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**Importance of honey bees**

- Honey bees are a major pollinator group providing essential pollination of crops to maintain yield and variety of food crops.
- Products of the honeybee: honey, wax, propolis, royal jelly, pollen.
- Honey bees face many threats, including: lack of forage and reduced diversity of forage owing to intensive agriculture, pests, parasites and diseases, effects of pesticides used on crops, and adverse weather.

**Surveys in Scotland 2006-2017**

- We began surveys of beekeepers in 2006\(^{6,7}\), to study beekeeping experience as a result of the Varroa mite moving north (Fig. 4):
  - The COLOSS (Prevention of honey bee Colony Collapse Disorder) has occurred elsewhere to a more limited extent\(^{3}\), and is now less common.
  - CCD has not occurred anywhere to the same extent as in North America.

**Winter loss rates internationally**

- Varying patterns of loss rates between countries and regions from year to year (Fig. 7)\(^{6,7,8}\).
  - Responses will vary depending on the local beekeeping experience as a result of the Varroa mite moving north.

**References**


**Ongoing work**

- Monitoring patterns and trends in loss rates
- Risk factors include queen problems, Varroa treatment strategy, forage availability and pesticides\(^{7,8}\).
- Current work is identifying the role of temperature and rainfall levels at critical times of year using generalised linear mixed models (GLMMs) for the risk of colony loss.

**Winter losses in Scotland**

- Overall proportion of colonies lost varies (Fig. 6).

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- We began surveys of beekeepers in 2006\(^{6,7}\), to study beekeeping experience as a result of the Varroa mite moving north (Fig. 4):
  - Term colony collapse disorder (CCD)\(^{2}\) owing to rapid disappearance of most adult worker bees, leaving brood, queen and food stores.
  - Lack of dead worker bees inside and near the hive, and with delayed invasion of hive pests and robbing of honey by nearby colonies.

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