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Report of the Intersessional Working Group on Impact on Bat Populations of the Use of Antiparasitic Drugs for Livestock

(submitted by the convenor, Mr. Tony Hutson)

1. Background

The dung produced by livestock supports a diverse community of invertebrates, some of which are of conservation interest in their own right, and many of which provide an important food source for other animals, including bats. The degree to which bats rely on dung fauna varies among species and possibly through the range of individual species, but some species in some areas are highly reliant on such insects.

A range of drugs (endectocides) is administered to livestock to control parasites. These drugs vary in persistence and there are variations in the timing and method of application. Of particular concern are avermectins, the collective term for the active ingredients in a range of such animal health products. After application, residues of the chemicals may be excreted from the animal through its dung. Exposure to these residues can adversely affect dung insects through direct killing of adult insects or their larvae, through impairing the reproduction of the associated insects, or through delayed development and/or malformation of the insects. Toxic effects have been recorded over 140 days post-treatment.

Through its Conservation and Management Plan, EUROBATS identified that 'the impact of pesticides such as antiparasitic drugs should be carefully assessed and the appropriate advice given to land managers to avoid possible deleterious effects on bats'. This was agreed at its first, second, fourth and fifth Meeting of Parties [MoP1 (Annex K (CMP), para 23), MoP 2.14 (Annex A, para 23), MoP 4 (Record, Annex 12a, para 6b) and MoP5.Record.Annex3, p 27].

2. Intersessional Working Group

An Intersessional Working Group (IWG) was formed by the EUROBATS' Advisory Committee (Lithuania 2004) to investigate the impact on bat populations of the use of antiparasitic drugs (endectocides) for livestock, in conjunction with any work being carried out under the Bern Convention. The IWG has met at AC11 (Slovakia, 2005) and at each subsequent Advisory Committee meeting and at MoP5 (Slovenia, 2006). At Mop5 it was agreed that a final report would be made available to MoP6 (?2010).

The main agreed activities of the group were

1) to establish current practices throughout Europe via a questionnaire,

2) to carry out a literature review,

3) to identify the bat species most likely to be affected by the use of these drugs,

4) to identify any international initiatives or the presence of wider conservation concerns about the use of these drugs,

5) to identify any future action that EUROBATS should pursue regarding the effect on bats of the use of these drugs.

The group has discussed the impact on bats of such drugs and the position and activities that it would be appropriate for EUROBATS to adopt.

The group currently comprises

Tony Hutson (UK, Convenor), May Abido (Syria), Laurent Biraschi (Luxembourg), Jasja Dekker (Netherlands), Aurora Dibra (Albania), Marie-Jo Dubourg-Savage (France), Christine Harbusch (Germany), Karen Haysom (UK), Anna Nele Herdina (Austria), Thierry Kervyn (Belgium), Peter Lina (Netherlands), Kaja Lotman (Estonia), Jacques Pir (Luxembourg), Paul Racey (UK), Roger Ransome (UK), Dino Scaravelli (Italy), Laurent Schley (Luxembourg), Henry Schofield (UK), Abigel Szodoray-Paradi (Romania), Masa Zdralevic (Montenegro).

3. Questionnaire

In trying to establish the scale of use of such antiparasitic drugs around Europe a questionnaire produced by the group was circulated by the Secretariat to all range states. A copy of the questionnaire and covering note are presented in Annex A.

Responses were received from 16 range state. These are Albania, Czech Republic, Denmark, Estonia, Finland, Georgia, Germany, Ireland, Italy, Latvia, Lithuania, Portugal, Romania, Slovak Republic, Ukraine, United Kingdom.

Although this is one third of the countries circulated, it gives a good geographical spread from Ireland and Portugal in the west to Georgia in the east, and from Finland in the north to Albania and Italy in the south.

The questionnaire asked for information on the following issues:

Questions 1 and 2 asked for the name of the responding country and the compiler of the response.

Q.3. Are antiparasitic drugs used for livestock in your country?

Every responding country reported that such drugs are used in its country. In one country (Georgia) such use is compulsory, in 11 countries they are used routinely and widely, in four countries (possibly seven) they are only used in special circumstances.

Q.4. What active ingredients are approved for use?

