

植物提取物和常用药剂对蚜虫重要天敌瓢虫孵化、存活和捕食效能的影响

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摘要:为解决目前化学合成杀虫剂长期大量使用所带来的“3R”问题,有必要从对人畜无毒或低毒、对害虫天敌安全的植物和其它天然产物中筛选与环境相容性好的物质作为害虫控制的手段。已经从 63 种植物中筛选出两种对蔬菜蚜虫有较好控制作用的植物苍耳 *Xanthium sibiricum* Petr. et Widd. 和白蝴蝶 *Syngonium podophyllum* Schott。报道该两种植物乙醇提取物以及几种常用天然源药剂(鱼藤酮精、机油乳剂和 0.3% 印楝素乳油)对深圳菜区蚜虫重要天敌瓢虫(六斑月瓢虫 *Menochilus sexmaculata* (Fabricius) 和狭臀瓢虫 *Coccinella transversalis* Fabricius) 的影响。结果表明,两种植物提取物(0.04gDW/ml)对所测试瓢虫的孵化、存活和捕食效能与对照之间在 0.01 或 0.05 水平均无显著差异,表明两种植物提取物对瓢虫安全、无明显毒性。而鱼藤酮精(800×)、机油乳剂(400×)和 0.3% 印楝素乳油(2000×)在所测试的浓度对瓢虫卵的毒性较强,瓢虫卵的孵化率明显降低,仅有对照瓢虫卵孵化率的 7.74%~14.31%, 因此应避免在田间瓢虫大量产卵的季节使用。苍耳和白蝴蝶提取物对蚜虫的重要天敌瓢虫没有负面影响,可以考虑作为保护十字花科蔬菜免遭蚜虫危害的植物保护剂配方。

关键词:植物提取物; 药剂; 瓢虫; 存活率; 羽化率; 捕食效能; 植物保护剂

Effect of plant extracts and some biorational insecticides on egg hatch, survival and predation rates of *Menochilus sexmaculata* (Fabricius) and *Coccinella transversalis* Fabricius: the key natural enemies of cruciferous vegetable aphids in south China

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Abstract: One of the mechanisms that plants have developed to resist the effects of herbivorous pests is the production of secondary metabolites. Recently these metabolites have been considered as potential alternatives to synthetic pesticides because they are natural products that are active against insect pests

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while being compatible with the environment because of their low-toxicity to humans, livestock and natural enemies. In southern China the problems of resistance, resurgence and residue associated with the use of synthetic insecticides is particularly severe in cruciferous vegetable production. In a previous study the bioactivity of extracts from 63 plant species were screened against *Myzus persicae* (Sulzer) and *Lipaphis erysimi* (Kaltenbach) in vegetables. Extracts from *Xanthium sibiricum* Petr. et Widd. and *Syngonium podophyllum* Schott were found to be particularly active and in this study we compared the effect of plant extracts from these two species with a range of other biorational insecticides (including rotenone, petroleum spray oil and 0.3% azadirachtin water-in-oil emulsion) on the important predatory coccinellid species *Menochilus sexmaculata* (Fabricius) and *Coccinella transversalis* Fabricius in the laboratory. There was no significant difference between survival of adults, predation of adults and larvae, hatching of eggs of coccinellids treated with alcohol extracts of *X. sibiricum* and *S. podophyllum* and the control groups treated with water. However, rotenone (800×), petroleum spray oil (400×) and 0.3% azadirachtin water-in-oil emulsion (2000×) did significantly reduce hatchability of the coccinellid eggs, with the hatching rates being 7.74%~14.31% that of control groups. Results indicate that rotenone, petroleum spray oil and azadirachtin should not be used during the reproductive period of the coccinellids. *X. sibiricum* and *S. podophyllum* extracts appear to have promising prospects for formulation into natural insecticides against cruciferous vegetable aphids, as they have no adverse effects on predatory coccinellids.

