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Dermal exposure of Belgian florists to insecticide residues

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INTRODUCTION

In Europe, as elsewhere in the world, floriculture are one of the most globally produced commercial mass production items , with a high growth potential and a major economic weight in international trade. As in any intensive culture, insecticide use is a significant strategy to fight against many pests (mainly mites and insects) which can damage production and marketability , so that ornamental producers can stay competitive in both national and international markets. The lack of maximum residue limits (MRL) for flowers means that there is no restriction on the use of pesticides, unlike other crops, which are harvested for consumption. This explains why imported cut flowers receive heavy pesticide applications prior to shipment. Many insecticides applied on flowers are persistent, dislodgeable by contact with the hands, and are fat-soluble. As they can easily be absorbed through skin contact, florists who handle the flowers daily and for several hours can potentially be exposed to residual deposits of pesticides and possibly endanger their health.

OBJECTIVE

- Evaluate the average levels of contamination of the cut flowers most commonly sold in Belgium (roses, the number one flower sold annually, gerberas, and chrysanthemums)[1,2].
- Assess the risk of the potential dermal exposure to dislodgeable pesticide residues.

MATERIALS AND METHODS

Sampling of 90 bouquets (roses, gerberas and chrysanthemums)

Sampling of cotton gloves which were distributed to florists (two pairs to each florist) and worn during two consecutive half days when handling flowers and preparing bouquets (min 2 h, max 3 h/day)

The residual insecticide values were determined using a multi-residue (QuEChERS) method and a combination of gas chromatography and liquid chormatograhphy analysis

Evaluate the average levels of contamination of the cut flowers most commonly sold in Belgium in mg/kg

Assess potential dermal exposure of workers through hands

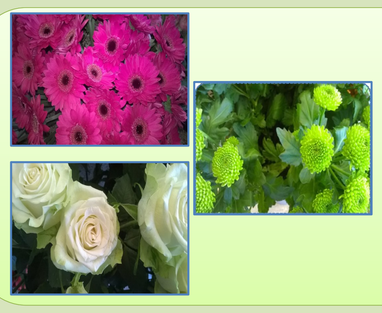
Calcul of potential dermal exposure (PDE)

PDE (in mg a.s./kg bw per day) = [($C_{T\,[h]}$ [mg/kg] x GW [kg] x 3] / bw [kg]

Where, C is the concentration of active substance in the sub-sample (5 g), GW is the average weight of the cotton gloves samples (57 g), T is the task duration during the trial (2 h) and bw is the body weight (60 kg)

RESULTS AND DISCUSSIONS

- **Global Results of Analyses of Residual Deposits**



Flowers : For 90 samples (1)

- Total number of insecticides detected: **53**
- Average number of active substances(s.a) /sample: **4 s.a**
- Average concentration per flower sample: **3.28 mg/kg**

Cotton gloves : For 20 samples

- Total number of insecticides detected: **55**
- Average number of active substances/sample: **16 s.a**
- Average concentration per glove sample: **6.65 mg/kg**

Table 1 _ Insecticide most detected in the 90 samples (roses, gerberas, and chrysanthemums) and their CLP classification

Insecticide	Number of detection	CLP Classification
Flonicamid	33	H302
Thiamethoxam	26	H302
Imidacloprid	24	H302
Bifenazate	19	H317, H373
Acephate	17	H302
Lufenuron	17	H317
Methamidophos	15	H300, H311, H330
Acetamiprid	13	H302

H300: Fatal if swallowed
H302: Harmful if swallowed
H311: Toxic in contact with skin
H317: May cause an allergic skin reaction
H318: Causes serious eye damage
H330: Fatal if inhaled
H373: May cause damage to organs through prolonged or repeated exposure

