

Trends in Commercially Reared Bumblebee Importation for Pollination in Ireland

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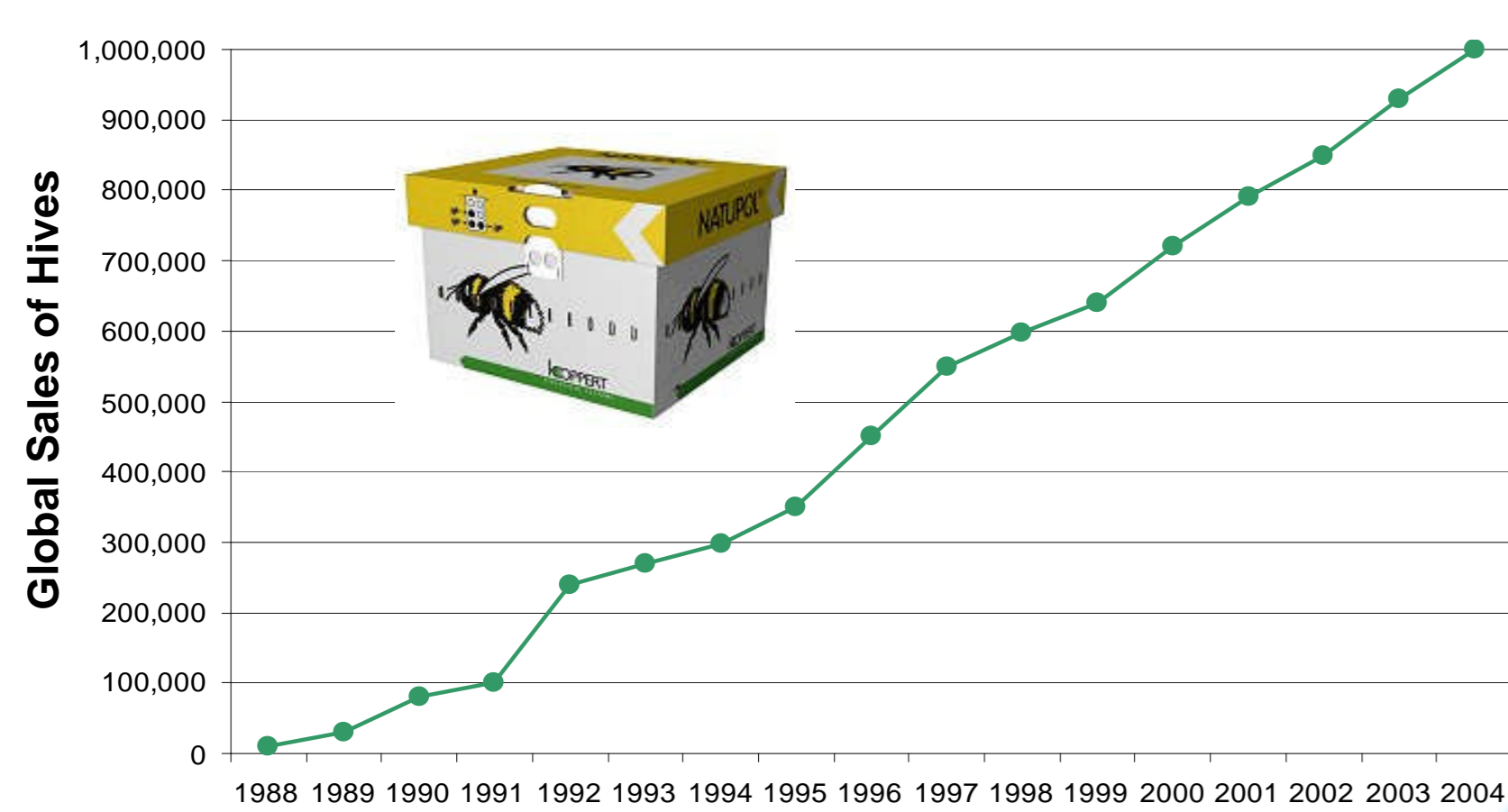