The responses demonstrated a huge range of materials with a mixture of active ingredients and product names offered. Some respondees appended printed lists of products and/or ingredients. If further analysis of this is required it will need the services of somebody with better experience of these products and ingredients.

Q.5. What kind of animals are treated?

In order of frequency the following animals were identified:

Cattle (14), horses (10), sheep (8), pigs (8), goats (2), donkeys (2), reindeer (1).

Not strictly in the nature of the ‘livestock’ under consideration, responses also included dogs (3), cats (3), poultry (2), ‘birds’ (1) and macaques (Gibraltar).

Responses with respect to the age of animals treated were not clear, but it is thought that the majority of treatments are for young animals.

Q.6. How is the drug administered?

Drugs are administered by mouth by bolus (6), tablet (7), liquid (7), gel (8); by injection (12); and externally by spray (7), dip (5), pour-on (7).

Note that drugs administered by bolus are the most long-lived and hence widely regarded as having the most serious impact on dung fauna.

Q.7. At what time of year?

Drugs were administered at all time of year with peaks in spring and autumn:

Jan (3), Feb (3), **Mar** (**5**)**, Apr** (**10**), May (3), Jun (4), Jul (4), Aug (3), **Sep** (**7**), **Oct** (**9**), Nov (3), Dec (3).

Q.8. How often is the drug administered?

Annually (2), c.1.5 per year (3), twice per year (4).

Q.9. Are the animals indoors or outdoors when treated?

Indoors (13), outdoors (9).

Q.10. Does any national legislation/regulation or official guidelines apply to the use of such drugs?

Applicable legislation or regulation or guidelines was reported for six countries, but none reported that no such legislation/regulation existed.

Q.11. Is there any policy relating to their use in nature reserves?

No range state reported specific measures for nature reserves, nine states reported that no such guidance existed.

Q.12. Can you identify any alternative treatments that are effective?

Three states wrote that they were aware of no alternatives to treatment, five offered alternatives that included pasture rotation, biocontrol, targeted treatment to limit resistance, hygiene, breeding, vaccines, 'management'.

Q.13. Is there any recent research (since 2000) carried out in your country?

No country reported recent research in its country relating to the affects on wildlife (five reported about research on other aspects, such as resistance), and four countries reported that there had been none. It is known that there has been recent research on impacts on wildlife in UK.

Q.14. Are there special problems in acquiring information about the drugs used and their application in your country?

The topic involves a wide range of bodies and scattered sources of information. Seven countries reported difficulties in obtaining data from their various departments, but it is considered likely that most did, and that the difficulties were probably responsible for a number of other countries not responding.

Q.15. Any further comments?

Some of the comment included here is incorporated elsewhere above. One country reported that although treatment was compulsory, there was no financial assistance to animal keepers; this may affect the actual level of treatment implemented, but may also affect the control of application.

Many range states have had considerable difficulty in obtaining information on the drugs used in their country and in the methods of application. A small number of states do not use such drugs, either for reasons of cost or for difficulties of control. Where they are used the main problem is a bewildering range of products used on a wide range of animals and via a wide range of methods of application. It would seem that practices vary widely geographically.

4. Bat species most likely to be affected

Comparing bat dietary studies with information on dung fauna, an account of the bat species most likely to be affected by the impact of drugs on their insect prey has been compiled and is presented in Annex 2.

The bat species most likely to be affected are the horseshoe bats (*Rhinolophus* spp), *Eptesicus serotinus*, *Nyctalus* spp,the larger *Myotis* spp (*Myotis blythii*, *myotis*, *punicus*) and some *Pipistrellus* spp (notably *P. pipistrellus*). About 10 other species are likely to be affected, but to a lesser extent.

It has proved difficult to assess the level of impact of the use of these drugs on the prey availability and hence the foraging behaviour of these bats.

5. Possible mechanisms to reduce impact

With respect to mechanisms to relieve impact, further investigation of measures identified in Question 12 of the above questionnaire (re alternative treatments – see results in Section 2 above) could be carried out. These were pasture rotation, biocontrol, targeted treatment to limit resistance, hygiene, breeding, vaccines, 'management'. The use of non-chemical treatments (e.g. diatomaceous earth, herbal supplements) is being increasingly accepted (S. Beynon, pers. comm.).

