

3-3-21. Effect of Several Persistent, Bioaccumulative, Toxic Chemicals (PBTs) on a Lepidopteran Insect Species

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Pollutants that are persistent, bioaccumulative, and toxic have been linked to numerous adverse effects in human and animals. PBTs include heavy metals, polychlorinated biphenyls (PCBs), dioxins, polycyclic aromatic compounds (PACs) in addition to pesticides. This study focuses on toxic effects of the PBTs except pesticides on insects.

Eight PBTs were selected from subgroups: three heavy metals (Pb, Hg, and Cd), two PCB mixtures (Aroclor mixtures 1 and 2), 2,3,7,8-tetrachlorodibenzo-p-dioxin, two monophenols (4-octylphenol and 4-nonylphenol), and tetrabutyltin. Beet armyworm, *Spodoptera exigua*, was used as test target insect species. Three physiological markers (metamorphosis, immune reaction, and follicle patency) were assessed in each exposure to different doses of the PCBs. Heat-shock proteins as molecular markers were also analyzed in response to the PCBs.

All tested PBTs were toxic to metamorphosis from larvae to pupae when they were applied with diet. Two PCB mixtures were the most toxic compounds in this assay by giving significant toxicity at 0.005 ppm, while others had from 10 to 1000 ppm. Dioxin (0.1 ppb), tetrabutyltin (0.1 ppb), Pb (10 ppb), and Hg (0.01 ppb) were potent to inhibit immune reactions analyzed by inducing phenoloxidase activity and blocked phospholipase A2 enzyme. Tetrabutyltin and dioxin significantly induced follicle cell patency, but their effects were lower than that of endogenous juvenile hormone. Dioxin, Pb, Hg, and Cd could induce the expression of heat shock proteins that were detected by immunoblotting against human HSP70 monoclonal antibody. HSP78 and HSP80 were upregulated in response to the PBTs. This expression was detected from the fat body and epidermis at as fast as 4h after injection.

All these results clearly suggest that PBTs give significant ecotoxicity to insects that are valuable organisms in our environment.