Figure 1. Global sales of bumblebee hives from 1988-2004 (Velthuis & van Doorn, 2006)

Commercialisation of Bumblebees

Bumblebees (*Bombus* spp.) pollinate a wide range of crops and can be used where honeybee pollination is poor. For example, bumblebees forage at under a wide range of weather conditions, including low temperatures, wind and rain. Currently, over 19 countries worldwide have production facilities for bumblebees with sales of bumblebee hives worth over €55 M p.a. (Fig. 1; Velthuis & van Doorn, 2006). The increased yields produced by bumblebee pollination far outweigh the cost of the hives, e.g. globally the bumblebee pollinated tomato crop alone is valued at €12 B p.a.. In Ireland, the top five fruit and vegetable crops have a farmgate value of €35.7 M p.a. of which €11.5 M p.a. is due to bee pollination.

Environmental Concerns

1. Establishment

Most commercially reared bumblebees are used in glasshouses and plastic tunnels. However, due to the need for ventilation and inadequate disposal of colonies, many bees frequently escape. Colla *et al.* (2006) found that over 75% of the pollen carried by commercially reared bumblebee workers is from plants outside of glasshouses. Commercially reared bumblebees have now become established in many countries outside their native range, such as Brazil, Chile, Japan, Tasmania and Uruguay.

2. Hybridization

In Europe, *Bombus terrestris terrestris* and *B. t. dalmatinus* are reared commercially, neither of which is native to Ireland (Fig. 2A). Biological differences exist between the different subspecies for colour preference and foraging performance (Ings *et al.*, 2005), and distinct genetic differences have been found between continental and Mediterranean island populations (Estoup *et al.*, 1996). *In vitro*, subspecies readily hybridise, but as subspecies are difficult to differentiate in the field, there is no information on rates of hybridization in the wild. Morphologically, queens of the subspecies unique to Ireland and Britain, *B. t. audax*, can be differentiated from non-native queens (Figs. 2B & 2C).

3. Pests and Disease

Transmission of pests and diseases to wild populations has occurred in areas where imported *B. terrestris* is not native (Niwa *et al.*, 2004; Colla *et al.*, 2006). The introduction of a novel strain of microsporidian parasite, *Nosema bombi*, by commercially reared bumblebees has been implicated in the extinction of one, and rapid decline of two, North American species (NRC, 2006). Current methods used by companies to screen for *N. bombi* may be inaccurate, with up to 75% of infections being overlooked (Klee *et al.*, 2006).

