[Research on *Azypetia shirakii* in Yichang, Hubei]

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Introduction

Gastrodia elata Bl. is a perennial herbaceous heterotrophic plant of the genus *Gastrodia* in the Orchidaceae, known as Chijian, Tianma, Dingfengcao, etc. in Chinese. Under natural conditions, the germination of seeds of *Gastrodia elata* requires the participation of germination bacteria, and the growth of bulbs depends on the assimilation of *Armillaria* invading into the bulb to obtain nutrition. The nutrient source of *Gastrodia elata* is not the soil, but a section of wood or branches and leaves, but its field cultivation is inseparable from the soil. *Gastrodia elata* bulbs have high medicinal and health value, and rice hemp, white hemp (can be used as asexual seed) and arrow hemp (commercial hemp) are different growth and development stages of Gastrodia elata [2 , 3].

With the gradual increase in the demand for *Gastrodia elata* in domestic and foreign markets, and the daily increase in the market price, farmers in mountainous areas in Yichang City (Hubei Province) are gradually increasing their enthusiasm for planting *Gastrodia elata*. During the survey, the author found a new pest harmful to *Gastrodia elata* - *Azpeytia shirakii* Hurkmans, which in the local area damaged more than 60%. *Azpeytia shirakii* belongs to the Syrphidae, first recorded in Japan [5].

In 2007, Korean scholars discovered this species in South Korea and made a supplementary description of its adult morphology [6]. According to reports, *Azpeytia shirakii* can harm the rhizomes of the herbaceous heterotrophic plant *Gastrodia elata* in Japan [7] (actually bulbs [8]). This species was first discovered in Yichang in China, and it is a new underground pest of *Gastrodia elata* production in China. In order to formulate technical measures to control effectively the pest and protect the safe production of *Gastrodia elata* and the economic benefits to hemp farmers, the author investigated and studied the hazard characteristics, population density, and damage to *Gastrodia elata* in continuous- and discontinuous-cropping cultivation. The results are reported below.

1 Materials and methods

1.1 Test site

The test sites were located in the villages of Anqiaohe (1000 m above sea level), Sancha (1100 m) and Dashuitian (1200 m), Dengcun township, Shuiyuesi town, Yichang city, Hubei Province. The management of *Gastrodia elata* plantings is relatively consistent.

1.2 Test method

1. 2. 1 Field investigations were conducted on the damage to *Gastrodia elata* in Anqiaohe Village, Shuiyuesi Town, Sancha Village, Zhangcunping Forest Farm, and Dashuitian Village, Dengcun Township. We dug up infested gastrodia bulbs and examined the surface for infestation features. Then the injured corm was dissected in cross-section and longitudinal section, and the internal injuries checked and photographed.

1. 2. 2 Surveys of insect population density were carried out in three *Gastrodia elata* plantings in Anqiaohe Village, Shuiyuesi Town, Sancha Village, Zhangcunping Forest Farm, and Dashuitian Village, Dengcun Township in March, September and late November 2006 respectively. To investigate insect population density, we randomly selected 10 survey points in each village, excavated *Gastrodia elata* and soil in 1-m² hemp cellars at each point, and recorded in detail the state and population density of the bulbs.

1. 2. 3 Investigation of *Gastrodia elata* damage in continuous- and discontinuous-cropping hemp pits. In 2006, surveys were conducted on the damage to *Gastrodia elata* in continuous-cropping and discontinuous-cropping hemp pits in the above three plantings. In each village we selected 5 points, sampling about 1 m² of hemp pits each time, and recording the damage in detail.

1. 2. 4 Investigation of *Gastrodia elata* damage in different growth and development stages In November 2007, when *Gastrodia elata* was harvested, the damage in Dashuitian Village, Dengcun Township was investigated. The survey area was about 1000 m², and the damage of all bulbs in different growth and development stages was recorded in detail. We recognised the arrow hemp that had lost its commodity value due to the harm of the hoverfly larva, and the white rice hemp that could be used as seeds, and calculated the percentage of damage to commercial hemp and seed hemp respectively.

1. 3 Data processing

Analysis of variance (ANOVA) was performed using SPSS software (SPSS Inc., Chicago, Illinois, U.S.A.), and Duncan's multiple comparisons were performed on the mean, with a significance level of $p < 0.01$.

