

几种虫生真菌对斜纹夜蛾的致病性*

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摘要 用布氏白僵菌、球孢白僵菌、玫烟色拟青霉、绿僵菌和莱氏野村菌5种真菌的固体培养物,对斜纹夜蛾2、3龄幼虫进行了毒力测定.结果表明:布氏白僵菌和莱氏野村菌两种菌株对斜纹夜蛾幼虫有明显的致病效果,对2龄幼虫的致死中时(LT₅₀)分别为2.95 d和4.10 d,累计校正死亡率分别为100%和95.2%;对3龄幼虫的致病力低于2龄,致死中时(LT₅₀)分别为19.67 d和19.63 d,累计校正死亡率分别为56.6%和52.2%.玫烟色拟青霉、球孢白僵菌两菌株也有一定的致病力,对2龄幼虫的致死中时(LT₅₀)分别为4.89 d和6.34 d,累计校正死亡率分别为85.7%和71.4%.

关键词 虫生真菌 斜纹夜蛾 致病性

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Pathogenicity of several fungal species on *Spodoptera litura*. LIN Hua-feng, YANG Xin-jun, GAO Yi-bo, LI Shi-guang (College of Plant Protection, Anhui Agricultural University, Hefei 230036, China). -*Chin. J. Appl. Ecol.*, 2007, 18(4): 937-940.

Abstract: The virulence test of five species of entomogenous fungi *Beauveria brongniartii*, *Beauveria bassiana*, *Paecilomyces fumosoroseus*, *Metarhizium anisopliae* and *Nomuraea rileyi* to *Spodoptera litura* larvae showed that *B. brongniartii* and *N. rileyi* had evident pathogenic effects on *S. litura*, with the LT₅₀ value to *S. litura* 2nd instars being 2.95 and 4.10 days, and the corrected accumulative mortality of the instars being 100% and 95.2%, respectively. The virulence of *B. brongniartii* and *N. rileyi* to the 3rd instars was lower than that of 2nd instars. The LT₅₀ value to 3rd instars was 19.67 and 19.63 days, and the corrected accumulative mortality was 56.6% and 52.2%, respectively. Other two fungal species *P. fumosoroseus* and *B. bassiana* also had virulence to *S. litura* larvae. The LT₅₀ value for the 2nd instars was 4.89 and 6.34 days, and the corrected accumulative mortality reached 85.7% and 71.4%, respectively.

Key words: entomogenous fungi; *Spodoptera litura*; pathogenicity.

1 引言

斜纹夜蛾(*Spodoptera litura*)是近年来备受关注的—种重要害虫.该虫分布广、食性杂,可为害99科200多种植物^[3],其中主要农作物寄主有大豆、棉花、甘薯、烟草、花生、莲藕及多种蔬菜和果树,发生具有间歇爆发性.近十几年来,斜纹夜蛾在我国各地大发生的频率明显提高^[12,14,18],造成的损失也日益严重.化学农药不仅造成环境和农产品污染,而且会导致其抗药性急剧增强,使许多常规化学农药失去

其控制作用^[16].

用微生物防治该虫,可减少环境残留污染,有利于保护其天敌,维护生态平衡,促进自然抑制能力的发挥,从而降低害虫虫口密度^[6].目前,对细菌和病毒制剂防治斜纹夜蛾已有一些研究和应用^[2,4,11],但真菌对其致病性的研究报道较少.借鉴真菌防治其它农林害虫经验和研究技术^[5,7-10,15],本文用布氏白僵菌(*Beauveria brongniartii*)、球孢白僵菌(*Beauveria bassiana*)、玫烟色拟青霉(*Paecilomyces fumosoroseus*)、金龟子绿僵菌(*Metarhizium anisopliae*)和莱氏野村菌(*Nomuraea rileyi*)5种真菌,对斜纹夜蛾幼虫进行了毒力测定,以期从中筛选出高致病力的真菌种类.

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2 材料与方法

2.1 供试材料

2.1.1 供试昆虫与菌株 斜纹夜蛾幼虫由安徽农业大学农药研究所提供. 室内人工饲养^[19]并繁殖一代后获得. 真菌菌种部分由中国虫生真菌研究中心提供(表1). 将真菌接种在萨氏葡萄糖琼脂酵母膏(SDAY)培养基上,在光照培养箱内(25 ± 1) °C下恒温培养15 d待用.