In general, chemical treatment should be timed to cause minimum impact and should avoid the use of products more toxic to dung fauna. France has a Regulation controlling the use of such drugs (Decret 2005-935, 2 August 2005).

In general, application by bolus should be avoided. Sustained-release ivermectin bolus can cause risks for Diptera (especially Muscidae and Scathophagidae) for up to four months after application. Impacts are less on adult scarabaeid beetles, but increased in larvae; larvae of *Onthophagus*, *Euoniticellus*, *Copris*, *Onitis* and *Aphodius* may be affected for more than 140 days (Lumaret, pers.comm.).

Moxidectin is identified as a product similar to ivermectin, but having almost no effect on Diptera and Coleoptera. On the other hand, Dichlorvos, mainly applied to horses, is particularly dangerous with the main period of impact for the first ten days after application (Lumaret, pers.comm.)

Where animals can be kept indoors for about two weeks after treatment (as is common particularly in northern latitudes) most problems can be avoided. At least some beetle species will avoid dung of treated animals, so where untreated dung is within range of the beetles, the beetles will be able to maintain themselves. Problems may be particularly acute where treatment is applied over a wide area at the same time and where treatments cannot be applied while animals are kept indoors (and this may be particularly applicable to Mediterranean countries).

A number of more specific recommendations have been proposed (e.g., Ransome, 1996, Webb et al. 2006):

- Treating livestock only when necessary and avoiding treatment of older animals if they are not susceptible to the parasite of concern (this may include assessment of parasite burdens before treatment (e.g. by faecal egg count assays or FAMACHA);

- Grazing avermectin-treated livestock in fields close to others containing untreated animals;

- Treating livestock with any appropriate non-avermectin product or moxidectin (a less toxic avermectin) (see, e.g., Anon, 1998);

- Altering (if relevant from an animal health perspective) the timing of avermectin treatment in the spring (to change the period when residues in the dung coincide with key foraging periods of the vertebrates);

- Restricting the use of products containing doramectin, ivermectin or eprinomectin to housing of the livestock or in the autumn (when the main dung insect breeding season is over);

- keep stock dung free of avermectins within the home range of young bats (e.g. 0.5-1.5km of maternity roost site) of key species, such as horseshoe bats;

- as far as possible do not treat grazing animals in nature reserves with more toxic products;

- maintain an up-to-date list of chemicals used and their relative toxicity.

6. Recommended research priorities

- Investigation of any relevant differences in diet through the geographical range of key species.

- Assessment of levels of bat activity in relation to use of drugs in areas with a mosaic of drug use and non-use. (There have been some attempts at this, but thus far the data has been inconclusive).

- Assessment of any increased energetic costs to bats or decline in productivity attributable to the use of these drugs.

- [?Decomposition rates of treated dung by insects with respect to the different methods of application. There appears to be a lot of data on this already]

- Assessment and encouragement of research on alternative treatments.

- Longer-term field investigations of the lethal and sub-lethal effects of avermectins on dung fauna populations are required in north temperate regions. These will help to effectively evaluate whether antihelminthic residues in livestock dung represents a single toxic event with no long-lasting effect on populations of dung fauna or is an event that can have a detrimental impact on successive generations of dung insects and other farmland wildlife that depends on them. (O'Hea et al, 2010)

7. Bibliography

There is a very extensive literature on the subject of antiparasitic drugs and their impact. A provisional bibliography is offered at Annex 3. A review is currently in preparation by Wall and Beynon (UK); current reviews are available (Strong, 1993; Lumaret & Errouissi, 2002; Rahmann & Seip, 2006). An analysis of current procedures and impacts of the EU Directive (see Section 8) is in preparation in Belgium. The insect fauna of livestock dung is discussed in Skidmore (1991) and Lee & Wall (2006)

8. Related international initiatives and other wider conservation concerns

Although the Bern Convention had discussed the issue in 1998 and considered draft recommendations of a group of experts, there has been no follow-up through the convention. These discussions can be found in T-PVS (98) 18: pp. 83-86, Annexe 5, *Presentation relative a l'usage des endectocides et leur effets sur l'entomofaune* (by Mr le professeur Jean-Pierre Lumaret, Universite Paul Valery Montpellier, France); p. 87, Annexe 6, *Draft recommendation of the Group of Experts on the consequences of the use of endectocides on non-targeted invertebrates*).

