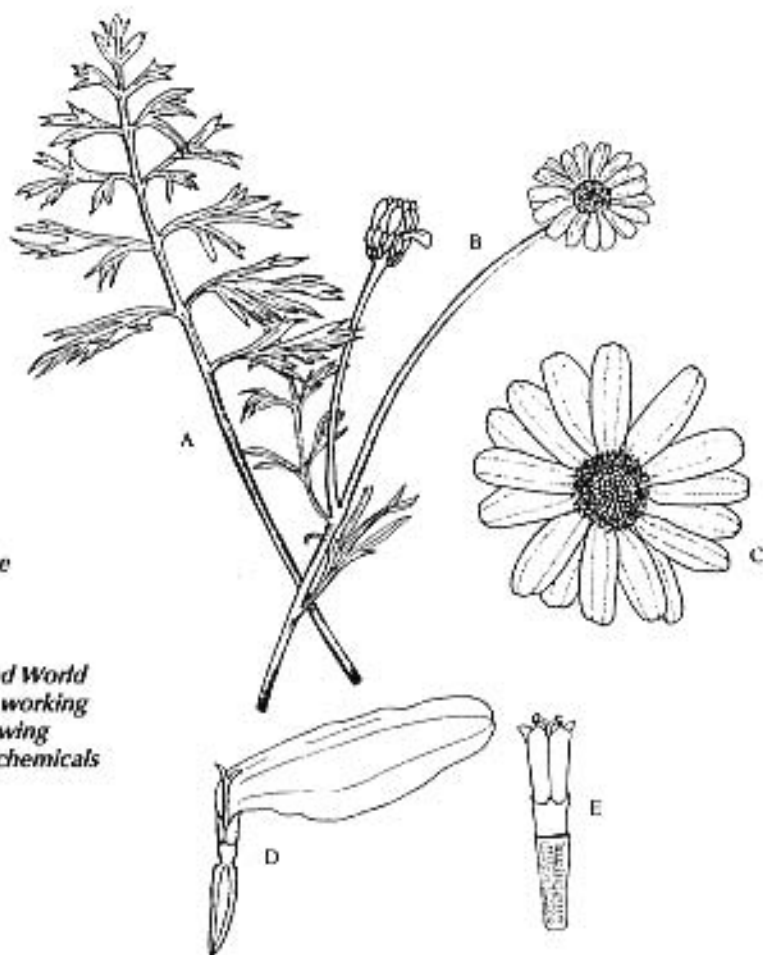


*Pyrethrins are a group of economically very important natural plant insecticides. These compounds are derived from the dried flowers of the pyrethrum daisy, *Chrysanthemum cinerariaefolium* (Fam. Compositae). Pyrethrum powder and extract, containing various pyrethrins, have been used as insecticides for more than a century. After the Second World War, the demonstration of the powerful insecticidal working of the pyrethrins came at a time when there was growing concern about the use of environmental unfriendly chemicals such as DDT.*



## Natural insecticide pyrethrum

Rik Thijssen

The natural pyrethrins have some of the qualities of an ideal pest-control agent. They are very effective against a broad range of insects and up to now there have been no reports of the development of resistant strains. Pyrethrins paralyse insects very rapidly on contact, a much valued characteristic. One of the major advantages of the pyrethrins is their low toxicity to all warm-blooded animals including human beings.

Pyrethrins processed from pyrethrum plants are not stable making the insecticide not so useful for crop protection. The pyrethrins are an effective pesticide only when exposed to light and when air is limited. This means they can be used effectively in domestic sprays but are not efficient or economic when used to control pests in agricultural crops and in forest areas. However, industrial imitations of pyrethrins called pyrethroids can be used for general crop spraying.

### The plant

Pyrethrum plants grow wild on the Dalmatian coast of Yugoslavia. In 1929, Captain Gilbert Walker, who was the first planter to grow pyrethrum commercially in Kenya, imported some seed from

Yugoslavia and planted it on his farm in the highlands near Nakuru town. With the outbreak of the Second World War, Kenya became the leading producer of pyrethrum, a position it still retains, and Nakuru remains the centre of production.

Pyrethrum is a perennial herb with white-yellow flowers that grows to a height of about 60cm. In Kenya it is grown by more than 100,000 small-scale farmers at altitudes between 1500m and 3000m. Pyrethrins are concentrated in the flowers to a level of 1 to 2 percent of dry weight. Pyrethrin content is larger at higher altitudes. The pyrethrum plant is propagated by seeds or vegetatively by splitting parent plants. The first flower picking takes place about 4 months after planting seedlings or splits, and thereafter at intervals of 2-3 weeks during flowering, a period which, in Kenya, extends over 9-10 months of the year. The flowers are picked by hand, usually by women and children, and a skilful picker can harvest up to 25kg of fresh flowers per day. The harvesting of flowers is labour intensive, and this has resulted in a decrease in cultivation in some parts of the world.

### Production and market possibilities

A special assessment study by the Biotechnology Programme of the Dutch Ministry of Foreign Affairs (Jovetic, 1994) concludes that despite high global market demands for natural pyrethrins, it is very

unlikely that production of pyrethrum materials 'in vitro' in greenhouses will be commercialised in the near future as productivity is low when compared to farm production. In addition, the market price of pyrethrins is not very high and the natural source is a relatively high-yielding and fast-growing plant, with not very strict climatic requirements.