表1 菌株寄主及来源

Tab.1 Hosts and origins of fungi

真菌种类 Fungi species	代号 Code	寄主 Host	来源地 Origin
玫烟色拟青霉 <i>P. fumosoroseus</i>	Pfu02	不详 Unknown	安徽宣州 Xuanzhou, Anhui
绿僵菌小孢变种 <i>M. anisopliae</i> var. <i>anisoplia</i>	Ma3	油菜蓝跳甲 <i>Psylliodes chrysocephala</i>	英国 England
球孢白僵菌 <i>B. bassiana</i>	5S03	一种泥蜂 <i>Ammophila</i> sp.	陕西 Shaanxi
布氏白僵菌 <i>B. brongniartii</i>	Bbr	不详 Unknown	吉林 Jilin
莱氏野村菌 <i>N. rileyi</i>	Nr98-1	不详 Unknown	澳大利亚 Australia

2.1.2 菌液的制备 将真菌的分生孢子粉刮到盛有5 ml 0.05% 土温-80 润湿剂的三角瓶中,在涡旋振荡器上充分振荡(10 min),经血球记数板测定孢子浓度,然后按比例稀释,菌液浓度均配成每毫升 8.0×10^7 个孢子.

2.1.3 试虫接菌与饲养 采用浸蘸法^[17].用毛笔挑起试虫,放入已配好的孢子悬浮液中浸蘸3 s后,置于无菌滤纸上,任其爬行晾干身体上的水分,然后移入洁净的培养皿($\Phi = 5$ cm)中单头饲养.皿内用湿棉球保湿,置于22 °C ~ 25 °C的自然环境.每处理试虫30头,3次重复.以0.05% 土温-80 无菌水处理

作为对照.

2.2 测定方法

幼虫接种后,每日按时观察和记录其行为、感病症状、罹病死亡虫数,直至化蛹为止.中途及时清除养虫器皿的排泄物,更换饲料.每天检查出的死虫放在25 °C下保湿培养,每日观察记录其变化情况,根据虫尸上长出菌丝的症状,统计僵虫率.

2.3 数据处理

以 LT_{50} 、校正死亡率和僵虫率作为害虫毒力分析的指标.以时间(d)的对数为 x ,死亡率的机率值为 y ,采用机率值分析法^[5],计算毒力回归方程和 LT_{50} 值.据此分析不同菌种的毒力.

3 结果与分析

3.1 不同真菌对斜纹夜蛾幼虫的感病症状

几种真菌对斜纹夜蛾幼虫均有致死作用,其共同感病症状为:感病致死初期,幼虫身体发僵、挺直或扭曲,成紫红色;24 h后绒毛状或棉毛状菌丝从体壁长出;48 h后菌丝覆盖整个虫体.同种菌种在不同龄期幼虫上形成的僵虫颜色相近,不同菌种相同虫龄颜色不一.球孢白僵菌、布氏白僵菌侵染后僵虫为白色,玫烟色拟青霉侵染后僵虫为殷红色,莱氏野村菌侵染后的僵虫先为白色,然后变为绿色.

3.2 不同真菌的致病死亡率

由表2可以看出,各种供试真菌对斜纹夜蛾2龄幼虫表现出不同程度的致病效果,其中校正死亡率较高的是布氏白僵菌和莱氏野村菌,分别为100%和95.2%;玫烟色拟青霉、球孢白僵菌和金龟子绿僵菌的校正死亡率分别为85.7%、71.4%和47.6%.

