

# Pyrethrum – Pyrethrins, Pyrethroid – Permethrin: Let's Call the Whole Thing Natural?

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## Terminology

**Pyrethrum:** Liquid extract or dry preparation from the flowers of the pyrethrum plant (*Chrysanthemum cinerariifolium*).

**Pyrethrins:** Collective name of the six naturally-occurring insecticidal active ingredients (esters) found in pyrethrum.

**Pyrethroid:** A manmade or laboratory-synthesized insecticide patterned after one of the pyrethrins.

**Permethrin:** A pyrethroid.

Through the course of civilization, perhaps through keen observation and happenstance, humans have figured out that extracts from certain chrysanthemum flowers (Scientific Name: *Chrysanthemum cinerariifolium*; Common Names: pyrethrum plant, Dalmatian chrysanthemum, insect flowers) [Fig. 1] have insecticidal properties. Legend has it that a person picked certain chrysanthemum flowers as beautiful adornment—and then noticed dead insects around the flowers once they had dried and withered several days later. It is possible that pyrethrum extracts have been used for hundreds of years as insecticides in the Middle East. Persian pellitory, Persian powder and Zacherlin were names used by early Europeans to refer to preparations from pyrethrum extracts originating from the Middle East and the Balkans.

## You say pyrethrum and I say pyrethrins?

With the advent of modern chemistry, it was soon determined that there were actually six separate active ingredients in the pyrethrum extract that can kill insects [Fig. 2]. These six active ingredients are now collectively known as pyrethrins or natural pyrethrins (with an s) to denote the six active insecticidal esters. Thus, when a house fly is treated with an insecticide containing natural pyrethrins, such as ULD<sup>®</sup> BP-100 or Stryker<sup>™</sup> Insecticide Concentrate, or any of the products listed in [Table 1] (see page 19), it is actually being simultaneously exposed to six natural insecticides.

This might be the reason why, despite being used for hundreds of years, natural pyrethrins are still very effective against many insect pests. Insects have not yet developed widespread resistance to natural pyrethrins despite being used for centuries. In comparison, many insect species, such as the house fly, can develop resistance against much simpler man-made or laboratory-synthesized insecticides like permethrin (a synthetic pyrethroid) if used continuously for three to four years without employing resistance management strategies.



Fig 1. Flowers of the pyrethrum plant (*Chrysanthemum cinerariifolium*). (Photo: Botanical Resources Australia <http://botanicalra.com.au>)

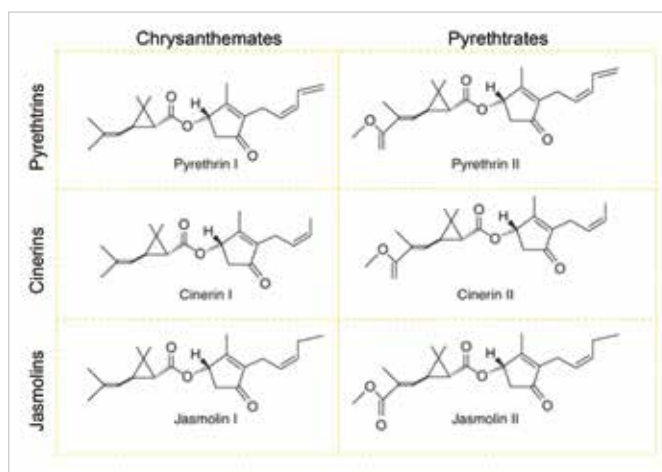


Fig 2. Chemical structures of the six esters collectively known as pyrethrins (Head, 1973).

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**Fig 3.** Stands of perennial pyrethrum plants in Australia showing white flowers close to harvest.  
(Photo: Botanical Resources Australia <http://botanicalra.com.au>)

### What about you, PBO?

Usually combined with pyrethrins are so-called synergists. Synergists do not usually kill insects on their own but, when combined with pyrethrins, they enhance or synergize the potency of pyrethrins. Synergists work by inhibiting the ability of insects to metabolize or breakdown pyrethrins. The resulting effect is that only a minute amount of pyrethrins is required to kill the insect, thereby making an otherwise expensive insecticide more affordable to consumers. Natural pyrethrins are neurotoxins to invertebrates; they affect the transmission of impulses in the invertebrate nervous system thereby causing paralysis and death.

The most common synergist used with pyrethrins today is piperonyl butoxide (PBO for short). Although synthetic, piperonyl butoxide is actually derived from safrole oil which comes from the fruits and root-bark of the sassafras tree (Scientific Name: *Sassafras albidum*). Thus, the PBO used in the market today is only partly-natural or semi-synthetic. Because of this semi-synthetic nature, formulations of pyrethrins that also contain PBO are usually not certified organic. Without the PBO or any synthetic synergists, pyrethrins-only formulations can be declared certified organic by most organic labeling organizations. For example, EverGreen<sup>®</sup> Pyrethrum Concentrate, as seen on

**Table 1 (next page)**, is considered organic because it only contains natural pyrethrins (no synergists added).

### On-animal use?

Products containing natural pyrethrins can be used directly as on-animal treatments on poultry, hogs, cattle and horses [Table 1]. However, for some biological reason, cats are sensitive to higher dosages of natural pyrethrins that are usually benign to most other animals; products with natural pyrethrins are administered very carefully when used on cats and dogs. Always read and follow label directions. Prior to using any product mentioned in this article, carefully read and follow all available instructions, warnings and safety information made available by the product's manufacturer. Consult with your veterinarian prior to using any product that contains natural pyrethrins or pyrethroids on your pets.