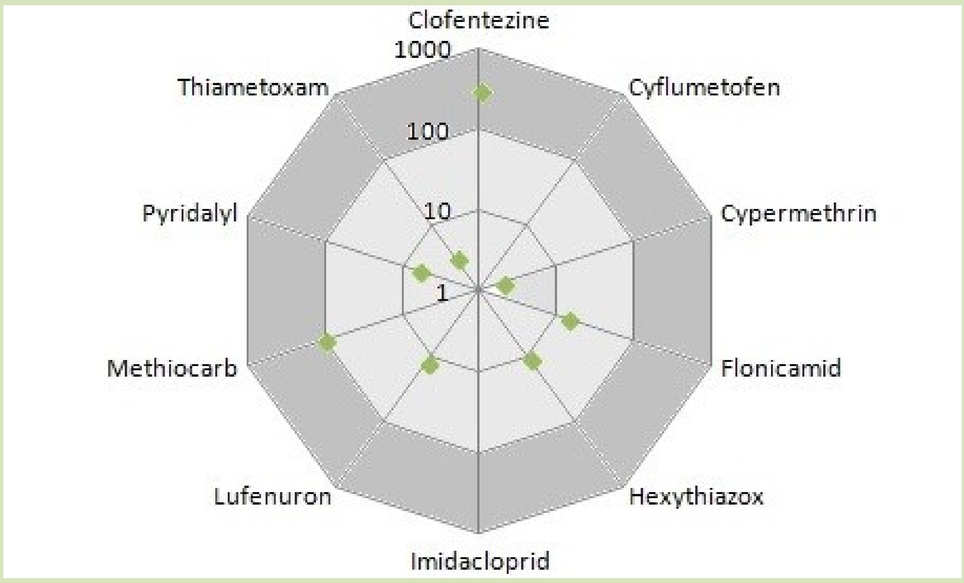


Figure 2 _ The PDE (90th Percentile) of the ten most frequently detected insecticide residues on gloves worn by florists in % of the AOEL

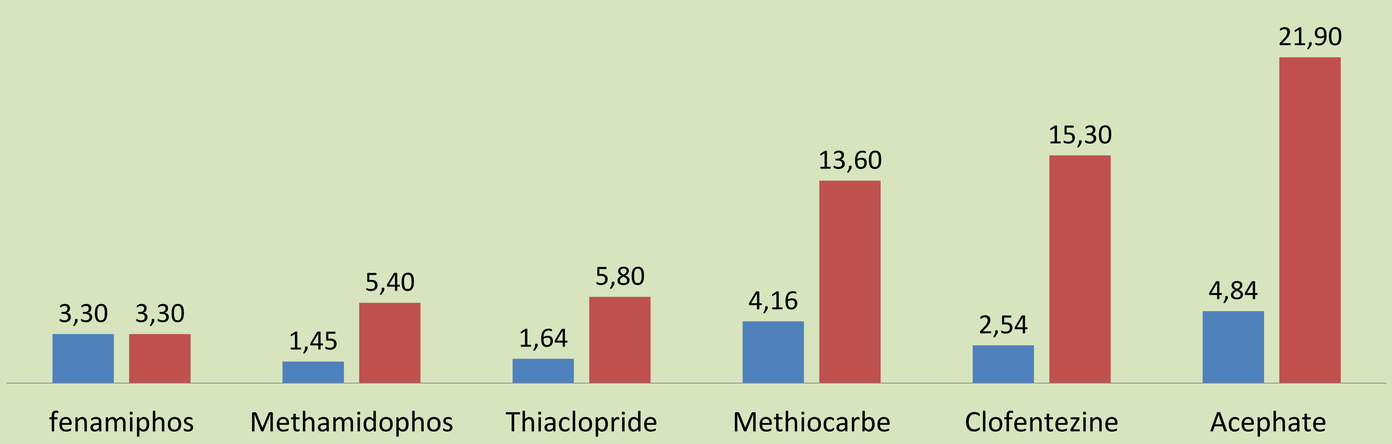


Figure 1 _ the highest average and maximum concentrations of insecticide residues detected on 90 samples of cut flowers

- Flonicamid was the insecticide most detected on cut flowers.
- Acephate had the highest mean and maximum concentration (4.8 and 21.9 mg/kg, respectively) measured on cut flowers.
- Among the ten insecticides most frequently detected on the gloves worn by florists, clofentezine and methiocrab exceeds the AOEL at the P90 level predictive.

CONCLUSION

Florists who handle a large number of flowers are exposed daily with a potential effect on their health. To reduce the exposure of florists to pesticide residues, solutions could be recommended: a better management of the pesticide used (ipm at the field or even organic flower production, a potential niche market); a stronger quality control of imported cut flowers and it could be interesting to set up a maximum residue limit for flowers to decrease the risk for professionals and all other people in contact with flowers. To better assess the risk, bio-monitoring of florists with analysis of their urines and hairs are still to be investigated.

REFERENCES

1. Toumi, K., Vleminckx, C., Van Loco, J. & Schiffers, B. (2016a). Pesticide residues on three cut flower species and potential exposure of florists in Belgium. International journal of environmental research and public health, 13 (10), 943.
2. Toumi, K., Vleminckx, C., Van Loco, J. & Schiffers, B. (2016b). A survey of pesticides residues in cut flowers from various countries. . Comm. Appl. Biol. Sci. Ghent University.

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