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Suspected poisoning of domestic animals by pesticides

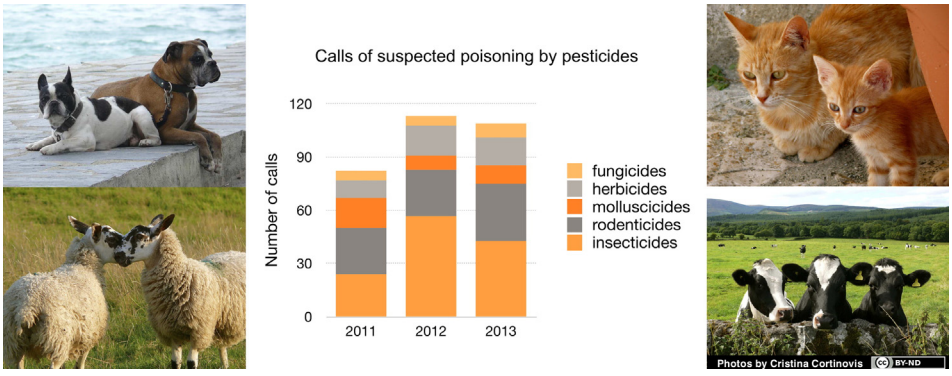
Francesca Caloni [a,*], Cristina Cortinovis [a], Marina Rivolta [b], Franca Davanzo [b]

[a] Department of Health, Animal Science and Food Safety (VESPA), Università degli Studi di Milano, Via Celoria 10, 20133 Milan, Italy
[b] Milan Poison Control Centre, Ospedale Niguarda Cà Granda, Piazza Ospedale Maggiore 3, 20162 Milan, Italy

HIGHLIGHTS

- Pesticides are the most important cause of suspected poisoning in domestic animals.
- The trend seems to be influenced by bans and restrictions.
- Insecticides were the primary cause of suspected poisoning followed by rodenticides.
- Pyrethrins–pyrethroids were the insecticides most frequently implicated.
- A sharp decline from organophosphates and carbamates was observed.

GRAPHICAL ABSTRACT



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ABSTRACT

A retrospective study was carried out by reviewing all suspected cases of domestic animal poisoning attributed to pesticides, reported to the Milan Poison Control Centre (MPCC) between January 2011 and December 2013. During this period, pesticides were found to be responsible for 37.3% of all suspected poisoning enquiries received (815). The most commonly species involved was the dog (71.1% of calls) followed by the cat (15.8%), while a limited number of cases involved horses, goats and sheep. Most cases of exposure (47.1%) resulted in mild to moderate clinical signs. The outcome was reported in 59.9% of these cases, with death occurring in 10.4% of them. Insecticides (40.8%) proved to be the most common group of pesticides involved and exposure to pyrethrins–pyrethroids accounted for the majority of calls. According to the MPCC data, there has been a decrease in the number of suspected poisonings cases attributed to pesticides that have been banned by the EU, including aldicarb, carbofuran, endosulfan and paraquat. In contrast, there has been an increase of suspected poisoning cases attributed to the neonicotinoids, imidacloprid and acetamiprid, probably due to their widespread use in recent years. Cases of suspected poisoning that involved exposure to rodenticides accounted for 27.6% of calls received by the MPCC and anticoagulant rodenticides were the primary cause of calls, with many cases involving brodifacoum and bromadiolone. Herbicides were involved in 14.2% of calls related to pesticides and glyphosate was the main culprit in cases involving dogs, cats, horses, goats and sheep. As far as exposure to molluscicides (11.5%) and fungicides (5.9%), most of the cases involved dogs and the suspected poisoning agents were metaldehyde and copper compounds respectively. The data collected are useful in determining trends in poisoning

* Corresponding author.
E-mail address: francesca.caloni@unimi.it (F. Caloni).

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episodes and identifying newly emerging toxicants, thus demonstrating the prevalence of pesticides as causative agents in animal poisonings.

1. Introduction

The poisoning of domestic animals by inappropriate or careless use of commercial pesticide formulations has been documented worldwide (Berny et al., 2010; Caloni et al., 2012a; Caloni et al., 2012b; Guitart et al., 2010a; McLean and Hansen, 2012; Vandenbroucke et al., 2010; Wang et al., 2007). The pesticides most frequently involved are insecticides and rodenticides (Anastasio and Sharp, 2011; Berny et al., 2010; Caloni et al., 2012a, 2012b; Segev et al., 2006; Sheafor and Couto, 1999; Waddell et al., 2013; Wang et al., 2007; Yas-Natan et al., 2007). Poisoning episodes by herbicides, molluscicides and fungicides have also been reported but less frequently (Burgat et al., 1998; Berny et al., 2010; Bates et al., 2012; Caloni et al., 2012a, 2012b; Kaye et al., 2012). According to Martínez-Haro et al. (2008), the incidence of specific intoxication by pesticides is highly dependent on the toxicity of commercial formulations. A ban on the use of highly toxic pesticides can reduce their availability and consequently the occurrence of animal poisoning. This has been seen to occur in the case of cattle poisoning by organochlorines, frequently recorded until 1998 (Caloni et al., 2012a; Guitart et al., 2010a). However, the poisoning of animals by banned compounds is still frequently reported in literature. Carbamates such as aldicarb and carbofuran which have been banned by the EU, are still frequently reported in poisoning episodes involving domestic animals (Berny et al., 2010; Caloni et al., 2012a, 2012b) and wildlife (Guitart et al., 2010b; Ruiz-Suárez et al., 2015). Therefore, in addition to banning, stricter controls on distribution among professionals are also needed (Martínez-Haro et al., 2008). Moreover, to reduce the occurrence of fatal poisonings of non-target animals repellents and a lower percentage of the active ingredient should be used in formulations of pesticides (Martínez-Haro et al., 2008).

