Butterfly Conservation

Saving butterflies, moths and their habitats

BUTTERFLY CONSERVATION POSITION PAPER

GENETICALLY MODIFIED CROPS

1. Why are genetically modified crops of concern to Butterfly Conservation?

Genetically modified (GM) crops and GM food and their potential effects on human health and the environment have become major issues in recent years. Whilst cultivation of GM crops may have no impact on the environment and may even have the potential to benefit biodiversity in arable farmland, it may also have adverse impacts on wildlife, including butterflies and moths and their habitats. This position paper addresses the main concerns of Butterfly Conservation with respect to the impact of GM crops on Lepidoptera and aims to clarify some of the issues for Society members and other interested parties. Here we are primarily concerned with the possible introduction of GM crops into the UK although any negative impacts on non-pest Lepidoptera throughout the world will clearly be of concern.

2. Butterfly Conservation's principles

The Society will base its view on GM crops on the best available scientific evidence on the impact of GM crops on biodiversity, and especially any proven or likely impacts on butterflies, moths and their habitats. These may be either direct impacts on butterflies and moths themselves, or indirect impacts on agricultural production and land use. Butterfly Conservation's position will be based on the precautionary principle that GM technology should not be introduced until any likely adverse impacts on Lepidoptera and other wildlife have been studied and their ecological significance evaluated.

3. What are genetically modified crops?

All organisms contain a unique set of instructions within their cells controlling growth and development. The instructions are contained in a long molecule called DNA which is divided into sections called genes which code for the synthesis of proteins which then control different aspects of the organism's structure or development. Genetic engineering or modification involves the insertion of a gene from the cells of one organism into another, thereby transferring the ability to synthesise ('express') a protein with functions that the recipient organism doesn't have naturally.

In the case of two types of GM crops causing current concern, genes that code for proteins that confer resistance either to **insect** herbivores or to **herbicides** are copied from the DNA of one species (sometimes a bacterium or invertebrate animal) and inserted into the DNA of the plant so that the resultant cultivated crop becomes similarly deterrent or resistant. Examples include genetically modified maize ('sweet corn'), soya and tomatoes that are already grown widely in the USA and Canada, and used in processed foods sold in the UK. Increased yield and reduced pesticide use make the development of GM crops more favourable for commercial exploitation. So far no insect resistant crops are grown in the UK but are being grown commercially in Spain, and GM herbicide tolerant (GMHT) crops have been grown recently in small experimental plots and in field-scale trials.

4. Potential impacts on butterflies and moths and their habitats

There are three main types of impact on Lepidoptera that may result from the development and cultivation of GM crops: 1) Direct insecticidal effects, usually on the larval stage; 2) Indirect harmful effects resulting from changes in farming practice or in the ecological balance between plants, Lepidoptera and their predators; and 3) Possible beneficial effects on farmland biodiversity due to reduced insecticide and herbicide use.

4.1 Direct insecticidal effects

- Genetic modifications in crops to make them more resistant to pest herbivores have been practised by conventional breeding techniques for generations and the bacterial toxin from *Bacillus thuringiensis* (Bt) – the only one used currently in commercial GM crops - has been used as an externally applied insecticide since the 1950's. What is new in GM crops is the transfer of the ability to express these toxins (there is a range of them with some insect target selectivity) in the crop plants themselves. These toxins can sometimes also appear in plant structures such as pollen, which has the possibility of being blown and could potentially harm butterflies and moths that breed in and around the crop. Recent research in the USA highlighted this as a potential problem for the Monarch butterfly, although further field and laboratory studies have shown this not to be the case.

- Crops with GM characteristics such as insecticidal toxin may cross pollinate with adjacent closely-related wild plants making them harmful to non-pest butterflies and moths.

4.2 Indirect harmful effects

- GM herbicide tolerant plants have been developed to allow them to survive spraying by broad-spectrum herbicides such as glyphosate. Although herbicide tolerance in crops can be achieved through conventional breeding techniques, GM technology makes such modifications easier and this could further accelerate the intensification of agriculture and lead to further loss of naturally occurring nectar plants and larval foodplants in and around farmland.

- Recent field scale trials have shown that some, but not all, GM herbicide resistant crops support significantly less biodiversity compared to conventional equivalents.

- Recent trials have shown that pollen from herbicide resistant GM crops can cross-pollinate with related plants growing nearby. This could lead to the creation of weeds that are difficult for farmers to control and could provide an incentive for additional spraying. Such resistant weeds can also result from the regular use of herbicides in conventional crops.

- Changes in cropping patterns due to the introduction of GM crops are difficult to predict but could have major impacts on habitats of butterflies and moths. For example, future GM crops could be developed to grow outside their existing geographical or altitudinal range - for example further up hillsides and on poorer soils, replacing native grasslands and other semi-natural habitats which may have considerable wildlife interest.

- Crops support not only 'pest' insects but also other arthropods that feed upon them as predators or parasitoids. Insecticidal GM crops have the potential to disrupt the balance between plants, herbivorous insects and natural biological control by 'beneficial' insects and the wider ecological effects on this hierarchy need to be included in any risk assessment.

4.3 Benefits to wildlife

The intensification of agriculture in the UK since 1950 has led to major losses of habitat and a reduction in biodiversity, including butterflies and moths. The cultivation of GM crops could help reverse certain aspects of intensification and lead to some beneficial effects on wildlife. This potential for good needs to be set against the potential for harm in any balanced appraisal of the impact of GM crops.

More efficient farming with higher yields may, with suitable incentives, allow the area under cultivation to be reduced and important wildlife habitats (e.g. field margins) to be re-instated.

Given appropriate changes in farming practice, herbicide-tolerant crops could allow more accurate timing and selective use of weed control and reduce the need for repeated spraying. This could result in more weeds (i.e. potential larval foodplants and nectar sources and roosting habitats) at certain times of year and greater numbers of invertebrates in the cropped area, and of the predators (including birds) and parasitoids that depend on them. Finally, the cultivation of GM crops resistant to target pest insects could lead to a reduction in use of insecticides particularly non-selective 'broad spectrum' ones.

Butterfly Conservation is supporting:

1. A balanced science-based approach that neither over-emphasises nor under-estimates the risks to wildlife including butterflies and moths and a precautionary approach to the planting of GM crops in the UK and elsewhere.

2. More detailed research into the possible environmental effects of GM crops on wildlife. Any potential GM crop should be the subject of a biodiversity impact assessment, including large field scale trials where appropriate. Such crops should only be granted permission to be grown commercially if they can be shown to have no adverse impact. Butterflies and moths are key indicator species of the health of the environment and the Society's already considerable knowledge and expertise in this area should be more extensively used in this research and financially supported.

3. A more clear and accountable regulatory and approval process for GM crop planting for experimental purposes, building on the work of ACRE (the Advisory Committee on Releases into the Environment).

4. Clear labelling of foods containing products from GM crops to allow consumers the choice whether they wish to support this new type of agriculture or not.

5. Butterfly Conservation is also working with Wildlife and Countryside Link to share knowledge about GM crops and their impacts, and to gain a consensus with other voluntary conservation organisations.