Key words: plant extracts; biorational insecticides; coccinellids *Menochilus sexmaculata* (Fabricius) and *Coccinella transversalis* Fabricius; survival rate; hatching rate; predation; plant protectants

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许多天然源物质由于具有对害虫较好的杀伤和控制作用以及与环境良好的相容性而日益受到植保工作者的重视^[1],为寻找对蚜虫具有较好控制作用的物质,以作为植物保护剂^[2]的配方,作者对63种常见植物进行了试验^[3],从中筛选出两种对蚜虫有较好控制作用的植物种类——苍耳 *Xanthium sibiricum* Petr. et Widd. 和白蝴蝶 *Syngonium podophyllum* Schott, 本文报道了这两种植物提取物和几种天然源药剂对深圳菜区蚜虫重要天敌六斑月瓢虫 *Menochilus sexmaculata* (Fabricius) 和狭臀瓢虫 *Coccinella transversalis* Fabricius 的影响。

1 材料与方法

1.1 材料

1.1.1 供试植物提取物和药剂 苍耳 *Xanthium sibiricum* Petr. et Widd. (茎叶), 2000年9~10月采自广州五山;白蝴蝶 *Syngonium podophyllum* Schott (蔓叶), 同上;0.3%印楝素乳油(0.3% azadirachtin water-in-oil emulsion), 深圳农宝生物工程有限公司生产;鱼藤酮精(rotenone), 广州市农药厂生产;机油乳剂(petroleum spray oil), 加德士公司生产。

1.1.2 供试瓢虫虫源 六斑月瓢虫 *Menochilus sexmaculata* (Fabricius)、狭臀瓢虫 *Coccinella transversalis* Fabricius;成虫和幼虫采自深圳市龙岗区碧岭生态村未施农药的萝卜菜田,室内用蚜虫饲养1周后供试。

1.1.3 供试虫源及其寄主植物 萝卜蚜 *Lipaphis erysimi* (Kaltenbach) 和桃蚜 *Myzus persicae* (Sulzer), 采集同上环境,并饲养于400mm×400mm×700mm 养虫笼中的盆栽萝卜苗上,1周后供试;

小白菜 *Brassica chinensis* L., 葵白品种。栽种于网笼的小杯中,长出5~6片真叶时,供试。

1.2 方法

1.2.1 供试植物提取方法 采用索氏提取法^[3]。

1.2.2 对瓢虫卵孵化的测定 将带瓢虫卵块的萝卜叶片放入配制好的药液中浸10s后,取出晾干,置入培养皿中,用孔有数据的保险膜封口,观察记录瓢虫卵孵化数,每处理5重复,每重复6~8粒卵。

1.2.3 对瓢虫成虫的毒性 将苍耳提取物(0.04gDW/ml)、白蝴蝶提取物(0.04gDW/ml)倒入15mm×

100mm 的指形管中,静置 10s 后倒出,待晾干形成药膜,用小棉球沾取相应的植物提取液放入管中。设对照为等量的乙醇加水。每管接入瓢虫成虫 6 头,每天观察记录瓢虫的存活情况,直到瓢虫死亡为止。每处理 5 重复。

1.2.4 对瓢虫成虫捕食效能影响的测定 剪取无虫的小白菜叶片,在苍耳乙醇提取物(0.04gDW/ml)和白蝴蝶乙醇提取物(0.04gDW/ml)中浸没 10s 后,取出,晾干,置入 30mm×100mm 的指形管中,然后分别挑入 2~3 龄桃蚜和萝卜蚜各 60 头,再把室内羽化的六斑月瓢虫成虫(捕食萝卜蚜)和狭臀瓢虫成虫(捕食桃蚜)移进管中,每管 1 头。以相应量的乙醇加水处理的叶片为对照。24h 时挑出瓢虫,记录剩下的蚜虫数。每处理 5 重复。

1.2.5 对瓢虫幼虫捕食效能的影响 方法同“1.2.4”,供试的捕食者为六斑月瓢虫的高龄幼虫,猎物是萝卜蚜 3~4 龄若蚜 50 头,桃蚜 3~4 龄若蚜 80 头,对照与相应处理的蚜虫种类和数目一致。每处理 5 重复。

