



Issue Paper 2

Butterflies, insects and genetically modified crops

The impact of genetically modified (GM) crops developed to produce their own insecticides has been the subject of ongoing monitoring globally. One of the major areas of interest is the possibility that such GM crops may harm beneficial insects as well as the insect pests they were designed to target.

The possibility of beneficial insects being harmed by GM crops was highlighted by the publication of a laboratory study involving monarch butterfly caterpillars by Dr John Losey from Cornell University in 1999. Monarch caterpillars feed on milkweed which sometimes grows near corn fields in the Midwest of the USA. The scientist considered the possibility of pollen from GM corn drifting in the wind onto nearby milkweed and the affect it could have on monarch caterpillars.

The controversial study showed that pollen from GM corn containing the insecticidal *Bacillus thuringiensis* (Bt) toxin gene killed monarch butterfly caterpillars. The Bt corn is modified to stop attacks by the European corn borers, a major pest. The study has subsequently attracted much attention both in the media and in scientific discussions.

The experiments

Dr Losey's experiments were preliminary and conducted in a laboratory, not in the field. Milkweed was 'dusted' with pollen from Bt corn and non-GM corn plants. Monarch caterpillars were then allowed to feed on the leaves. After four days the researchers found that around half the caterpillars on the Bt-pollen coated leaves died. The survivors were around half the size of the other caterpillars and their leaf consumption was less.

This study was carried out in a laboratory and does not consider interactions between monarch caterpillars and pollen in the field. Several entomologists and other scientific experts in this area urged caution in the interpretation of these results. Dr Losey himself stated that it would be inappropriate to extend the results from the laboratory into the field.

He said, "Our study was conducted in the laboratory and, while it raises an important issue, it would be inappropriate to draw any conclusions about the risk to monarch populations in the field based solely on these initial results". Dr Losey also said that the proven benefits of growing Bt corn outweigh the risks.

Indeed, studies of farmers growing Bt corn show that insecticide use is decreasing, a factor that should be beneficial not only for the monarch but other insect species and the environment overall.

Differences between laboratory studies and field conditions

The major differences between Dr Losey's laboratory study and field conditions were:

- The primary period of monarch egg laying and caterpillar feeding in the field takes place well before corn produces pollen - thus it is highly unlikely that monarch caterpillars would feed on milkweed with significant amounts of pollen from corn.
- Monarchs prefer to fly in open areas and lay eggs on small milkweed plants in open areas, not in tall corn.
- Corn pollen is relatively heavy and only about 30 per cent drifts further than eight metres, therefore, only milkweed which grows close to corn will come into contact with pollen.
- It is impossible to determine how closely Dr Losey came to matching actual pollen 'dusting' in the field of milkweed leaves from corn, or even if there is a consistent pattern to this.
- It is not known what level of normal corn pollen a Monarch larva can tolerate.
- Even where monarchs lay eggs on milkweed near corn crops, pollen has to be on a particular milkweed leaf in significant amounts at the time the caterpillar is feeding. The caterpillar would not normally eat a leaf with pollen but move onto a lower leaf with less or no pollen.

Monarchs are neither endangered nor threatened

The monarch butterfly is neither an endangered nor a threatened species in North America. The biggest possible threat to the monarch is the destruction of winter habitat in Mexico. Other factors that may

affect monarch populations are weed control that reduces milkweed, and the use of insecticides on crops.

Field trials exploring the impact of Bt corn on monarchs must be compared with the impacts of conventional farming systems, including insecticide impacts. Ongoing monitoring of corn fields shows that insect diversity and numbers are significantly higher in Bt corn fields when compared with conventional corn fields treated with insecticide sprays. This is an indication of real improvements in farming systems and integrated pest management systems made possible through the use of GM crops.

Following the results achieved by Losey, further studies were undertaken in the USA to investigate the impact of Bt corn varieties on the monarch butterfly caterpillars.

Further studies conducted

Six scientific papers were published in September 2001 further investigating the impact of Bt crops on monarch butterfly populations, however these did not attract significant media attention.

The six papers were published in the *Proceedings of the National Academy of Science (PNAS)*. Their overall conclusion was that although monitoring should continue, any risks from Bt corn to the monarch butterfly were relatively minor.

Further information

'Butterflies, GM crops and social responsibilities.' (2002). Science and Development Network. www.scidev.net/Editorials/index.cfm?fuseaction=readeditorials&itemid=12&language=1

Proceedings of the National Academy of Sciences (2001). Six articles available: vol 98. no 21. www.pnas.org/cgi/search?fulltext=Monarch&submit.x=12&submit.y=13

'Three years later: genetically engineered corn and the monarch butterfly controversy.' (2002). Pew Initiative on Food and Biotechnology. www.pewtrusts.org/our_work_report_detail.aspx?id=33380