Based on the Milan Poison Control Centre (MPCC, formerly CAV) data, a general overview of domestic animal poisoning in Italy has been provided in a previous study (Caloni et al., 2012b). It found exposure to pesticides to be the primary cause of poisoning, accounting for 47.7% of total enquiries received. The present work is a three-year epidemiological study of all enquiries on the suspected poisoning of domestic animals by pesticides, received by the MPCC between January 2011 and December 2013. It aims to collect essential information on pesticide exposure such as the frequency, the specific pesticides and animal species involved, the severity of clinical signs and the final outcome. The relationship between the frequency of poisoning by specific pesticides, restrictions on their use and the commercial release of new products is also discussed.

2. Materials and methods

For each MPCC enquiry, a standard form including date and origin of call, information on animal characteristics (species/breed/sex/age), suspected causative agents, clinical signs, routes of exposure and exposure site (indoor or outdoor) was completed by telephone. Follow-up calls were then made to obtain continuous case updates including the final outcome. The collection of accurate and complete data was attempted in every case. Information obtained at both the time of enquiry and from follow-up calls was then entered and stored in the MPCC database. According to the data, the causative agents were classified into six main categories: pesticides, drugs, household products, metals, plants and zootoxins. All suspected animal poisoning cases recorded between January 2011 and December 2013 were reviewed to identify those caused by pesticides. The latter were classified into insecticides (excluding veterinary parasiticides), rodenticides, molluscicides, herbicides and fungicides. Analysis was performed only in cases where a correspondence existed between the suspected agent, the time of onset of effects and the type of clinical sign or in cases where the exposure was witnessed by the owner. In collaboration with veterinary toxicologists at the University of Milan, the data were processed using epidemiological analysis and evaluated based on the animal involved, the clinical signs and the final outcome. The severity of clinical signs was classified as 'no signs', mild, moderate or severe (Table 1), in accordance with the methodology used by Gwaltney-Brant (2007). The Student's t-test was used to compare the frequency of pesticide exposures over time. A P-value of <0.05 was considered significant.

3. Results

The MPCC recorded 304 cases involving domestic animals that were accidentally exposed to pesticides, corresponding to 37.3% of all the suspected poisoning cases recorded (815) in the 2011–2013 period. Of these enquiries, 86.2% involved dogs and 10.5% involved cats. Calls related to other species were much fewer in comparison and mainly involved horses and sheep (1% each) followed by goats (0.7%). In 91.8% of the cases, the route of exposure appeared to be oral intake, followed by cutaneous exposure and inhalation (1.6% each). The number of calls received each year related to the different classes of pesticides is shown in Fig. 1. Of these calls, 81.2% came from urban areas, 16% from neighbouring villages and 2.8% from rural areas. In Table 2, the site of exposure (indoor or outdoor) reported in calls involving dogs and cats is shown.

3.1. Insecticides

Insecticides (40.8%) proved to be the most common group of pesticides involved. Enquiries were related almost exclusively to dogs (105 calls) and cats (18 calls). The MPCC classified the insecticide enquiries as shown in Fig. 2. The majority of calls involving dogs (31.4%) and cats (44.4%) involved suspected exposure to pyrethrins–pyrethroids. Several pyrethrins–pyrethroids including allethrin, cyfluthrin, cypermethrin, deltamethrin, tetramethrin, and phenothrin

Table 1
Clinical signs by severity category.

No signs	No clinical signs	–
Mild	Mild, transient and spontaneously resolving clinical signs	Hypersalivation, mild vomiting and diarrhoea, inappetence, coughing, skin or eye irritation, lacrimation.
Moderate	Pronounced, prolonged or systemic clinical signs	Pronounced or prolonged vomiting and diarrhoea, dysphagia, dyspnea or tachipnea, mild to moderate bradycardia or tachycardia, pallor, mild to moderate hypotension, fasciculations, tremors, renal dysfunction, 2nd degree burns in <50% of body surface, corneal abrasion.
Severe	Life-threatening clinical signs or possible residual disability or disfigurement following recovery	Severe bradycardia or tachycardia, respiratory insufficiency, clinical evidence of liver dysfunction, massive haemorrhage, generalized seizures, coma, renal failure, 2nd degree burns in >50% of body surface or 3rd degree burns, corneal ulcers.