in details. This paper reports our researches on this subject.

Conidium density could affect the conidial germination rate of *M. grisea* (Table 1). Conidium density had no significant effects on the conidial germination rate when it was lower than 10^5 conidia · ml^{-1}, and high conidium density (> 10^5 conidia · ml^{-1}) reduced the germination rate significantly, while conidium density had no effect on the appresorium formation rate.

Twelve pH values were tested for the effect on appresorium formation. Results showed that there was no effect on germination and appresorium formation when pH value was at 4 - 10, but unsuitable pH (> 10 or < 4) reduced germination rate and number of appresorium significantly.

Eight different substratum surface were tested for the effect on the conidial germination and the appresorium formation. Results showed that hydrophobic surface such as paraffin, poly styrene, polypropylene, and polycarbonate enhanced the appresorium formation, while the ability of inducing appresorium formation on cellophane and glass slide surface was lower than that on hydrophobic surface.

cAMP and IBMX (a common phosphodesterase inhibitor) were tested for the effect on the conidial germination rate and the appresorium formation. Results showed that cAMP inhibited conidial germination, but it enhanced the appresorium formation. IBMX had no effect on conidial germination, but it inhibited the growth of germ tube and promoted the appresorium formation.

Effect of nutrition on the conidial germination and the appresorium formation were also tested. Results indicated that various nutrition promoted conidial germination and inhibited the differentiation of appresorium morphology. Nitrogen starvation stimulated the appresorium morphogenesis. Conidial germination of *M. grisea* required some mineral nutrition in tap water(Table 2).□

Table 1. Effect of conidial suspension concentration of *M. grisea* on conidium germination and its appresorium formation.

Item	Concentration of conidial suspension (conidia·ml^{-1})						
	10^2	10^3	10^4	10^5	10^6	10^7	10^8
Conidial germination rate(%)	98.7 ±0.4	98.7 ±0.8	97.6 ±0.9	96.5 ±0.5	70.6 ±0.4	10.5 ±0.7	0.0
Appresorium formation rate(%)	91.6 ±0.8	90.9 ±1.0	89.6 ±1.0	90.4 ±0.2	88.7 ±0.8	90.3 ±1.0	-

Table 2. Effect of different nutrient sources on appresorium formation of *M. grisea*.

Nutrient source	Germination rate(%)		Appresorium formation (%)	
	2 h	6 h	6 h	18 h
2.0% Sugar	99.8±0.2	99.9±0.1	0.0	5.2±0.4
2.0% Peptone	98.8±0.8	99.9±0.1	0.0	3.1±0.2
2.0% Yeast extract	99.5±0.5	99.9±0.1	0.0	1.2±0.1
2.0% Tomato juice	99.9±0.1	98.9±0.4	0.0	8.6±0.3
20.0% Rice straw juice	99.7±0.3	99.8±0.2	10.1±0.8	20.5±0.4
20.0% PDB	99.8±0.04	99.8±0.05	0.0	6.0±0.3
Sterilized tap water	97.8±0.3	98.3±0.7	48.5±0.7	85.6±0.8
Ion-free water	90.5±0.5	91.3±0.5	37.4±0.6	76.5±0.6

Insecticide resistance selection in rice planthoppers

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Brown planthopper (BPH, *Nilaparvata lugens* Stål) and whitebacked planthopper (WBPH, *Sogatella furcifera* Horváth) are the main insects on rice in China. The insecticide resistance of the two planthoppers have often been reported. Availability of the resistant population is a prerequisite for studying the resistance mechanism. In this paper, one method to select methamidophos resistance of the two planthoppers was recommended.

Planthoppers used in the experiment were provided by Jiangsu Acad of Agri Sci. To compare the effects of different resistance selection methods, six were used, including topical treatment using hand microapplicator (THM), topical treatment using capillary tube (TCT), spraying on rice seedlings (SRS), spraying on planthoppers (SPH), spraying on rice and planthoppers (SRP), and soaking rice stems (SOR). THM, TCT, SRS, SPH, and SOR had

been commonly used in China, but SRP was not often used.