2 Results and analysis

2. 1 Damage characteristics

Gastrodia elata bulbs are harmed by *Azpeytia* larvae in the soil. Larvae mostly choose to enter at the young growth points of the bulbs or the new hemp parts. According to the on-site dissections in Sancha Village, Zhangcunping Forest Farm, among all the *Gastrodia elata* surveyed in 5 plots with continuous cropping and 5 plots with discontinuous cropping, the proportion of bulbs with a single boring accounted for 29.67%; with two borings 1.27%; and three borings 0.81%. Among the injured bulbs, single canals accounted for 93.45%; two canals 3.99%; and three canals 2.56%; among all the damaged bulbs, there was one larva in 60.12%, while 39. 88% had no larvae.

An independent-samples t test for the differences in the proportions of 1, 2, and 3 borers and the proportion of victims between discontinuous and continuous cropping showed there were some significant differences in the proportions (Table 1).

[**Table 1:** Investigation and analysis table of hazard characteristics of *Gastrodia elata*
Type / Proportion with no borer (%) / Proportion with 1 borer (%) / Proportion with 2 borers (%) / Proportion with 3 borers (%) / Proportion of *Gastrodia elata* damaged (%)
Discontinuous cropping
Continuous cropping]

The boreholes are irregular and twisted, and the diameter increases with the age and food intake of the larvae. In November, during the harvest season of *Gastrodia elata*, damaged bulbs were dissected and the diameter of the cavity was found to be 5-8 mm. Among the damaged bulbs, most had obvious insects on the surface, some were hollowed out, and some were rotted due to the damage induced by the hoverfly larva, and had completely lost their commercial value (Figure 1).

[**Figure 1:** Damage characteristics of the *Azpeytia* larva. a. Cavities on the surface of *Gastrodia elata* bulbs; b. Cross-section of the injured bulb; c. Longitudinal section of injured bulbs; d. Damaged bulbs begin to rot]

2.2 Damage rate and bulb density in continuous- and discontinuous-cropping hemp pits

Field surveys found that the larvae had pupated and overwintered nearby in March and late November. In September, during a field survey at the planting base in Sancha Village, Zhangcunping Forest Farm, larvae were found harming the bulbs (mainly arrowhead, but also white rice). Among 10 randomly selected plots (5 plots each of discontinuous and continuous cropping), there were 197 bulbs (including arrowroot and white rice) and 41 larvae in an average plot (1 m^2 hemp cellar). A t-test was used to test the damage rates and densities in the three villages in discontinuous and continuous cropping respectively, and there were extremely significant differences ($p < 0.01$) (Table 2).

[**Table 2:** Comparison of damage rate and bulb density between discontinuous and continuous cropping
Type / Anqiaohe Village, Shuiyuesi Town / Sancha Village, Zhangcunping Forest Farm / Dashuitian Village, Dengcun Township
Hazard rate / Insect population density / (repeated)
Discontinuous cropping
Continuous cropping]

Through the investigation and analysis of the damage to *Gastrodia elata* in continuous- and discontinuous-cropping cellars of planting bases, the damage rate in discontinuous-cropping cellars is obviously lower than that in continuous-cropping cellars. In discontinuous-cropping hemp cellars, the damage rate was about 20%, and in continuous-cropping hemp cellars of two and three crops, the damage rate was more than 50% (Figure 2), and some areas almost failed to harvest any. Analysis of variance showed that there was a very significant difference between the two ($p < 0.01$).

By comparing the damage rate and the syrphid density differences in the three villages, there is a significant difference in the damage rate of the uncropped hemp cellar in Anqiaohe Village, Shuiyuesi Town, and the other two villages. There were significant differences in insect density between continuous- and discontinuous-cropping hemp pits and the other two villages; there were no other differences (Table 3, Figure 3).

[**Table 3:** Comparison of the damage rate of *Gastrodia elata* and the density of *Azpeytia*.
Different villages / Hazard rate (%) / Insect density (per m^2)
discontinuous / continuous / discontinuous / continuous cropping
Anqiaohe Village, Shuiyuesi Town
Sancha Village, Zhangcunping Forest Farm
Dashuitian Village, Dengcun Township]

[**Figure 2:** Continuous (open bars) and discontinuous cropping (shaded bars) in three survey sites
Damage rate (y-axis, %) of *Gastrodia elata* bulbs in continuous-cropping hemp cellars in the three different survey sites (x-axis: Anqiaohe, Sancha, Dashuitian)
Note: "**" means there is a very significant difference between the two [open vs shaded].]

