

Insecticide Usage and Chemical Contamination Assessment in Asiatic Pennywort

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Abstract. The insecticide usage in commercially grown asiatic pennywort plantations in Nakhonpatum and Nonthaburi province, Thailand was surveyed during January-June, 2016. The results showed that asiatic pennywort cutworms was leaf destructive and caused the most damage to the production. The growers used organophosphate insecticides to control the caterpillars the most, followed by pyrethroid, abamectin, carbamate and organochlorine, respectively. The chemical contaminants of pennywort from 9 fresh markets in Bangkok was monitored, the result indicated that lead was not detected in the samples. The amount of arsenic was less than 0.075 mg / kg. The insecticide residue measurement of dicofol, chlorpyrifos and methidathion was 0.98, 2.84 and 0.46 mg / kg, respectively.

1. Introduction

Asiatic pennywort is health benefit and has been used for various treatment. The major problem for pennywort production for local consumption and export is damage and destruction caused by cutworms (*Zonoplusia ochreata* Walker). The sizes of these insect populations vary with seasons and cultivated areas. Infestation of common cutworm causes considerable decrease in pennywort production [1].

Insect pest control by insecticide is the most widely used for control method, producing quick and clear results, but chemicals have a huge impact on ecosystem and destroy natural enemies of insect pests. Up to 33% of pennywort from markets was pesticide contaminated and was recorded the most contaminated vegetable among samples[2]. Thai Department of Agriculture banned pennywort production from export due to a residue problem in 2011.

2. Material and Methods

2.1. Questionnaire Survey of Insecticide Usage

The questionnaire survey was conducted to interview growers of commercially grown Asiatic pennywort from Nakhonpatom and Nonthaburi province. The growers were randomly selected for the participation at 30 persons from each province to achieve the information on pest problems and insecticide usage.

2.2. Lead and Arsenic Analysis

Asiatic pennywort sample was collected from 9 location of fresh markets in Bangkok. The sample of 3 g of powdered pennywort was digested with nitric acid till the solution was clear and measured. Determination of heavy metals (official method 986.15 for arsenic and official method 999.10 for lead by ICP-MS was based on AOAC[3]. Then, it was compared with standard substances and the arsenic and lead content was calculated.



2.3. Organochlorine and Organophosphate Determination

The sample for this analysis was collected from the same place as in 2.2. The analysis of organochlorine and organophosphate residues were performed followed Steinwandter [4]. Universal 5 minutes online method for extracting and isolating insecticide residues based on the Fresenius Journal of Analytical Chemistry no 1155. The analysis was performed by the GC-MS.

3. Results and Discussion

3.1. Pest Problems and Insecticide Usage

The interview results showed that growers from both Nonthaburi and Nakhonpatum had similar pests and the most destructive one was the pennywort cutworm (*Zonoplusia ochreata* (Walker)) followed by diamondback moth, plant hoppers and thrips (see Table 1). The pennywort cutworm was a leaf feeder and could devour the entire plants. Therefore, the grower preferred chemical control method due to fast and easy. The most preferred insecticide group was organophosphate (43.33% of Nakhonpatum and 33.33% of Nonthaburi) (Table 2).

3.2. Lead and Arsenic Contamination

The content of lead and arsenic was calculated from the standard curve: $Y = 2.542E+0003 \cdot x + 1.474E+002$ ($r^2 = 0.9999$) and $Y = 4.440E+0003 \cdot x + 1.610E+003$ ($r^2 = 0.9999$), respectively. No lead detection on pennywort collected from fresh markets in Bangkok. Arsenic was found 20% of samples with less than 0.075 mg / kg (Table 3).

Table 1. Insect pest of Asiatic pennywort

Insect pests	Percentage of growers (n=30)	
	Nakhonpatum	Nonthaburi
pennywort cutworm	43.33	53.33
diamondback moth	26.67	26.67
plant hoppers	16.67	13.33
thrips	13.33	6.67

Table 2. Insecticide usage in Asiatic pennywort plantations

Insecticide group	Percentage of growers (n=30)	
	Nakhonpatum	Nonthaburi
abamectin	26.67	30.00
carbamate	20.00	26.67
organophosphate	43.33	33.33
pyrethoid	3.33	10.00
organochlorine	6.67	0.00

Table 3. Lead and arsenic contamination on asiatic pennywort collected from local markets in Bangkok.

Heavy metal	amount ¹ (mg/kg)
lead	ND
arsenic	<0.075

¹ND= not detected

3.3. Organochlorine and Organophosphate Contamination

The organochlorine group in pennywort was analysed and the results showed that only dicofol was found 0.98 mg/kg and above the MRL of 0.1 mg/kg. No detection was found on BHC, heptachlor&heptachlor epoxide, aldrin&dieldrin, DDT, chlordane, endosulfan and endrin (Table 4). Determination of organophosphate group showed that the samples had chlorpyrifos and methidathion 2.84 and 0.64 mg/kg, respectively. The sample contained the chlorpyrifos residue above the MRL of 0.5 mg/kg [5]. No detection was found on DDVP, methamidophos, mevinphos, omethoate, diazinon, dicrotophos, monocrotophos, dimethoate, pirimiphos-methyl, chlorpyrifos, parathion-methyl, pirimiphos-ethyl, malathion, malathion, fenitrothion, parathion ethyl, prothiofos, methidathion, profenofos, triazophos, EPN, phosalone and azinphos-ethyl (Table 5).

Table 4. Organochlorine insecticide contamination on asiatic pennywort collected from local markets in Bangkok.

Organochlorine insecticides	amount ¹ (mg/kg)
BHC	ND
Heptachlor&Heptachlor epoxide	ND
Aldrin&Dieldrin	ND
Dicofol	0.98
DDT	ND
Chlordane	ND
Endosulfan	ND
Endrin	ND

¹ND = not detected

Table 5. Determination of organophosphate insecticide contamination on

Asiatic pennywort	
Organophosphate insecticides	Amount ¹ (mg/kg)
DDVP	ND
Methamidophos	ND
Mevinphos	ND
Omethoate	ND
Diazinon	ND
Dicrotophos	ND
Monocrotophos	ND
Dimethoate	ND
Pirimiphos-methyl	ND
Chlorpyrifos	2.84
Parathion-methyl	ND
Pirimiphos-ethyl	ND
Malathion	ND
Fenitrothion	ND
Parathion ethyl	ND
Prothiofos	ND
Methidathion	0.46
Profenofos	ND
Triazophos	ND
EPN	ND
Phosalone	ND

Azinphos-etthyl	ND
¹ ND = not detected	

4. Conclusions

Growers rely on chemical method to control insect pest due to fast and easy way. They continue the calendar spray and subsequently induce pest resurgence and pennywort product contamination. The residues of dicofol and chlorpyrifos in pennywort were exceed acceptable levels. Moreover, pennywort was not only food but also for pharmaceutical products. Therefore, it should be free of pesticides. Asiatic Organic farming should be implement for sustainable production.

5. References

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