As shown in the table, higher selection effects were observed for THM and TCT than those for other methods, and no significant differences were observed between THM and TCT. Among the other methods, SRP had the highest effect for both BPH and WBPH. Taking the convenience and the manpower devoted into consideration, SRS, SPH, SOR, and SRP were better than THM and TCT were. Because the insecticide resistance had mass population, giving attention to the selection effect, SRP was considered as the best among the methods mentioned. □

Changes of insecticide resistance of two planthoppers in using different methods[a].

Insect	Method	LD-p line	LD_{50} ($\mu g \cdot pest^{-1}$)	Resistance
BPH	No selection (NS)	Y = 3.4706x + 12.8205	0.00558	1.0
	THM	Y = 2.6377x + 8.7380	0.03827	6.9 a
	TCT	Y = 2.2194x + 8.3235	0.02924	5.7 a
	SRS	Y = 2.9372x + 10.6722	0.01172	2.1 b
	SPH	Y = 2.7701x + 9.8057	0.01841	3.3 b
	SRP	Y = 2.3187x + 8.6665	0.02623	4.7 a
	SOR	Y = 2.7533x + 9.9311	0.01618	2.9 b
WBPH	No selection (NS)	Y = 3.0673x + 13.2333	0.00207	1.0
	THM	Y = 2.1839x + 8.5535	0.02360	11.4 a
	TCT	Y = 2.3981x + 8.9583	0.02236	10.8 a
	SRS	Y = 2.1171x + 9.1844	0.01056	5.1 b
	SPH	Y = 2.2289x + 9.2643	0.01221	5.9 b
	SRP	Y = 2.4358x + 9.3923	0.01573	7.6 c
	SOR	Y = 2.5703x + 9.8442	0.01304	6.3 b

[a] Data in the last column followed by the same letter was not significant at 0.05 level.

Biocontrol of *Rhizoctonia solani* with *Trichoderma* Spp.

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From over 800 fungal strains of *Trichoderma* Spp., 6 strains were found to greatly inhibit the growing of *Rhizocotonia solani*, the pathogen of rice sheath blight in dual culture. Among them, strain T3 was the best antagonist, which reduced the growing of the pathogen by 52.54% (Table 1).

In field, both the pesticide Jinggangmycin and the mixture of T1-T6 could reduce the severity of rice sheath blight (Table 2), which resulted in the increases of seed-setting rate and 1000-grain weight. Because the effect of the antagonists on the control of the pathogen could be partially realized in the watery environment, studies on the biocontrol mechanism of the fungi should be strengthened to help the establishment of a best way of antagonist utilization. □

Table 1. Effects of antagonistic *Tricoderma* Spp. T1-T6 on *R. solani* in dual culture.

Project	Radius of colony of *R. solani* (cm) treated by anagonists[a]						
	CK	T1	T2	T3	T4	T5	T6
Repetition 1	7.8	4.5	4.5	4.0	3.5	4.5	4.5
Repetition 2	7.2	4.5	4.4	3.5	4.0	4.0	3.4
Repetition 3	7.5	4.0	4.2	3.0	3.7	5.5	4.7
Repetition 4	7.0	5.0	5.0	3.5	3.9	5.0	4.4
Mean radius of colony	7.38	4.50	4.53	3.50	3.78	4.75	4.25
Percentage of inhibit (%)[b]	0.00	38.98	38.64	52.54	48.88	35.59	42.37
Significant difference	A	BC	BC	BCD	BC	B	BC

[a] Radius of *R. solani* was tested when *Tricoderma* Spp. was inoculated after 3 d in dual culture; [b] Percentage of inhibit = (Radius of colony of CK − mean radius of colony treated)/ radius of colony of CK × 100%.

Table 2. Effects of biocontrolling on sheath blight by using strains T1-T6 in field.

Treatment	Main disease rank	Disease index (%)[a]	Relative control effect (%)[b]	Percentage of empty-husk (%)	1000-grain weight (g)
Jinggangmycin 50 ($\mu g \cdot ml^{-1}$)	3	39.68	59.53	10.20	25.9
Spraying mixture of T1-T6	5,7	65.56	32.98	19.07	25.8
Throwing mixture of T1-T6	7,9	84.02	14.10	16.13	24.7
CK	9	97.81	0.00	51.38	21.7

[a] Disease index = (Σ [disease rank × its number])/(the most serious disease rank × the total number) × 100%; [b] Relative control effect = (Disease index of CK − disease index of treatment)/disease index of CK × 100%.