[**Figure 3:** Comparison of the damage rate (upper) and population density (lower) in three survey sites (x-axis)
Note: The uppercase letters indicate the difference in the damage rate / insect density between continuous- (black bars) and discontinuous-cropping (white bars) hemp pits; lowercase letters indicate differences among the three villages. Having the same letter means no difference, while different letters means significant differences]

[**Figure 4:** Damage rate of *Gastrodia elata* bulbs in different growth and developmental stages]

2.3 Damage rate of Gastrodia elata bulbs in different growth and development stages
In November 2007, when bulbs were being harvested in Dashuitian, in a discontinuous-cropping hemp cellar of about 1000 m², the total output of arrow hemp (commercial hemp) was 3400 kg, of which 785 kg was damaged by *Azpeytia* and the commodity value was lost; the total output of white hemp and rice hemp (seed hemp) was 918 kg, of which 96 kg could not be used as seed hemp due to the hoverfly damage (Figure 4). According to 2007 prices, the direct economic loss is as high as more than 20,000 yuan. The analysis of variance showed that there was no significant difference in the damage rates of different growth and developmental stages of the bulbs.

3 Discussion

There are few herbivorous species in the Syrphidae [9,10], but they are more harmful, such as *Eumerus strigatus, Eumerus tuberculatus* and *Merodon equestris*. The larvae harm narcissus and have caused serious damage to the narcissus industry in Europe [11]. The results of this investigation show that the larvae of the *Azpeytia* hoverfly like to enter at the young or new growth point of the *Gastrodia elata* corm or newborn hemp, and the borers can be clearly observed on the surface of the damaged plants. On-site dissection (cross-cutting and longitudinally cutting of the corm) found that in the corm there is generally one borer channel in the damaged white and rice hemp, and 1 to 3 borer channels in the injured arrow plant; the bore diameter reaches 5-8 mm. The population density per m² can reach 38-50. There was no significant difference in the damage rate of *Gastrodia elata* bulbs in different growth and development stages. There was a very significant difference ($p < 0.01$) between the damage rates in continuous-cropping and discontinuous-cropping hemp pits, which may be because the adults have an obvious tropism to immature manure and decayed organic matter. Gravid females usually choose to lay eggs on moist rotten organic matter nearby about 1 cm away in the soil layer or in soil crevices, or on the underside of leaves near the ground. The environmental conditions of continuous-cropping cellars are better than those of discontinuous-cropping cellars (usually raw wasteland or secondary wasteland) at attracting and satisfying the conditions for oviposition on *Gastrodia elata*: the specific stimuli need to be confirmed by further research.

Due to the large densities of *Azpeytia* and the great harm it does, and the fact that the harm mainly occurs underground, it is recommended to take the following control measures: (1) fumigate and disinfect the soil in the hemp cellar; (2) try not to use continuous cropping or continuous-cropping hemp pits, otherwise the hemp pits and soil must be strictly fumigated to kill larvae or pupae in the soil; (3) bulbs that have been harmed should be destroyed in a centralized manner, and not thrown away to prevent larvae or pupae from continuing to use them; (4) mixing pesticides with the soil at the time of sowing for prevention and control, and 1:1 powder of chamaejasma (*Stellera chamaejasme*: Thymelaeaceae) and herba chinensis (*Lobelia chinensis*?) can be used as insecticides [1]; (5) winter and spring (November Until April of the next year). The pupae of *Azpeytia* has the habit of crawling out of the soil surface to keep warm[?], and these can be manually captured and destroyed in a concentrated manner in combination with management measures.

天麻蚜蝇在湖北宜昌发生危害的调查研究*

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Abstract In order to safeguard the safe production and economic benefit of *Gastrodia elata* Bl., and provide scientific direction for the prevention and control of its pests, we studied the adverse effects of a new pest of this plant, *Azpeytia shirakii* Hurkmans (Diptera: Syrphidae). The damage caused by different densities of *A. shirakii* was studied in both continually cropped and non-continually cropped fields. The results show that *A. shirakii* larva enter the new growing tips of *G. elata* rhizomes; the damaged exterior of the resultant wormholes could be easily observed. We found 1-3 bands of 5-8 mm diameter worm-tracts in rhizomes. Larval density was 38-50 individuals per m^2. The proportion of damaged plants exceeded 20% but differed ($P < 0.01$) between continually cropped and non-continually cropped fields. Some suggestions for the prevention and control of *A. shirakii* are provided.