The yield of fresh flowers and the content of pyrethrins depend on the variety used, and on factors such as soil, climate, picking interval, and drying methods. On average, 3 to 4kg of fresh flowers yield 1kg of dried flowers. About 250kg per hectare of dried flowers are produced during the first year, increasing to 1000-1200kg per hectare for the second and third year. The price of dried pyrethrum flowers depends, of course, on the quality, but with an average pyrethrins content of 1.5 percent farmers in Kenya get US\$1 per kilo. After the third year yields decline.

In the early days pyrethrum was exported from Kenya as baled dried flowers and contained a minimum of 1.3 percent pyrethrins. Pyrethrum flowers are now processed by the Pyrethrum Board of Kenya and marketed as an extract containing 25-50 percent pyrethrins. Present production in Kenya is about 10,000 tons of dried flowers per annum, roughly 50 percent of the world production. The largest importers of pyrethrins are the USA and Europe.

## New uses of pyrethrum

In the past, growing pyrethrum was seen as the way small-scale Kenyan farmers raised a little cash for their farm family. All the produce was sold to the processing industry and few farmers were really aware of the potentials of pyrethrum. Extension agents from the Pyrethrum Board gave pyrethrum growers advice on the technical aspects of production and the best drying techniques for the harvested flowers. In return farmers were able to generate a regular and reasonable amount of money.

Recent developments, however, have opened up new and interesting options for the use of pyrethrum in pest management on smallholdings. A combination of pyrethrum and non-toxic piperonyl butoxide results in a powder that is highly effective in preventing insect damage to stored grain, particularly wheat, maize, barley and oats. This powder, mixed with grain immediately after harvest, controls weevils, beetles, grain borers and meal worms for up to two years. Both large- and small-scale users can apply it easily and safely. A similar formula was designed by researchers from the Kenya Agricultural Research Institute (KARI) to protect stored tobacco from the cigarette beetle and the tobacco moth.

Other very interesting new developments are related to the initial problem of what to do with the 'waste materials' of the pyrethrin industry. Out of every 10 lorries delivering the dried pyrethrum flowers to the factory, 9 lorries can be filled with the powder that remains after pyrethrins have been extracted. It was found that this powder, the pyrethrum marc, was a healthy feed supplement for dairy cattle, sheep, goats, pigs and horses and is comparable to other common feeds such as hay, Napier grass and bran (Table 1). Pyrethrum marc is sold to farmers at Ksh300 (about US\$5) per 50 kg bag.

It has been reported that livestock fed on pyrethrum marc have a reduced load of intestinal parasites and have ticks less often. Regular feeding with pyrethrum marc also results in an improved general appearance and has meant that farmers presenting livestock for display in agricultural shows now put their animals on a pyrethrum marc diet. The output of the factory in Nakuru sustains about 10,000 cows every year at the recommended feeding level of 3 kg per day per adult animal.

Farming Systems Kenya, an NGO, and farmers have been experimenting over the last six years with the use of pyrethrum marc to control maize stem-borers, one of the most important pests of Kenya's staple



Gathering pyrethrum flowers

food. Female moths deposit their eggs on the leaves of the maize plant and the larvae eat out extensive tunnels in the stem. This sometimes results in complete crop failure. A small handful of pyrethrum marc with a slightly higher level of pyrethrins (about 0.3 percent), placed in the heart of the plants at the critical time when the stem-borers' eggs hatch, can almost completely control this hazard. With a grant from the UNDP Global Environment Facility (GEF), Farming Systems Kenya will now begin an awareness and training campaign to share these findings with more farmers and to develop better ways of fitting the on-farm production and use of Pyrethrum into existing farming systems.

The Kenya Institute of Organic Farming (KIOF), an NGO that has been promoting organic agriculture since 1986, describes the preparation and use of pyrethrum to control insects such as aphids, white fly, spider mite, mealy bug, on crops in its **Field Notes on Organic Farming** in the following way. Boil 500 g of fresh pyrethrum flowers in four litres of water to make a 'strong tea'. Let the infusion cool before straining or filtering. Dilute this mixture with an equal amount of water made soapy with a 30 gram bar of soap. Soap enhances the effect of pyrethrum by making it stick better to the plants. The mixture should then be applied to or sprayed on the affected crop.

Meanwhile, some farmers have been experimenting with pyrethrum on their

own. Hellen Chirchir, a retired teacher with a farm in the termite- and tick-infested drier areas of Kericho district, is a good example. She was given about half a kilogramme of dried pyrethrum flowers by a friend in Molo, one of the major pyrethrum growing areas in Kenya, 40 km from Nakuru. She pounded the leaves into a powder and because she had read somewhere that mixing pyrethrum with sesame oil would increase its effectiveness against insects she mixed the pyrethrum powder with half a litre of sesame oil and 3 litres of used deep-frying oil. After making a small opening in two termite mounds on her farm she poured a little of this mixture into the mounds every day for about a week. Much to her surprise the termites disappeared completely after a week.

Later Mrs. Chirchir found that mixing a little pyrethrum powder with milking salve and smearing this mixture under the tail, the legs, and behind the ears of her dairy cows protected them from tick attack. Her only regret is that she cannot grow pyrethrum on her farm.

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### References

-Jovetic, S., 1994. **Pyrethrins and production by 'in vitro' systems**. DGIS, Min. of Foreign Affairs, The Hague, The Netherlands.

### Useful addresses

- Farming Systems Kenya, PO Box 2816, Nakuru, Kenya.  
- Kenya Institute of Organic Farming, PO Box 34972, Nairobi, Kenya.  
- Pyrethrum Board of Kenya, PO Box 420, Nakuru, Kenya.

Table 1. Nutritive value of Pyrethrum marc.

Proteins	Carbohydrates	Fibre	Minerals	Oils	Pyrethrins
13%	56%	23%	7%	1%	0.1%