Through Directive 2001/82/EC (6 November 2001) on the Community code relating to veterinary medicinal products (and as amended 2005), each new product must be assessed through procedures to obtain a Marketing Authorization (MA). This may include testing for its impacts on dung fauna, but implementation may not always be strong in this respect.

Within the EU, the European Medicine Evaluation Agency (EMEA) is the regulatory authority for manufacturers of veterinary medicines.

The Directive also establishes a process of veterinary 'pharmacovigilance' for the ongoing surveillance and reporting of adverse reactions to veterinary medicinal products (VMP).

Concerns about how to carry out ecotoxicity studies on dung-dwelling organisms led to the establishment of a global Dung Organism Toxicity Testing Standardisation (DOTTS) group to investigate the toxicity of veterinary drugs on dung flies and dung beetles, which was first established in 2002.

CSIRO (Australia) is believed to carry out research on the issue. Toxicity research is also being carried out by 'Dung Beetles for Africa' a research group based at the University of Pretoria.

National concerns amongst conservation organisations with a remit for other groups of animals or plants or for wider conservation have been varied. The European Invertebrate Survey has not been involved in this issue to date.

In the UK, both the Royal Society for the Protection of Birds (RSPB) and Buglife – The Invertebrate Conservation Trust have expressed particular concern about the widespread use of such drugs. A recent PhD, carried out with part-funding from the RSPB, suggested that because of the way the drugs were used there was not a major issue in the area studied and that the impact could be reduced by appropriate timing and methods of application and animal husbandry. This study related to one product in one area. There are a few other recent or current studies in UK (e.g. a PhD based at Oxford University). Nothing is yet published from these studies (but see Webb et al. 2006 and Bibliography). The UK government has recently suspended the licence for the use of cypermethrin (not an endectocide) in sheep dip through concerns for run off affecting aquatic invertebrates (this may encourage wider use of endectocides). English Nature has published a case study of the effects of such drugs on the greater horseshoe bat (*Rhinolophus ferrumequinum*).

9. General results

While it is widely recognised that a range of endectocides has important impacts on the insect dung fauna and which may consequently have an impact on bats that feed on that fauna, there has been extreme difficulty in establishing with confidence

1. what chemicals are used in which countries, the scale of their use and how they are applied;

2. to what extent the use of these drugs impacts on the availability of insect prey to bats;

3. to what extent any reduced availability may impact on bats in such matters as their foraging behaviour and energetics, or productivity, including juvenile survival;

4. To what extent, following alerts of the problems associated with the use of these drugs, changes in husbandry are being implemented to reduce the impacts.

10. Proposed future activities for EUROBATS

The group is uncertain of the importance of this issue to bats, but feels that a precautionary approach should be adopted.

EUROBATS may wish to

1. Present a Resolution as drafted in Doc.EUROBATS.MoP6.24, including recommendations for Parties and Range states to do what they can to limit the impacts through mechanisms such as those identified in Section 5 above (Possible mechanisms to reduce impacts); and

2. incorporate elements of this into the report and Resolution of the IWG on Critical Feeding Areas.

3. Identify a list of target groups where guidance would have maximum impact (e.g. agri-environment schemes, veterinary services).

4. Maintain awareness of developments in the field of control of parasites of livestock.

11. References cited in this report

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Lumaret, J.-P. & Errouissi, F. 2002. Use of anthelmintics in herbivores and evaluation of risks for the non target fauna of pastures. *Veterinary Research* 33: 547-562.

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Skidmore, P. 1991. *Insects of the British cow-dung community*. AIDGAP, Field Studies Council, Shropshire. 166pp.

Strong, L. 1993. Overview: the impact of avermectins on pastureland ecology. *Veterinary Parasitology* 48: 3-17.

Webb, L., McCracken, D., Beaumont, D. & Nager, R. 2006. *Conservation considerations regarding the use of avermectin animal health products*. Project Information Note, 3rd May, 2006. RSPB, SAC & University of Glasgow

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May 2010

Annex 1. Questionnaire and background information circulated.