Key words *Azpeytia shirakii*, injurious features, pest density, injurious rate, *Gastrodia elata*

摘 要 为了保护天麻(*Gastrodia elata* Bl.)的安全生产和麻农的经济效益,为后续防治工作提供科学依据,研究了危害天麻新害虫——天麻蚜蝇 *Azpeytia shirakii* Hurkmans 的危害特征、虫口密度、连作与未连作麻窖中天麻受害情况和天麻球茎不同生长发育阶段受害情况。结果表明:天麻蚜蝇幼虫多从天麻球茎的幼嫩生长点或新生麻部蛀入,被害天麻球茎表面可明显地观察到蛀眼,解剖天麻的球茎发现 1 个天麻内一般有 1~3 条蛀道,蛀道直径达 5~8 mm;在 1 m^2 麻窖内虫口密度可达 38~50 头;天麻被危害率(约等于损失率)为 20% 以上;连作与未连作麻窖中天麻的被危害率之间存在极显著性差异($P < 0.01$)。并提出了相应的防治建议。

关键词 天麻蚜蝇,危害特征,虫口密度,被危害率,天麻

天麻(*Gastrodia elata* Bl.)为兰科天麻属多年生草本异养植物,又名赤箭、明天麻、定风草等,是主产于中国的一味常用且名贵的中草药[1]。在自然条件下,天麻有性种子萌发需要萌发菌的参与,球茎的生长需依靠同化侵入其体内的蜜环菌获得营养;天麻的营养源不是土壤,而是段木或其枝叶,但天麻的大田栽培又离不开土壤;天麻球茎具有很高的药用及保健价值,米麻、白麻(可作无性种麻)和箭麻(即商品麻)是天麻球茎不同的生长发育阶段[2,3]。随着国内外市场对天麻需求量的逐步增加,以及天麻市场价格的逐日攀升,湖北省宜昌市山区农民种植天麻的积极性也逐渐提高,目前宜昌市已成为全国主要天麻种植区之一[4]。笔者在调查中发现了危害天麻的一新害虫——天麻蚜蝇 *Azpeytia shirakii* Hurkmans,其在当地的危害面积达 60% 以上。天麻蚜蝇属双翅目 Diptera 食蚜蝇科 Syrphidae,首次记录于日本[5]。2007 年韩国学者在韩国发现了该种并对其形态进行了补充描述[6]。据报道,天麻蚜蝇在日本可危害草本异养植物天麻的根状

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茎[7](实为球茎[8])。该种在中国首次发现于宜昌,大面积危害天麻的球茎,是国内天麻生产中一种新的地下害虫。为制定有效防治该害虫的技术措施,保护天麻的安全生产和麻农的经济效益,作者对天麻蚜蝇的危害特征、虫口密度、连作与未连作麻窖中天麻受害情况进行了调查研究,现将结果报道如下。

1　材料与方法

1.1　试验场地

试验场地设在湖北省宜昌市水月寺镇安桥河村(海拔 1 000 m)、樟村坪林场三岔村(海拔 1 100 m)和邓村乡大水田村(海拔 1 200 m)3 个天麻种植基地,管理水平相对一致。

1.2　试验方法

1.2.1　危害情况的调查　在水月寺镇安桥河村、樟村坪林场三岔村和邓村乡大水田村 3 个天麻种植基地对天麻蚜蝇的危害特点进行野外调查。将受害的天麻球茎挖起并检查其表面的受害特征。然后将受害的球茎进行横切面和纵切面的解剖,检查受害天麻内部的情况,并拍照。

1.2.2　虫口密度的调查　2006 年 3 月、9 月和 11 月下旬分别对水月寺镇安桥河村、樟村坪林场三岔村和邓村乡大水田村 3 个天麻种植基地进行虫口密度的调查。每个村随机选 10 个调查点,每个点挖取 1 m^2 麻窖内的天麻和土壤,详细记录麻窖内天麻蚜蝇的虫态和虫口密度。

1.2.3　连作与未连作麻窖中天麻受害情况的调查　2006 年分别对上述 3 个天麻种植基地的连作与未连作麻窖中天麻受害情况进行调查。每个村各选 5 个点,每次选取 1 m^2 左右的麻窖,详细记录连作与未连作麻窖中天麻受害的情况。