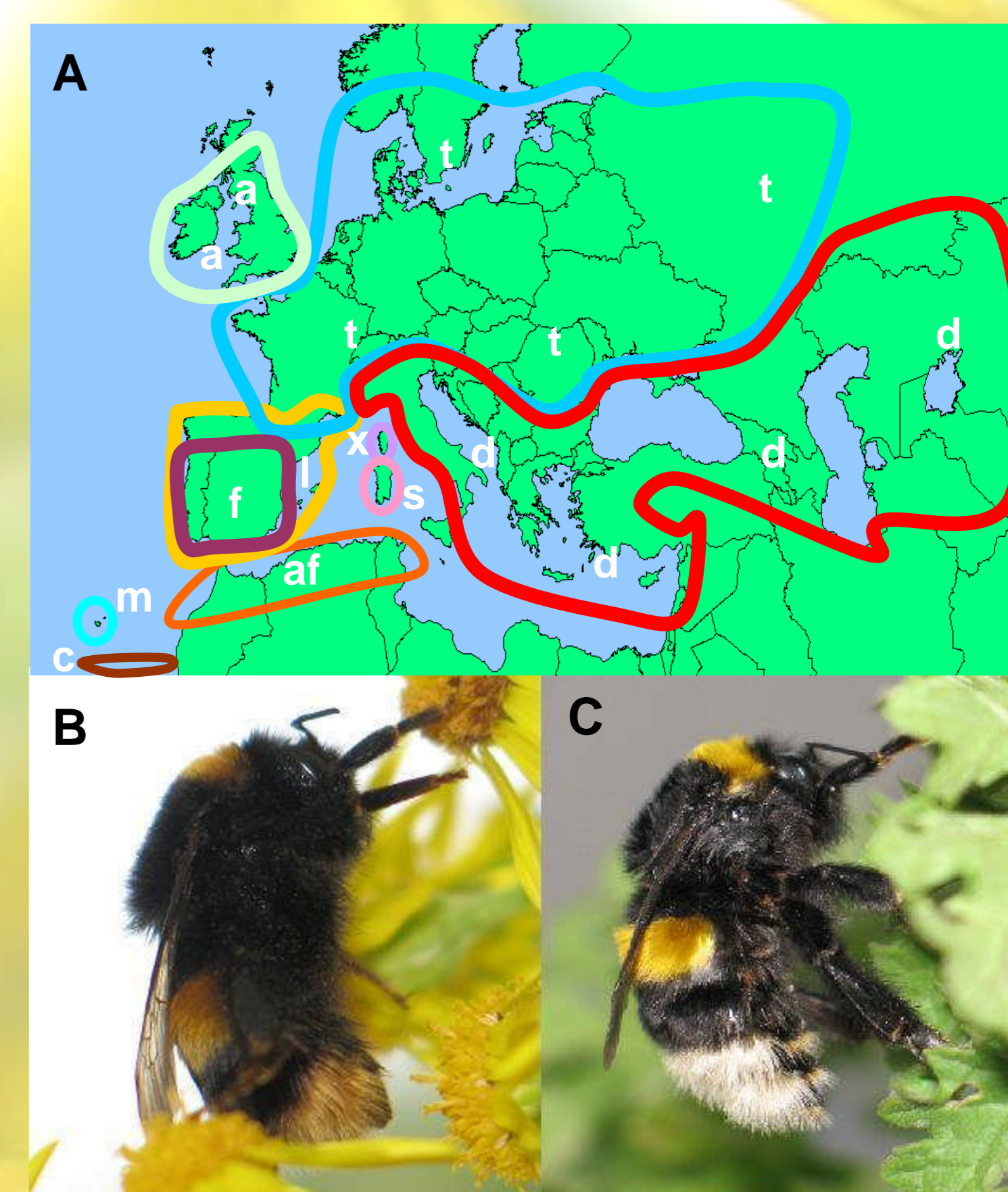


Figure 2. A. European distribution of *B. terrestris* subspecies. B. Native Irish *B. t. audax*. C. Continental European *B. t. dalmatinus*.