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#### References:

Head, S.W. 1973. Composition of pyrethrum extract and analysis of pyrethrins. p. 25-33. In J.E. Casida (ed.) Pyrethrum: The natural insecticide. Academic Press, Inc., New York.

Botanical Resources Australia. 2015. <http://botanica.com.au>

**TABLE 1. INSECTICIDES CONTAINING NATURAL PYRETHRINS**

MFR.	BRAND NAME	ACTIVE INGREDIENTS	FORMULATION	ON-ANIMAL USE (SEE LABEL FOR COMPLETE LISTING)
BASF	ULD® BP-100	natural pyrethrins (1.0%) + piperonyl butoxide (5.0%)	oil-based spray	cattle, horses, poultry, swine
	ULD® HydroPy-300	natural pyrethrins (3.0%) + piperonyl butoxide (15.0%)	water-based spray	cattle, horses
CONTROL SOLUTIONS	Stryker® 5-25	natural pyrethrins (5.0%) + piperonyl butoxide (25.0%)	water-based spray	can be used as a space spray with cattle, horses, poultry, or swine present
	Stryker™ Insecticide Concentrate	natural pyrethrins (6.0%) + piperonyl butoxide (60.0%)	water-based spray	cattle, horses, poultry, swine
	Stryker® 100	natural pyrethrins (1.0%) + piperonyl butoxide (5.0%)	oil-based spray	cattle, horses, poultry, swine
COUNTRY VET	Dairy Aerosol CV-ECO Flying Insect Killer	natural pyrethrins (0.5%) + piperonyl butoxide (5.0%)	aerosol	see label
	Farm & Dairy CV-80D for Insect Control	natural pyrethrins (0.5%) + piperonyl butoxide (4.0%)	aerosol	see label
	Mosquito & Fly Spray	natural pyrethrins (1.76%) + piperonyl butoxide (5.00%)	aerosol	see label
DURVET	Dairy Bomb 55	natural pyrethrins (0.5%) + piperonyl butoxide (5.0%)	aerosol	see label
	Dairy Bomb 55Z	natural pyrethrins (0.5%) + piperonyl butoxide (5.0%)	aerosol	see label
MGK	EverGreen® 100 Synergized ULV Concentrate	natural pyrethrins (1.0%) + piperonyl butoxide (5.0%)	oil-based spray	can be used as a space spray with cattle, horses, poultry, or swine present
	EverGreen® Pro 60-6	natural pyrethrins (6.0%) + piperonyl butoxide (60.0%)	water-based spray	cattle, horses, poultry, swine
	EverGreen® Pyrethrum Concentrate	natural pyrethrins (5.0%; organic)	water-based spray	cattle, horses, poultry, swine
	Riptide® Waterbased Pyrethrin ULV	natural pyrethrins (5.0%) + piperonyl butoxide (25%)	water-based spray	cattle, poultry; can be used as a space spray with horses, or swine present
NEOGEN	CT-75 Dairy Aerosol	natural pyrethrins (0.7%) + piperonyl butoxide (5.0%)	aerosol	see label
	DyFly Aerosol Insecticide	natural pyrethrins (0.5%) + piperonyl butoxide (5.0%)	aerosol	see label
	LD-44T®	natural pyrethrins (1.0%) + piperonyl butoxide (2.0%) + synergist 264 (3.0%)	aerosol	see label
	LD-44Z® Insect Fogger	natural pyrethrins (0.5%) + piperonyl butoxide (4.0%)	aerosol	see label
	Prozap® Dairy & Ranch Insect Spray	natural pyrethrins (0.1%) + piperonyl butoxide (1.0%)	oil-based spray	cattle, horses
	Prozap® Pyrethrin Aqueous Fly Spray Ready-to-use on Horses & Cattle	natural pyrethrins (0.1%) + piperonyl butoxide (1.0%)	water-based spray	cattle, horses
STARBAR	Pyronyl Crop Spray	natural pyrethrins (6%) + piperonyl butoxide (60%)	water-based spray	cattle, horses, poultry, swine
	Pyronyl™ 303 EC	natural pyrethrins (3.0%) + piperonyl butoxide (30.0%)	water-based spray	see label
	UL-100 EC Insecticidal Spray	natural pyrethrins (0.96%) + piperonyl butoxide (9.60%)	oil-based or water-based spray	cattle, horses, poultry, swine

Prior to using any product mentioned in this article, carefully read and follow all available instructions, warnings and safety information made available by the product's manufacturer.

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