1. Background information

Impact on bat populations of the use of antiparasitic drugs for livestock

Through its Conservation and Management Plan, EUROBATS identified that 'the impact of pesticides such as antiparasitic drugs should be carefully assessed and the appropriate advice given to land managers to avoid possible deleterious effects on bats'. This was agreed at its first, second and fourth Meeting of Parties [MoP1 (Annex K (CMP), para 23), MoP 2.14 (Annex A, para 23) and MoP 4 (Record, Annex 12a, para 6b)].

An Intersessional Working Group (IWG) was formed by the EUROBATS' Advisory Committee (Lithuania 2004) to investigate the impact on bat populations of the use of antiparasitic drugs (endectocides) for livestock, in conjunction with work being carried out under the Bern Convention.

These drugs are used for the control of external and internal parasites of a wide range of domesticated farm animals. Concern has been raised that the drugs persist into the faeces of the livestock and affect the normal insect dung fauna which is an important element of the diet of a number of species of bat.

It is the intention of the IWG to produce a report in 2006 for the next EUROBATS' Advisory Committee meeting and its 5th Session of the Meeting of the Parties.

We attach a brief questionnaire asking about the use of such drugs in your country and should be most grateful if you would complete this questionnaire and return it to the EUROBATS Secretariat by the end of November 2005.

2. Contents of questionnaire on the use of antiparasitic drugs for livestock

1. Country of response
2. Compiler of response (name and address)
3. Are antiparasitic drugs used for livestock in your country?

    Yes No

    Compulsorily

    Routinely and widely?

    Only in special circumstances? Specify
4. What active ingredients are approved for use?
5. What kind of animals are treated?

    Species:

    Age:
6. How is the drug administered?

    By mouth : * bolus * tablet * liquid * gel

    By injection

    By external application: *pour-on (drench) * spray * dip
7. At what time of year?
8. How often is the drug administered
9. Are the animals indoors or outside when treated?

    * Indoors * Outside

10. Does any national legislation/regulation apply to the use of such drugs?

    Name of legislation/regulation:

    Brief statement of scope of legislation/regulation:

11. Is there any policy relating to their use in nature reserves?

12. Can you identify any alternative treatments that are effective?

13. Is there any recent research (since 2000) carried out in your country?

    References (including reports):

14. Please identify if there are special problems in acquiring information about the drugs used and their application in your country.

15. Further comments

Please complete and return this form to the EUROBATS Secretariat by 10 November 2005.

Annex 2. Bat species most likely to be affected by impact of drugs on insect prey
Compiled by Christine Harbusch

1. Insects occurring commonly in herbivore dung (according to Strong 1992, Lumaret 1996, Skidmore 1991):

Coleoptera: Scarabaeidae: ***Aphodius*** (especially *rufipes*), *Onthophagus*, *Copris*, *Onitis*

Geotrupidae: ***Geotrupes*** spp.

Diptera: **Nematocera**: **Anisopodidae**, Sciaridae, Psychodidae, Trichoceridae, (plus some important species in Ceratopogonidae, Chironomidae, Bibionidae, Scatopsidae, Tipulidae)

Brachycera: (some important species in Stratiomyidae, Asilidae, Empididae, Dolichopodidae, Syrphidae)

Cyclorrhapha : Sepsidae, Sphaeroceridae, **Scathophagidae** (*Scathophaga*), Muscidae (*Musca* spp.), Fanniidae (*Fannia*), Calliphoridae **(***Calliphora*, *Lucilia*), Anthomyiidae.