2 结果与分析

2.1 植物提取物和几种药剂对瓢虫卵孵化的影响

两种植物提取物和几种药剂处理后,瓢虫卵的孵化率见表 1。可以看出,白蝴蝶提取物和苍耳提取物处理后,瓢虫卵的孵化率与对照无显著差异,孵化率分别为 46.43%、38.89% 和 42.83%;而鱼藤酮精、机油乳剂和印楝素乳油在所测试浓度可明显降低瓢虫卵的孵化率,尤其以机油乳剂和印楝素乳油处理为甚,3 种药剂处理后瓢虫卵的孵化率分别为 6.13%、3.33% 和 3.33%,比对照分别降低 85.68%、92.23% 和 92.23%。

2.2 植物提取物对六斑月瓢虫成虫的毒性测定

药膜法测试结果(表 2)表明,苍耳提取物(0.04gDW/ml)处理与对照比较,六斑月瓢虫成虫的存活时间明显延长,瓢虫的平均存活时间分别为 14.15d 和 8.54d,而白蝴蝶提取物(0.04gDW/ml)。

处理后瓢虫的存活时间(8.08d)与对照间无显著差异。在处理后 19d(见图 1),苍耳提取物处理的瓢虫成虫仍有 23.08% 存活,而对照仅有 7.7% 存活。说明两种提取物对瓢虫成虫均无明显毒性。

2.3 植物提取物对瓢虫成虫捕食作用的影响

测试结果(表 3)表明,白蝴蝶提取物和苍耳提取物处理后,瓢虫捕食蚜虫的捕食量与对照之间差异不显著,六斑月瓢虫成虫捕食萝卜蚜的捕食量分别为 43.33%、35.67% 和 43.33%,狭臀瓢虫成虫捕食桃蚜的捕食量分别为 60.67%、60.67% 和 56.67%,表明两种植物提取物对瓢虫成虫捕食蚜虫不存在有害影响。

2.4 植物提取物对瓢虫幼虫捕食效能的影响

用苍耳提取物和白蝴蝶提取物测试对六斑月瓢虫高龄幼虫捕食蚜虫的影响,结果见表 4,可见,两种植物提取物对瓢虫幼虫捕食蚜虫的捕食效能比对照稍有降低,但不存在显著性差异,六斑月瓢虫捕食萝卜蚜的捕食率分别为 16.00%、15.50% 和 19.60%,捕食桃蚜的捕食率分别为 13.00%、12.67% 和 17.00%。表明供试的两种植物提取物对瓢虫的捕食功能无显著影响。

3 结论与讨论

苍耳乙醇提取物和白蝴蝶乙醇提取物在所测试的浓度对瓢虫卵的孵化、六斑月瓢虫成虫的存活和捕食效能、狭臀瓢虫成虫的捕食效能以及六斑月瓢虫幼虫的捕食效能均无显著影响,表明两种提取物对蚜虫的重要天敌瓢虫是安全的;在对六斑月瓢虫成虫的毒性测试中,在处理后相同的时间内,苍耳提取物处理

表 1 植物提取物和药剂对瓢虫卵孵化的影响(深圳龙岗, 2001-11-12)

Table 1 Effect of the plant extracts and insecticides on incubation of coccinellid eggs(Longgang in Shenzhen, 2001-11-12)

处理 Treatments	孵化率 Hatching rate (%)
白蝴蝶提取物 Extract from <i>S. podophyllum</i> (0.04gDW/ml)	46.43±12.426a
苍耳提取物 Extract from <i>X. sibiricum</i> (0.04gDW/ml)	38.89±10.668a
鱼藤酮精 Rotenone (800×)	6.13±3.780b
机油乳剂 Petroleum spray oils (400×)	3.33±3.334b
0.3%印楝素乳油 Azadirachtin water-in-oil emulsion (2000×)	3.33±3.334b
CK	42.83±10.542a

表中同列数字后小写字母不同表示 DMRT 新复极差多重比较在 0.01 水平差异显著 The data in the same row with the different small letters showed significant difference at $p=0.05$. The follow was the same.

