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Antifeeding Effects of α -Tomatine on the Larvae of Cabbage Worm (*Pieris rapae crucivora* Boisduval) 【Scientific note】

番茄素對蔬菜害蟲紋白蝶之拒食效應【科學短訊】

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Abstract

Solutions of 0.1%, 0.2% and 0.4% α -Tomatine were tested respectively on larvae of *Pieris rapae crucivora* Boisduval by spraying on the cabbage leaves used as an antifeedant. In the no-choice test or choice test, solutions of α -Tomatine showed slight or strong inhibitory activities on the feeding of larvae.

摘要

以0.1%,0.2%及0.4%番茄素液處理甘藍葉，其對紋白蝶(*Pieris rapae crucivora* Boisduval)幼蟲在非選擇試驗與選擇試驗中均具輕度或強度抑制作用，可減少紋白蝶幼蟲之取食葉面積，降低田間之為害。

Key words: *Pieris rapae crucivora* Boisduval, antifeeding effect, α -Tomatine.

關鍵詞: 紋白蝶、拒食效應、番茄素。

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番茄素對蔬菜害蟲紋白蝶之拒食效應

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摘 要

以0.1%，0.2%及0.4%番茄素液處理甘藍葉，其對紋白蝶(*Pieris rapae crucivora* Boisduval)幼蟲在非選擇試驗與選擇試驗中均具輕度或強度抑制作用，可減少紋白蝶幼蟲之取食葉面積，降低田間之為害。

關鍵詞：紋白蝶、拒食效應、番茄素。

前 言

紋白蝶(*Pieris rapae crucivora* Boisduval)主要在幼蟲期為害十字花科蔬菜之葉片，影響蔬菜產量與品質，其為害程度雖不如小菜蛾之為害嚴重，但其幼蟲之取食量較小菜蛾幼蟲之取食量大(Chen and Su, 1981)，若防治時稍一疏忽則易形成嚴重損失，故不得不加強注意。目前對紋白蝶之防治，多以農藥及生物製劑等之防治法為主，防治效果雖十分顯著；但近年來，為期減少農藥對環境污染及對人體安全性之威脅，故開發有關拒食劑(Antifeedants)或取食抑制劑方面之研究，利用其影響或減少害蟲之取食量，而降低害蟲對蔬菜之為害程度。

曾由Gottlieb(1943)及Irving *et al.* (1945)等研究番茄中含有一種天然植物鹼類—番茄素(α -tomatine)，其可利用於抑制數種害蟲之取食(Dahlman and Hibbs, 1967; Harley and Thorsteinson, 1967; Hsiao and

Fraenkel, 1968; Siden *et al.*, 1978; Juvik *et al.*, 1982; Bloem, 1989)。在本省亦有番茄素利用於小菜蛾拒食效應方面之研究(Lu and Chu, 1992)，得知小菜蛾幼蟲對經番茄素液處理之甘藍葉片有減少取食葉面積之現象，且對其生長發育或存活率均有明顯抑制之作用。而十字花科蔬菜之重要害蟲，除小菜蛾外尚有紋白蝶等為害亦烈，故此文即探討番茄素對紋白蝶幼蟲取食及生長之影響，以了解番茄素應用於拒食劑之可行性。

在網室內以甘藍菜苗飼養紋白蝶，取同齡期幼蟲做為供試蟲源。並將番茄素(向Sigma公司購得)，以50%酒精配製成0.1%、0.2%及0.4%之番茄素液，以小形噴霧器將不同濃度之番茄素液均勻噴施於甘藍苗葉片做為處理組；而噴水的甘藍苗葉片，則做為對照組。

