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NOTES AND COMMENTS

Surveys to estimate winter losses in Switzerland

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In Switzerland, beekeeping is with rare exceptions a hobby, and about 18,000 apiculturists manage approximately 190,000 colonies. In winter of 2002/03, several Swiss beekeepers reported unusually high colony losses in their apiaries to our centre. We therefore conducted a survey in spring 2003 throughout Switzerland to obtain a more detailed picture, and to identify possible factors of colony mortality. A questionnaire was included in the Swiss Beekeeping Journal which yielded answers from 557 beekeepers keeping 9,629 colonies. The questionnaire included questions on: 1) geographic location of apiaries (including altitude); 2) surrounding crops (maize, rape or sunflower); 3) *Varroa destructor* control methods; 4) type of winter food and; 5) extent of colony losses (number of colonies on 1 October 2002 and 1 April 2003). The mean ± se losses during the winter of 2002/2003 were 17.6 ± 13.3%, and 7% of the beekeepers lost more than 60% of their colonies (Fig. 1). We found no obvious geographic pattern of winter losses in relation to climatic zones, apiary altitude (<700 m, 700-1000 m or >1000 m AMSL). Likewise, we found no influence of the nectar flow late in season (honeydew from conifers), type of winter food, crop (maize, rape or sunflower) and *V. destructor* control management strategy (summer treatment, winter treatment, formic

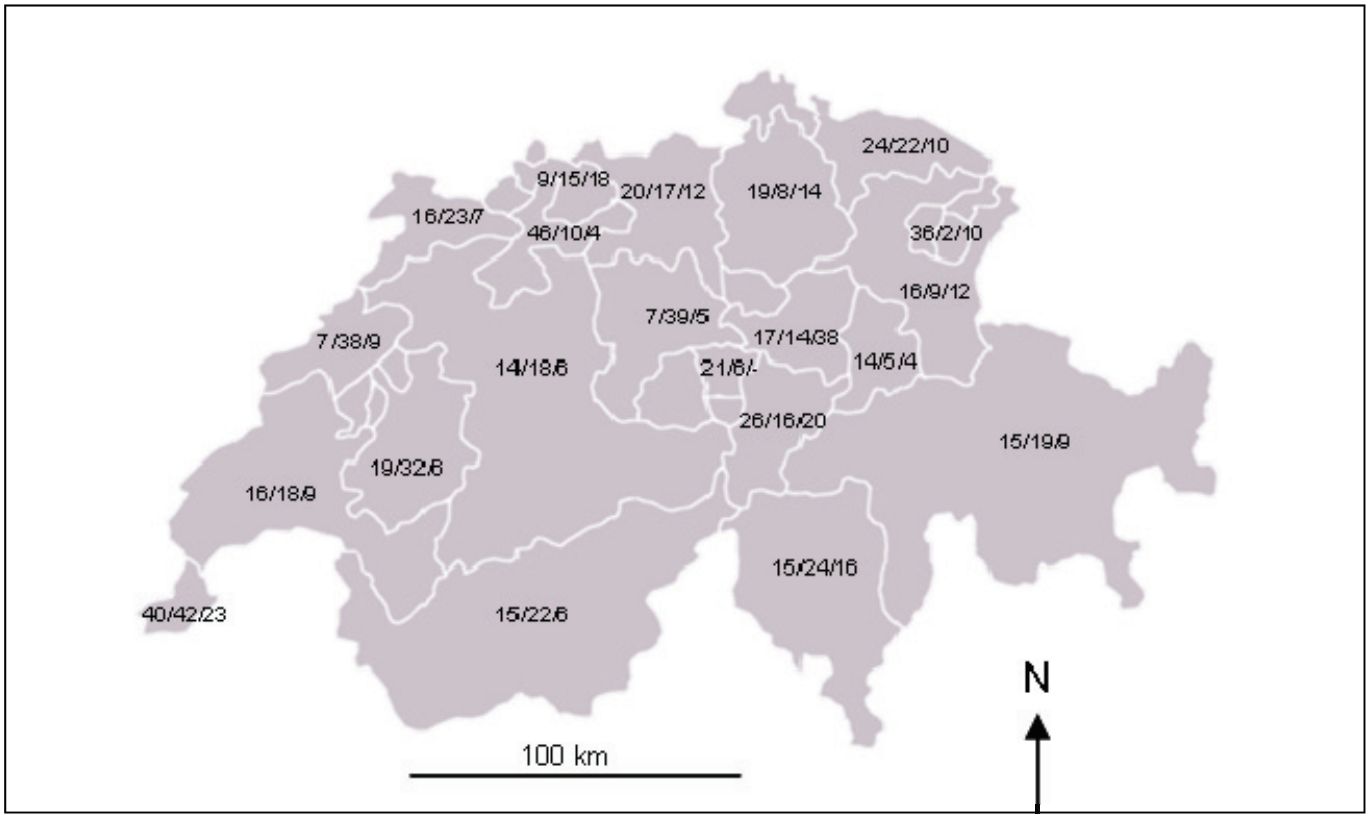

Fig. 1. Map of Switzerland with Canton borders. The mean winter losses are shown for individual Cantons (2002-2003 **/** 2007-2008 **/** 2008-2009).

acid, thymol, Apistan, Bayvarol, etc.) on the amount of losses (data from Charrière *et al.*, 2004). Such a questionnaire is, however, probably not sensitive enough to evaluate the complex *V. destructor* control issue (number and timing of treatments, type of product used, ambient temperature during treatments, quantity of product, precise mode of application, re-invasion, etc.).

In the winter of 2003/04, losses were considered to be normal at less than 10% (data not shown). Based on rough estimates from the Swiss Beekeeping Association, mean losses in the winter of 2004/05, were 10-15%. In the winter of 2005/06, however, losses were locally about 30% according to regional (canton) monitoring systems (Jura: 37%; Vaud: 31%). Based on a non-systematic survey performed by the Swiss Beekeeping Association less than 10 % of colonies were lost in the winter of 2006/07 (data not shown). In the winter of 2007/08, we obtained the first data from the new national survey, which was implemented in close collaboration between the Swiss Bee Research Centre and the beekeeping associations (Fig. 1.). A representative panel of 472 beekeepers distributed throughout Switzerland and managing 8,200 colonies were invited via email to provide data about their winter losses on a website. From 1 October 2007 until 1 April 2008, the mean colony losses in Switzerland were 17.3 ± 11.5% (ranging from 2-42% depending on the canton). In the winter of 2008/09 the national survey was repeated in exactly the same way (342 beekeepers with 5,268 wintered colonies). Winter losses were on average 9.2% (Fig. 1.).

In three out of seven years, therefore, we found no evidence for elevated winter losses. In the remaining four years, however, losses were twice or three times higher than normal. We consider the ectoparasitic mite *V. destructor* (see Dahle, 2010) in close association with pathogens (e.g. viruses, Berthoud *et al.*, 2010, Cox-Forster *et al.*, 2007; Nosema, Higes *et al.*, 2008) as a major factor for local winter losses. Clearly, we cannot exclude the possibility that pesticides used in agriculture and / or apiculture were also involved, for example at sublethal dosages. Several ongoing projects at our centre are aiming to identify the actual causes of these honey bee colony losses.

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