2. Bat species likely to be affected by the use of antiparasitic drugs in livestock on pasture:

Species	Insect prey taxa	References
Rhinolophus ferrumequinum	Aphodius, Geotrupes, Scathophagidae, Muscidae	Beck 1995, Beck et al 1997, Gloor et al 1995, Ransome 1996, Roué & Barataud 1999, Vaughan 1997, Duvergé & Jones 1994
R. hipposideros	Diptera (Muscidae, Sphaeroceridae, Scathophagidae), Coleoptera (Scarabaeidae)	Roer & Schober 2001, Roué & Barataud 1999, Vaughan 1997, McAney & Fairley 1989
R. mehelyi	Scarabaeidae, Muscidae	Sharifi & Hemmati 2001
Eptesicus serotinus	Aphodius, Geotrupes Calliphoridae, Sciaridae, Muscidae	Beck 1995, Catto 1994, Gerber et al. 1996, Harbusch 2003, Kervyn 2001, Vaughan 1997
Nyctalus leisleri	Aphodius, Scathophaga stercoraria Scarabaeoidea, Muscidae, Calliphoridae	Bogdanowicz & Ruprecht 2004 Sullivan et al., 1993
Nyctalus noctula	Aphodius, Geotrupes Sciaridae	Beck 1995, Vaughan 1997
Myotis myotis	Scarabaeidae, Aphodius, Geotrupes	Güttinger et al. 2001, Roué & Barataud 1999, Pereira et al. 2002, Kerwyn 1996
M. blythii	Scarabaeidae	Roué & Barataud 1999
Eptesicus nilssonii	Scarabaeidae, Aphodius	Rydell 1986, Gerell, R. & J. Rydell 2001
Plecotus auritus	(Scarabaeidae) Calliphoridae, Sciaridae	Beck 1995, Vaughan 1997, Shiel et

		al. 1991,
Plecotus austriacus	Aphodius	Beck 1995
Myotis nattereri	Scarabaeoidea, Aphodius Sarcophagidae, Sciaridae, Calliphoridae, Muscidae, Fanniidae, Sarcophagidae, Sciaridae	Bauerova & Cerveny 1986, Baagoe 2001, Gregor & Bauerova 1987, Shiel et al. 1991
M. punicus	Scarabaeidae (sp.?)	Topál & Ruedi 2001
M. mystacinus	Nematocera, Cyclorrhapha	Tupinier & Aellen 2001, Berge 2007, Vaughan 1997, Taake 1992, 1993
M. brandtii	Scathophagidae, Scarabaeidae	Berge 2007
M. emarginatus	Brachycera, Coleoptera (sp.?)	Topál 2001, Roué & Barataud 1999
Myotis daubentonii	Calliphoridae, Muscidae	Sullivan et al., 1993
P. pipistrellus	Muscidae Scatopsidae, **Scathophagidae**	Schober & Grimmberger 1998 Swift et al., 1985, Barlow 1997
P.pygmaeus	Scatophagidae	Barlow 1997
Vespertilio murinus	Scarabaeidae	Rydell, 1992
M. schreibersii	Brachycera (spp.?)	Roué & Barataud 1999

Bold text : bat species with regular and important use of relevant prey item
Plain text : bat species which consume key taxa irregularly or only in small numbers; or insect species/family was not defined

3. Bat species less likely to be affected

Bat species	Diet less affected	Diet not affected	no information	reference
R.aegyptiacus	n/a			
T. nudiventris			X	
R. euryale			X?	
R. blasii			X?	
M. brandtii	X			
M. emarginatus	X			
M. daubentonii	X			
M. dasycneme		X		?
M. capaccinii		X		Lugon 2006a
M. bechsteinii		X		?
M. alcathoe			X	
M. aurascens			X	
M. hajastanicus			X	
M. nipalensis			X	
M. schaubi			X	
E. bottae			X	
Hypsugo savii			X	
N. lasiopterus		X		Uhrin et al. 2006
N. azoreum			X	
Pipistrellus		X		?

kuhlii				
P. pygmaeus	X			
P. nathusii		X		?
P. maderensis			X	
Plecotus auritus	X			
P. austriacus	X			
P. kolombatovici			X	
P. macrobullaris			X	
P. sardus			X	
Pl. teneriffae			X	
B. barbastellus		X		?
B.leucomelas			X	
Vespertilio murinus	X			
M. schreibersii		X		Lugon 2006b
T. teniotis		X		Rydell & Arlettaz, 1994

References

Note that comments on diet can be found in most species accounts included in the *Handuch der Saugetiere Europas* (Krapp, 2001, Krapp, 2004)

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Annex 3. Annotated bibliography of literature relevant to the impact on bats of the use of antiparasitic drugs for livestock

The bibliography can be provided upon demand during the meeting.