的瓢虫成虫的存活率明显较对照高,其中可能含有对六斑月瓢虫有益的物质,存活率的提高,实际也就增强了瓢虫对蚜虫的控制效果。因此,可以考虑作为植物保护剂的配方。

表 2 植物提取物对六斑月瓢虫成虫的毒性(深圳龙岗,2001-11-12)

Table 2 The toxicity of the plant extracts on the adult of *M. sexmaculata*(Longgang in Shenzhen,2001-11-12)

植物提取物种类 Plant species	瓢虫的平均存活时间(d) Mean survival periods of <i>M. sexmaculata</i>
苍耳提取物 Extract from <i>X. sibiricum</i> (0.04gDW/ml)	14.15±2.808A
白蝴蝶提取物 Extract from <i>S. podophyllum</i> (0.04gDW/ml)	8.08±1.179B
CK	8.54±2.144B

表中数字后大写字母不同表示 DMRT 新复极差多重比较在 0.01 水平差异极显著 The data in the row with the different capital letters showed significant difference at $p=0.01$

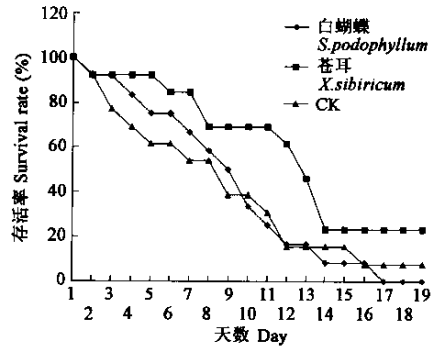


图 1 苍耳和白蝴蝶提取物对瓢虫存活时间的影响
Fig. 1 Effect of *X. sibiricum* and *S. podophyllum* extracts on survival of *M. sexmaculata*

表 3 植物提取物对瓢虫成虫捕食蚜虫的影响(深圳龙岗,2001-11-12)

Table 3 Effect of the plant extracts on predation of coccinellid adults (Longgang in Shenzhen, (2001-11-12)

处理 Treatments	捕食量(头蚜虫/天·只)Praying amount(aphid numbers/day)	
	六斑月瓢虫成虫捕食萝卜蚜 3~4 龄幼虫 The 3 rd ~4 th larvae of <i>Lipaphis erysimi</i> (Kaltenbach) preyed by adult of <i>M. sexmaculata</i> (60 : 1)	狭臀瓢虫成虫捕食桃蚜 3~4 龄幼虫 The 3 rd ~4 th larvae of <i>Myzus persicae</i> (Sulzer) preyed by adult of <i>C. transversalis</i> (60 : 1)
白蝴蝶提取物 Extract from <i>S. podophyllum</i> (0.04gDW/ml)	43.33±9.831a	60.67±6.433a
苍耳提取物 Extract from <i>X. sibiricum</i> (0.04gDW/ml)	35.67±8.132a	60.67±6.700a
CK	43.33±7.238a	56.67±10.500a

表 4 植物提取物对六斑月瓢虫高龄幼虫捕食蚜虫的影响(深圳龙岗,2001-11-12)

Table 4 Effect of plant extracts on predation of *M. sexmaculata* larvae (Longgang in Shenzhen,2001-11-12)

处理 Treatments	捕食率 Preying rate(%)	
	捕食萝卜蚜 3~4 龄幼虫 The 3 rd ~4 th larvae of <i>L. erysimi</i> preyed by <i>M. sexmaculata</i> larvae (50 : 1)	捕食桃蚜 3~4 龄幼虫 The 3 rd ~4 th larvae of <i>M. persicae</i> preyed by <i>M. sexmaculata</i> larvae (60 : 1)
苍耳提取物 Extract from <i>X. sibiricum</i> (0.04gDW/ml)	16.00±0.730a	13.00±5.385a
白蝴蝶提取物 Extract from <i>S. podophyllum</i> (0.04gDW/ml)	15.50±0.856a	12.67±3.472a
CK	19.60±8.134a	17.00±3.472a

另外两种植物源杀虫剂鱼藤酮精和 0.3%印楝素乳油以及矿物源农药机油乳剂,国内外有关它们对植食性昆虫的取食抑制、生长发育抑制、毒杀作用以及减少植物非持久性病毒传播的报道较多^[4~12],但鱼藤酮精(1000×)对蚜茧蜂成虫毒性较强^[13]。本研究表明它们对瓢虫卵具有较强杀伤力,应避免在田间瓢虫大

量产卵的季节使用。因此,如何协调这些药剂与自然天敌对农业害虫的综合控制作用,仍需要深入研究。

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