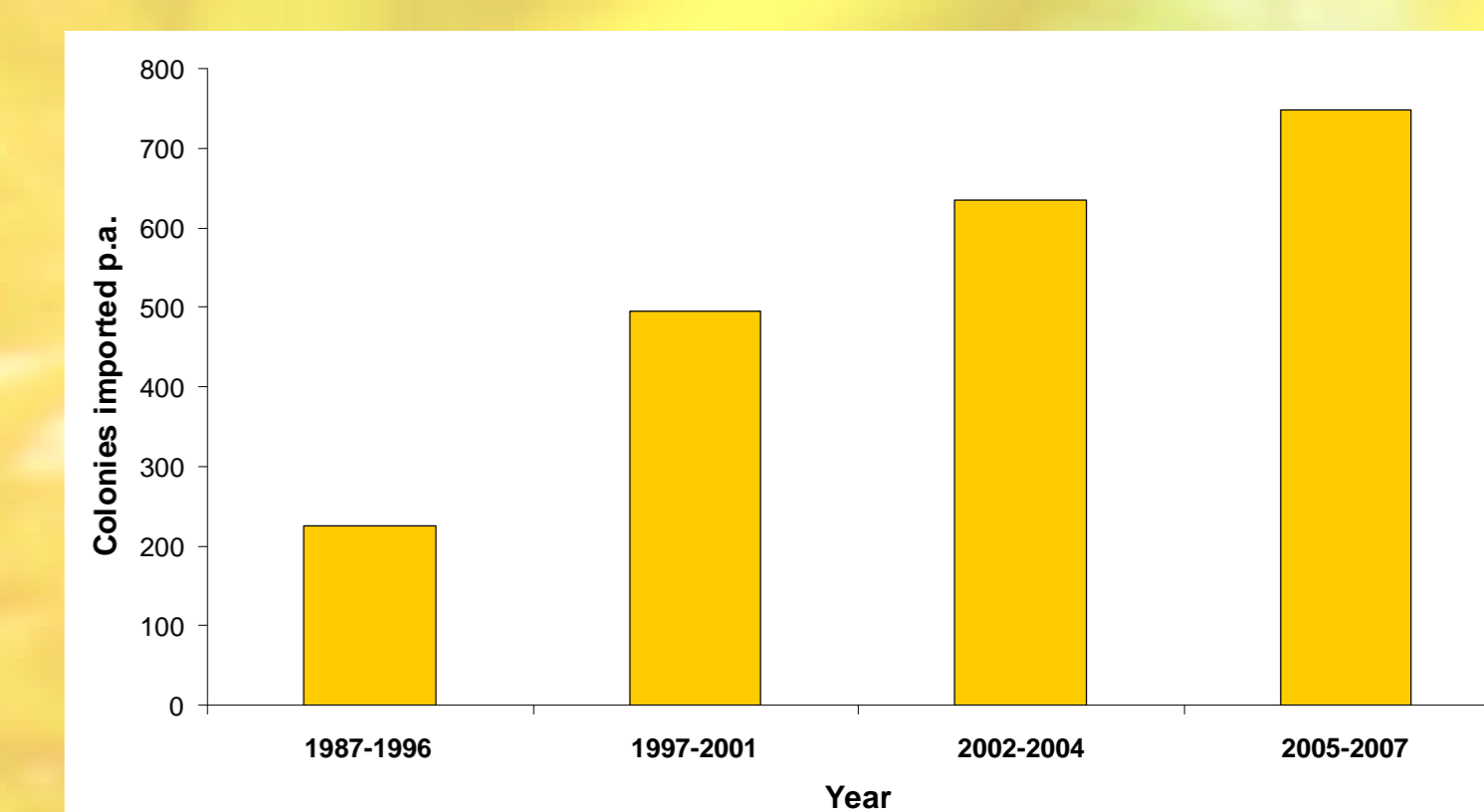


Figure 3. National importation of commercially reared bumblebees from 1988 to present.