表2 不同真菌对斜纹夜蛾2龄和3龄幼虫的致病效果*

Tab.2 Pathogenic effect to the 2nd instar and 3rd instar larva of *S. litura* treated with different fungi

虫龄 Instar larva	处理 Treatment	累计死亡率 Accumulative mortality rate (%)	校正累计死亡率 Adjusted accumulative mortality rate (%)	回归方程 Regression equation	相关系数 Correlation coefficient (r)	LT_{50} (d)	僵虫率 Rigid cadaver rate (%)
2龄	Bbr	100	100a	$Y = -1.1133 + 8.269X$	0.9354	2.95	43.4
2nd instar	Nr98-1	96.7	95.2a	$Y = 1.8067 + 5.2110X$	0.9815	4.10	13.3
	Pfu02	90.0	85.7ab	$Y = 2.4103 + 3.7579X$	0.9862	4.89	43.4
	5S03	80.0	71.4bc	$Y = -3.1528 + 2.303X$	0.9905	6.34	22.1
	Ma3	63.3	47.6c	$Y = 3.0535 + 1.9259X$	0.9580	10.25	—
3龄	Bbr	66.7	56.6a	$Y = 1.8109 + 2.465X$	0.9289	19.67	54.1
3rd instar	Nr98-1	63.3	52.2a	$Y = 0.1089 + 3.7827X$	0.9892	19.63	33.3
	Pfu02	41.8	23.3b	$Y = 2.6057 + 1.3757X$	0.9729	55.01	66.7

* 不同字母表示差异显著($P < 0.05$) Different letters meant significant difference at 0.05 level.

对致病力较高的前 3 种真菌,进行其对斜纹夜蛾 3 龄幼虫的毒力测定结果表明,布氏白僵菌、莱氏野村菌和玫烟色拟青霉对斜纹夜蛾 3 龄幼虫有一定的致病力,但累计校正死亡率显著低于对 2 龄幼虫,平均下降 50% 以上.这说明 3 龄幼虫具有一定的生理防御能力.

3.3 不同真菌的致病速度

由表 2 可以看出,对 2 龄幼虫来说,受测真菌中以布氏白僵菌致病速度最快,LT₅₀ 为 2.95 d;莱氏野村菌和玫烟色拟青霉致病速度较快,LT₅₀ 分别为 4.10 d 和 4.89 d;球孢白僵菌和金龟子绿僵菌致病较慢,LT₅₀ 分别为 6.34 d 和 10.25 d.而 3 龄幼虫的致病速度明显低于 2 龄幼虫,布氏白僵菌和莱氏野村菌的 LT₅₀ 3 龄比 2 龄分别延长 16.72 d 和 15.53 d.

3.4 不同菌株的僵虫率

除金龟子绿僵菌外(未出现僵虫,但死虫体内检测到绿僵菌存在),其他各菌株均有僵虫出现,僵虫率为 13.3% ~ 66.7%,表明各菌种对斜纹夜蛾都有致死能力.同种真菌侵染 3 龄比侵染 2 龄僵虫率高.同一龄期幼虫比较,布氏白僵菌和玫烟色拟青霉侵染后僵虫率较高,2 龄幼虫的僵虫率达 40% 以上,3 龄幼虫的僵虫率达 50% 以上.3 龄幼虫因虫体较大,营养丰富,真菌感染致死,虫尸中真菌增殖更快,更易在短期内形成僵虫.故 3 龄幼虫比 2 龄幼虫出现更高的僵虫率.

4 讨 论

试验表明,不同菌种对斜纹夜蛾的毒力不同,可筛选高毒力菌株作为进一步开发应用的生防材料^[4].同一菌株对不同龄期幼虫的表现为对低龄幼虫致病力强,对高龄幼虫致病力弱.这主要是因为害虫的生理状态与致病力有一定关系^[13].1~2 龄幼虫主要处于生长期,抵抗外界不良环境的能力差,极易感染真菌而死亡;3 龄后幼虫虫体长,体壁增厚,体内防御体系逐渐健全,不易发病或虽感染发病却不易致死.此外,真菌致病力受环境,尤其是湿度影响较大^[1,13],在实际应用中,要建立适应其侵染和流行的小生态环境,如结合灌溉或在小雨天气中施菌,也可在人工能控制的设施栽培(温室、朔料大棚等)及草坪上应用.

供测虫生真菌菌株对斜纹夜蛾均有一定的致病力.其中,布氏白僵菌和莱氏野村菌对斜纹夜蛾有较强致病力,可作为生产应用的首选菌物,其次是玫烟

色拟青霉.因同一菌种对 2 龄幼虫致病力强,对 3 龄幼虫致病力明显减弱.因此,建议在实际生产应用中将施菌期安排在低龄幼虫期,以 1~2 龄期为宜.

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