Effects of prenatal exposure to pyrethroid pesticides on neurodevelopment of 1-year- old children: A birth cohort study in China.](#) Qi, Z., Song, X., Xiao, X., Loo, K. K., Wang, M. C., Xu, Q., Wu, J., Chen, S., Chen, Y., Xu, L., & Li, Y. (2022). Effects of prenatal exposure to pyrethroid pesticides on neurodevelopment of 1-year- old children: A birth cohort study in China. *Ecotoxicology and environmental safety*, 234, 113384. <https://doi.org/10.1016/j.ecoenv.2022.113384>
- [Ambient Pyrethroid Pesticide Exposures in Adult Life and Depression in Older Residents of California’s Central Valley.](#) Furlong, Melissa A.a,*; Paul, Kimberly C.b; Cockburn, Mylesc; Bronstein, Jeffd; Keener, Adrienne; Rosario, Irish Delb; Folle, Aline Duarteb; Ritz, Beateb,d. Ambient Pyrethroid Pesticide Exposures in Adult Life and Depression in Older Residents of California’s Central Valley. *Environmental Epidemiology* 4(6):p e123, December 2020. | DOI: 10.1097/EE9.000000000000123
- [Nonoccupational Exposure to Pyrethroids and Risk of Coronary Heart Disease in the Chinese Population.](#) Han, J., Zhou, L., Luo, M., Liang, Y., Zhao, W., Wang, P., Zhou, Z., & Liu, D. (2017). Nonoccupational Exposure to Pyrethroids and Risk of Coronary Heart Disease in the Chinese Population. *Environmental science & technology*, 51(1), 664–670. <https://doi.org/10.1021/acs.est.6b05639>
- [Association between pyrethroid exposure and cardiovascular disease: A national population-based cross-sectional study in the US.](#) Xue, Q., Pan, A., Wen, Y., Huang, Y., Chen, D., Yang, C. X., Hy Wu, J., Yang, J., Pan, J., & Pan, X. F. (2021). Association between pyrethroid exposure and cardiovascular disease: A national population-based cross-sectional study in the US. *Environment international*, 153, 106545. <https://doi.org/10.1016/j.envint.2021.106545>
- [Cardiotoxicity of pyrethroids: molecular mechanisms and therapeutic options for acute and long-term toxicity.](#) Marques, L. P., Joviano-Santos, J. V., Souza, D. S., Santos-Miranda, A., & Roman-Campos, D. (2022). Cardiotoxicity of pyrethroids: molecular mechanisms and therapeutic options for acute and long-term toxicity. *Biochemical Society transactions*, 50(6), 1737–1751. <https://doi.org/10.1042/BST20220593>
- [Pyrethroid pesticides: An overview on classification, toxicological assessment and monitoring.](#) Ahamad, A. and Kumar, J. (2023) 'Pyrethroid pesticides: An overview on classification, toxicological assessment and monitoring', *Journal of Hazardous Materials Advances*, 10, p. 100284. doi: 10.1016/j.hazadv.2023.100284
- [Review of the residue definitions for risk assessment of pyrethroids forming common metabolites.](#) EFSA (European Food Safety Authority), 2023. Statement on the review of the residue definitions for risk assessment of pyrethroids forming common metabolites.

EFSA Journal 2023;21(5):8022, 15 pp. <https://doi.org/10.2903/j.efsa.2023.8022>

- [Pesticide exposure among organic and conventional smallholder farmers in Costa Rica and Uganda: biomarker evidence on exposure determinants](#). Petitpierre. A. et al. (2026). Pesticide exposure among organic and conventional smallholder farmers in Costa Rica and Uganda: biomarker evidence on exposure determinants, *The Lancet Planetary Health*. Available at: [https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196\(25\)00294-3/fulltext](https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(25)00294-3/fulltext)
- [Chronic health effects of recurrent indoor Pyrethroid exposure in enclosed workplaces: an occupational exposome-based clinical review in the context of limited safety guidance](#). Kamar AAM, Mavroudis I, Ciobica A, Gheban D and Gurzu I-L (2026) Chronic health effects of recurrent indoor Pyrethroid exposure in enclosed workplaces: an occupational exposome-based clinical review in the context of limited safety guidance. *Front. Public Health* 14:1827623. doi: 10.3389/fpubh.2026.1827623
- [Toxicological effects of agricultural pesticides on aquatic ecosystems: A review](#). Al-Maaitah, Murad I. and Kuldasheva, Shakhnoza and Abduganiev, Bekzod and Shakhmurova, Gulnora and Basheer, Noor M. and Abdul, Dhafrah J. and Singh, Ritesh and Sharma, Vipasha, 1405, Toxicological effects of agricultural pesticides on aquatic ecosystems: A review. Available at: <https://civilica.com/doc/2644454>

Gateway Health and Environmental Effects Citations

1. US EPA Office of Pesticide Programs. List of Chemicals Evaluated for Carcinogenic Potential. October 30, 2023. http://npic.orst.edu/chemicals_evaluated.pdf
2. Pesticide Action Network Pesticide Database. http://www.pesticideinfo.org/Search_Chemicals.jsp.
3. Bao, W., Liu, B., Simonsen, D.W. and Lehmler, H.J., 2020. Association between exposure to pyrethroid insecticides and risk of all-cause and cause-specific mortality in the general US adult population. *JAMA internal medicine*, 180(3), pp.367-374. <https://pubmed.ncbi.nlm.nih.gov/31886824/>
4. del Pilar Navarrete-Meneses, M. and Pérez-Vera, P., 2019. Pyrethroid pesticide exposure and hematological cancer: epidemiological, biological and molecular evidence. *Reviews on environmental health*, 34(2), pp.197-210. <https://pubmed.ncbi.nlm.nih.gov/30903760/>
5. US EPA, 2000. Table 1: Toxicity Data by Category for Chemicals Listed under EPCRA Section 313. Toxic Release Inventory (TRI) Program. https://www.epa.gov/sites/production/files/documents/hazard_categories.pdf
6. Extension Toxicology Network (EXTOXNET) Pesticide Information Profiles. <http://extoxnet.orst.edu/pips/ghindex.html>
7. Verma, R., Study of the mechanism of synthetic pyrethroid type II fenvalerate on biochemical and hematological alterations in poultry. [See PDF](#).

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