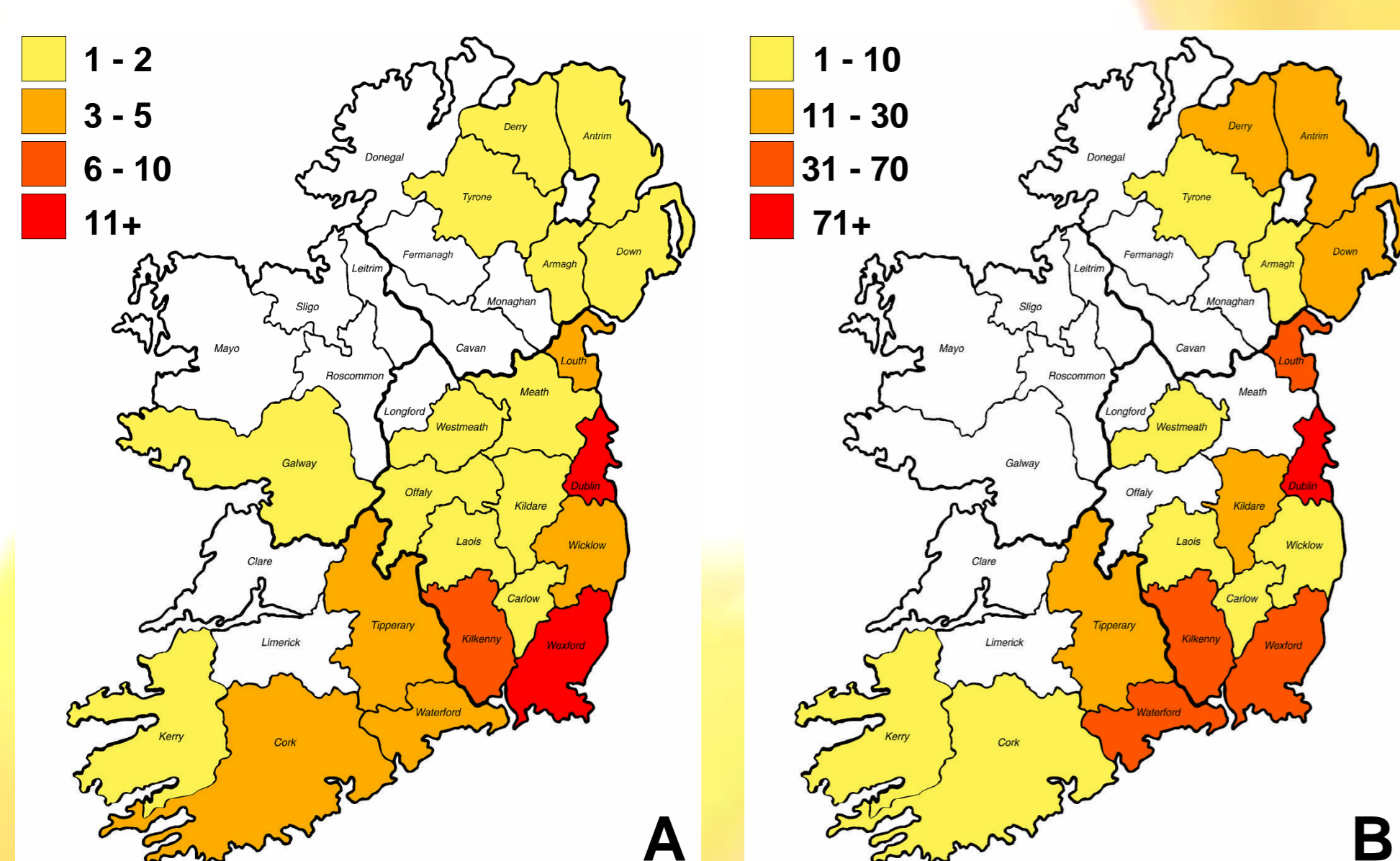


Figure 5. A. Areas of fruit production in Ireland and the number of respondents to the survey. B. The distribution and number of imported hives of commercially reared bumblebees.

All-Ireland Survey

As a first step in establishing the extent of bumblebee importation into Ireland, we conducted a postal survey of fruit and vegetable growers in both the Republic and Northern Ireland.

Results

- 56% response rate (77/137).
- The importation of bumblebees is increasing, with approx. 1500 colonies currently imported p.a. (Fig. 3).
- Colonies are predominantly employed for strawberry pollination (47.8% of responses; Fig. 4).
- Importation is primarily on the east coast, where fruit production is concentrated (Fig. 5).
- Imported colonies begin producing reproductive individuals 8-10 weeks after importation. 8-10 weeks after the peak period of importation coincides with the seasonal emergence of native *B. t. audax* queens and males (Fig. 6).
- 3.3% of growers believed importation had a positive effect on native bumblebee populations; 13.3% believed it had a negative effect; 30% believed it had no effect; and 53.4% stated they did not know.