1.2.4　天麻球茎不同生长发育阶段受害情况的调查　2007 年 11 月,在天麻收获之时,调查了邓村乡大水田村的天麻受害情况。调查面积约为 1 000 m^2,详细记录所有天麻球茎不同生长发育阶段的受害情况。即将受天麻蚜蝇危害而失去商品价值的箭麻和不能做种的白米麻挑出来,分别统计对商品麻和种麻的危害百分率。

1.3　数据处理

利用 SPSS 软件(SPSS Inc.,Chicago,Illinous,U. S. A.)进行方差分析(ANOVA),平均数进行 Duncan's 多重比较,显著水平 $P < 0.01$。

2　结果与分析

2.1　危害特征

天麻蚜蝇以幼虫在土壤中危害天麻球茎,幼虫多选择从天麻球茎的幼嫩生长点或新生麻部蛀入。经在樟村坪林场三岔村天麻种植基地的现场解剖发现,连作与未连作各 5 个样地调查的全部天麻中,天麻上 1 条蛀道的比例占 29.67%;2 条蛀道的占 1.27%;3 条蛀道的占 0.81%。而在受害天麻中,1 条蛀道的比例占 93.45%;2 条蛀道的占 3.99%;3 条蛀道占 2.56%;在所有受害天麻蛀道中,有 1 头幼虫的蛀道比例占 60.12%;没有幼虫的蛀道占 39.88%。Independent-Samples t 测验检验未连作和连作的无蛀道,1 条、2 条、3 条蛀道及受害比例的差异:无蛀道、1 条蛀道及受害天麻所占比例差异显著(表 1)。

表 1　天麻蚜蝇危害特征调查分析表

类型	无蛀道比例(%)	1 条蛀道比例 (%)	2 条蛀道比例(%)	3 条蛀道比例(%)	受害天麻比例(%)
未连作	80.11 ± 0.65a	18.26 ± 0.8a	1.04 ± 0.25a	0.05 ± 0.01a	19.89 ± 0.65a
连作	50.79 ± 1.24b	46.44 ± 1.0b	1.51 ± 0.42a	1.02 ± 0.47a	49.21 ± 1.24b
	$t = -20.881$	$t = 21.94$	$t = 0.951$	$t = 2.073$	$t = 20.881$
	$P < 0.001$	$P < 0.001$	$P = 0.369$	$P = 0.107$	$P < 0.001$

注:Independent-Samples t 检验未连作和连作的无蛀道,1 条、2 条、3 条蛀道,受害比例的差异。$P < 0.05$ 为显著,相同字母表示没差异,不同字母表示有差异。(表 2 同)

蛀道成不规则扭曲状，直径随着幼虫日龄和食量的增大而扩大。11 月份，在天麻的收获季节解剖被危害的天麻发现，蛀道直径达 5 ~ 8 mm。被天麻蚜蝇危害的天麻中，多数天麻的表面出现明显蛀眼，有些已被蛀空，有些由于天麻蚜蝇的危害诱发病害而腐烂，完全失去了商品价值（图 1）。

图 1　天麻蚜蝇的危害特征

a. 天麻表面的蛀眼；b. 受害天麻横切面；c. 受害天麻纵切面；d. 被危害后的天麻开始腐烂

2.2 连作与未连作麻窖中天麻的被危害率及虫口密度

野外调查发现，3 月份和 11 月下旬幼虫已就近入土化蛹越冬。9 月份在樟村坪林场三岔村天麻种植基地进行野外调查时发现，幼虫正在天麻球茎中危害（以箭麻为主，白米麻也有）。在随机选取的 10 个样地（未连作和连作各 5 个）中，平均 1 个样地（1 m^2 麻窖）有 197 个天麻球茎（包括箭麻和白米麻）、41 头幼虫。Independent-Samples t 检验分别测验 3 个村未连作和连作的天麻受害率和天麻蚜蝇虫口密度，均有极显著差异（$P < 0.01$）（表 2）。

表 2　未连作和连作天麻危害率和天麻蚜蝇虫口密度比较

类型	水月寺镇安桥河村		樟村坪林场三岔村		邓村乡大水田村	
	被危害率（%）	虫口密度（头/m^2）	被危害率（%）	虫口密度（头/m^2）	被危害率（%）	虫口密度（头/m^2）
未连作	16.37 ± 0.81a	27.4 ± 1.36a	19.89 ± 0.65a	28 ± 1.90a	22.02 ± 0.79a	35.2 ± 2.13a
连作	48.58 ± 1.72b	48.6 ± 1.36b	49.21 ± 1.24b	54 ± 1.82b	51.31 ± 2.08b	64.8 ± 2.13b
	t = 16.969，P < 0.001	t = 10.992，P < 0.001	t = 20.891，P < 0.001	t = 9.898，P < 0.001	t = 13.15，P < 0.001	t = 9.823，P < 0.001