(A)非選擇試驗(No-choice test)：

將紋白蝶二齡幼蟲移入玻璃試管($\phi = 2.5$ cm \times 10cm)中每管一隻，每次以噴0.1%或

0.2% 或0.4% 番茄素液之甘藍葉片做為處理組，並分別以噴水之甘藍葉片做為對照組；每次每組均各30隻幼蟲。試管口用紗布及橡皮筋固定，每天將每隻幼蟲取食後之甘藍葉片以方格紙(1mm² / 格)計算其每天之取食葉面積，並置換處理後之新鮮葉片，直至幼蟲化蛹或死亡。比較各組間每隻幼蟲平均每天之取食葉面積及攝食率(feeding ratio)(Wada and Munakata, 1968)，並比較各處理間之差異性，結果見表(一)。在每組試驗中，對照組之幼蟲平均取食葉面積均比處理組多，其間差異性甚為顯著。尤其在0.2% 及0.4% 番茄素之較高濃度時，其處理組與對照組間之差異更為顯著；由攝食率之比較，兩者均小於20%，故0.2% 及0.4% 番茄素液對紋白蝶幼蟲之取食具強度抑制效果(strong inhibitory activity)，而0.1% 番茄素液之攝食率在20.1% ~ 50% 之間則屬輕度抑制效果(slight inhibitory activity)。且在番茄素液處理組中，其幼蟲多生長不良，化蛹率降低，甚至無法化蛹而死亡。

(B)選擇試驗(Choice test)：

在培養皿(φ = 16cm)中，每次放兩片甘藍苗葉片，一為噴不同濃度之番茄素液之處理組，另一為噴水之對照組，各培養皿內以毛筆移入一隻紋白蝶二齡幼蟲，每天置換處理後之新鮮葉片，並將取食後之葉片取出，以方格紙計算每隻幼蟲每天之取食葉面積，每組均30隻幼蟲。比較對照組與處理組間取食葉面積及攝食率等之差異性，直至幼蟲化蛹或死亡。在選擇試驗中，幼蟲因具選擇取食之機會，故對照組葉片之被取食葉面積較大，而在番茄素液處理組中，其幼蟲之取食葉面積則較小表(二)；亦即表示番茄素液對紋白蝶幼蟲之取食具有抑制作用。

由以上之初步試驗得知，番茄素可減少紋白蝶幼蟲之取食量，且濃度愈高其抑制取食之效果則愈大。雖然番茄素屬天然植物鹼類，較易分解，但價格昂貴，又其施用甘藍葉片上是否會影響甘藍之生長尚未得知，故其是否可應用為十字花科蔬菜重要害蟲之拒食劑(Antifeedants)尚待考量。

表一 無選擇試驗中番茄素液對紋白蝶幼蟲取食之影響

Table 1. The effect of different concentrations of tomatine solutions on the feeding of *Pieris rapae crucivora* Boisduval larvae by no choice test (n=30)

Treatment	Fed leaf area (mm ² / day) / larva		FR (%)
0.4% Tomatine solution	3.5 ± 3.38	**	0.43++
Control	819.9 ± 38.64		
0.2% Tomatine solution	58.5 ± 5.31	**	9.70++
Control	603.2 ± 38.88		
0.1% Tomatine solution	146.8 ± 17.58	**	32.93+
Control	445.8 ± 44.23		

1)FR = Feeding ratio

= (fed area on treated leaf / fed area on control leaf) × 100%

++ 0% - 20% strong inhibitory activity;

+ 20.1% - 50% slight inhibitory activity;

-- >50% none inhibitory activity.

2)Means are significantly different at a significance level of 1% (t-test).

表二 選擇試驗中番茄素液對紋白蝶幼蟲取食之影響

Table 2. The effect of different concentrations of tomatine solutions on the feeding of *Pieris rapae crucivora* Boisduval larvae by choice test (n=30)

Treatment	Fed leaf area (mm ² / day) / larva		1)
			FR (%)
0.4% Tomatine solution	41.3±10.50	**	41.26+
Control	187.1±25.09		
0.2% Tomatine solution	117.3±17.10	**	47.04+
Control	249.4±19.98		
0.1% Tomatine solution	386.0± 8.19	**	22.05+
Control	935.6±42.20		

1), 2) Refer to footnotes of Table 1.

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ABSTRACT

Solutions of 0.1%, 0.2% and 0.4% α -tomatine were tested respectively on larvae of *Pieris rapae crucivora* Boisduval by spraying on the cabbage leaves used as an antifeedant. In the no-choice test or choice test, solutions of α -tomatine showed slight or strong inhibitory activities on the feeding of larvae.

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