References

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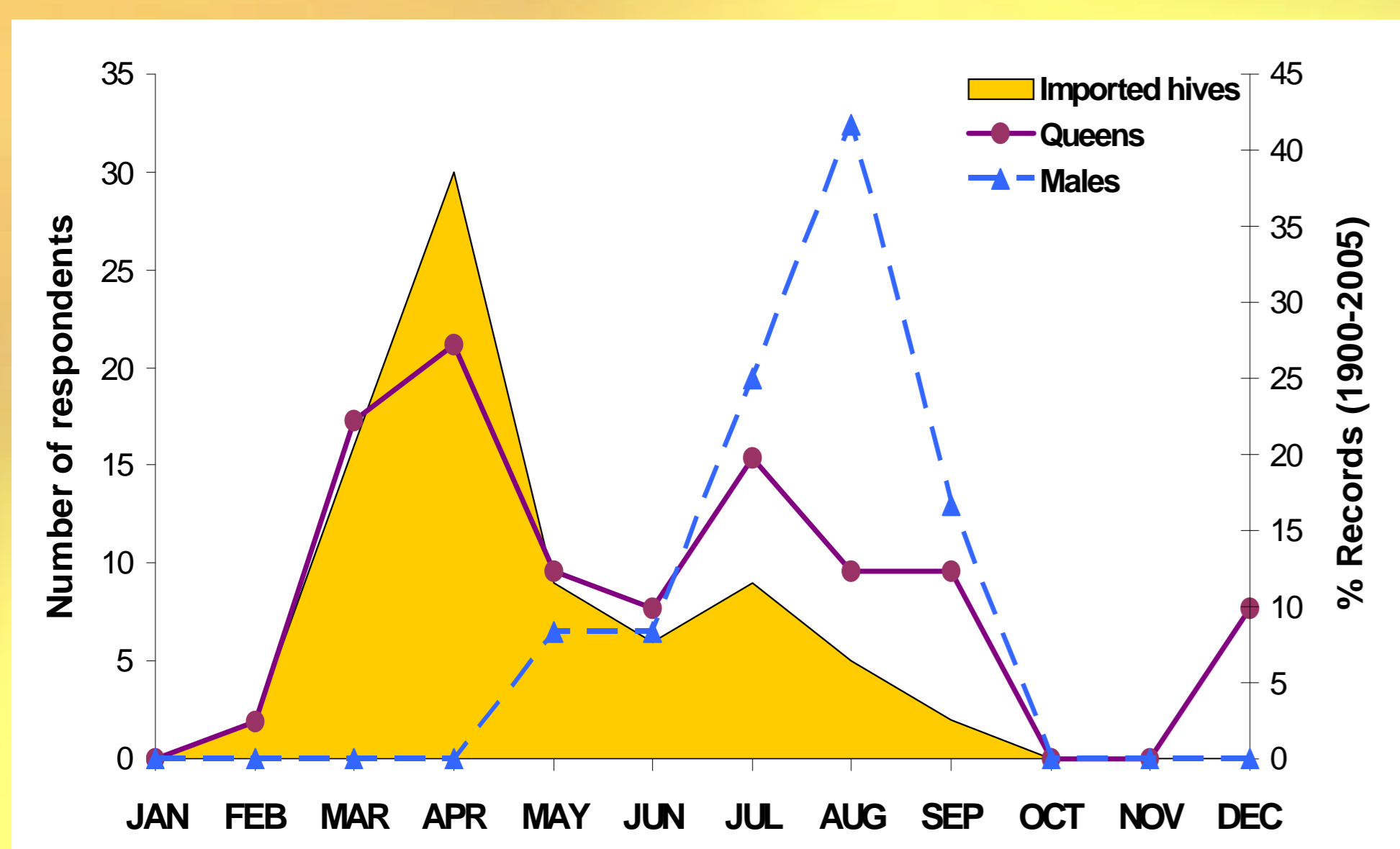


Figure 6. The seasonal distribution of bumblebee importation and the emergence times of native *B. t. audax* queens and males based on 436 records from 1900-2005.



Figure 4. Crops for which bumblebees are being imported. The farmgate values (in € M p.a.) of the top four crops are provided above bars.

Future Work

- Phylogeography and population genetics of *B. terrestris* in north and west Europe (in collaboration with Carlow IT).
- Epidemiology of macro- and microparasites in native and commercially reared bumblebees.
- Pollination biology, on-site management and recommendations for policy relating to the importation of bumblebees.