通过对 3 个天麻种植基地的连作与未连作麻窖中的天麻被天麻蚜蝇危害的情况调查分析，未连作麻窖中天麻的受害率明显比连作麻窖中天麻的受害率要低。未连作的麻窖中，天麻被危害率为 20% 左右，连作二茬和三茬的麻窖中，其被危害率超过 50%（图 2），局部地段几乎绝收。经方差分析，两者间存在极显著性差异（$P < 0.01$）。

通过对 3 个村天麻被危害率和天麻蚜蝇虫口密度差异比较分析，结果是水月寺镇安桥河村未连作麻窖被危害率与另两个村存在显著差异；邓村乡大水田村连作及未连作麻窖虫口密度均与另两个村存在显著差异；其它无差异（表 3，图 3）。

2.3　天麻球茎不同生长发育阶段的被危害率

2007 年 11 月在邓村乡大水田村收获天麻时调查发现，约 1 000 m^2 的未连作麻窖中，箭麻（商品麻）总产量为 3 400 kg，其中 785 kg 由于天麻蚜蝇的危害而失去商品价值；白麻和米麻（种麻）总产量为 918 kg，其中 96 kg 由于天

表 3　天麻被危害率和天麻蚜蝇虫口密度差异比较分析

不同村	被危害率(%)		虫口密度(头/m²)	
	未连作	连作	未连作	连作
水月寺镇安桥河村	16.37 ± 0.81a	48.58 ± 1.72a	27.4 ± 1.36a	48.6 ± 1.36a
樟村坪林场三岔村	19.89 ± 0.65b	49.21 ± 1.24a	28 ± 1.90a	54 ± 1.82a
邓村乡大水田村	22.02 ± 0.79b	51.31 ± 2.08a	35.2 ± 2.13b	64.8 ± 2.13b
	F = 14.328, df = 2,14; P = 0.001	F = 0.694, df = 2,14; P = 0.519	F = 5.652, df = 2,14; P = 0.019	F = 21.043, df = 2,14; P < 0.001

注:ANOVA 分析 3 个村的被危害率和虫口密度差异,相同字母表示无差异,不同字母表示有差异。

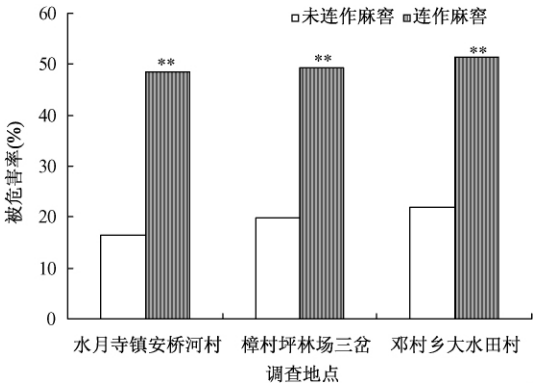
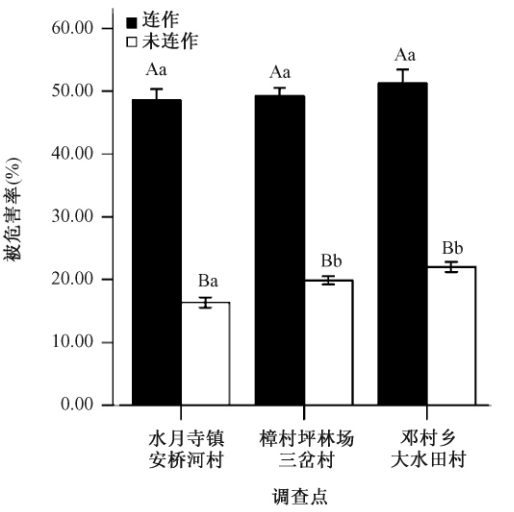


图 2　不同调查点中连作与未连作麻窖中天麻的被危害率

注:“**”代表两者间存在极显著性差异。



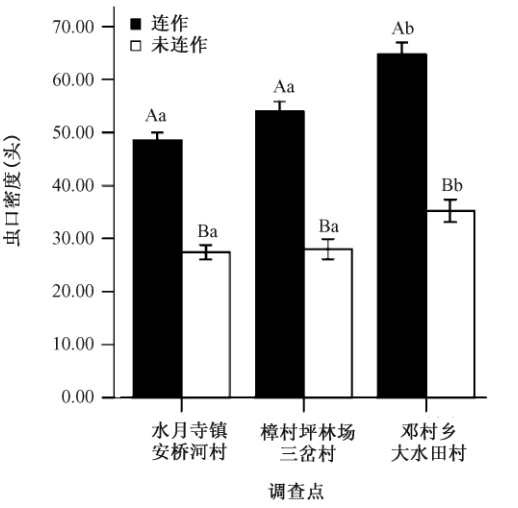


图 3　3 个村天麻危害率及虫口密度比较分析

注:大写字母表示连作与未连作麻窖危害率或虫口密度的差异性,相同字母无差异,不同字母差异显著;小写字母表示 3 个村之间连作与未连作麻窖危害率或虫口密度的差异性,相同字母无差异,不同字母差异显著。

麻蚜蝇的危害而不能做为种麻(图 4)。根据 2007 年天麻统装价格计算,直接经济损失高达 2 万元以上。经方差分析,天麻球茎不同生长发育阶段的被危害率间不存在显著性差异。

3　讨论

食蚜蝇科昆虫中植食性的种类较少[9,10],但危害性较大,如洋葱平颜蚜蝇 *Eumerus strigatus*、疣腿平颜蚜蝇 *Eumerus tuberculatus* 和水仙齿腿蚜蝇 *Merodon equestris* 的幼虫危害水仙,曾给欧洲的水仙业造成严重的损伤[11]。本调查结果表明,天麻蚜蝇幼虫喜欢从天麻球茎的幼嫩或新的生长点或新生麻蛀入,被害天麻表面可明显地观察到蛀眼。经现场解剖(横切和纵切天麻的球茎)发现,在天麻的球茎中,一般在受害的白、米麻中有 1 条蛀道,而在受害箭麻中有 1 ~ 3 条蛀道;蛀道直径达 5 ~ 8 mm。1 m² 内的虫口密度可达 38 ~ 50 头。天麻球茎不

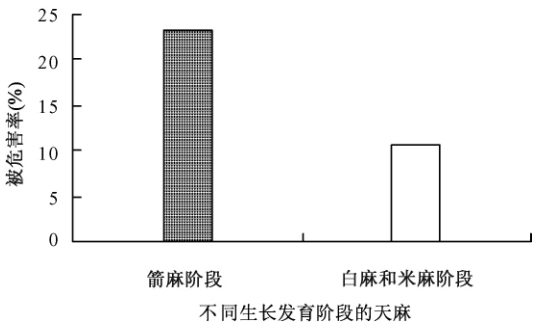


图 4　天麻球茎不同生长发育阶段的被危害率

同生长发育阶段的被危害率之间不存在显著性差异。连作与未连作麻窖中天麻的被危害率之间存在极显著性差异($P < 0.01$),这可能是因为成虫对未腐熟的粪肥、腐败有机物等有明显的趋性;成虫产卵时多选择潮湿、有腐败有机物附近 1 cm 左右的土层或土缝下、天麻蚜蝇蛹道或近地面背光的叶片上,而连作麻窖的环境条件比未连作麻窖(一般是生荒地或二荒地)更能吸引和满足天麻蚜蝇产卵,具体原因有待于进一步研究证实。

由于天麻蚜蝇虫口密度大,危害大,且其危害主要发生在地下,建议采取下列的防治措施:(1)对麻窖和麻窖中的土壤进行熏蒸和消毒;(2)尽量不要连作或使用连作麻窖,否则要对麻窖和土壤进行严格熏蒸,以杀死土壤中的幼虫或蛹;(3)对已被危害的天麻要集中销毁,不要随处乱扔,以防幼虫或蛹继续发育成成虫;(4)结合播种时和土壤一起拌药进行预防和防治,可选用 1∶1 的狼毒和百部草的粉末作为杀虫剂[1];(5)冬春季(11 月份至翌年 4 月)天麻蚜蝇蛹有爬出土壤表面取暖的习性,可结合管理措施对爬出土壤表面的蛹进行人工捕捉,集中毁灭。

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