RESEARCH ON ANSWER RESISTANCE (VEGETABLES-ECHINOCHLOA CRUS-GALLI) OF SOME NEW QUALITY RICE VARIETIES IN LABORATORY CONDITIONS

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Abstract: *Research and production of clean, high-quality and high-yield rice, sustainable environmental protection are the most important and important tasks of many countries in the world as well as in Vietnam today. Therefore, the research, selection and creation of rice varieties that are both high-yield and resistant to pests, weeds, and climate change, in order to minimize the use of herbicides and pesticides. Deeply protecting people's health and the environment sustainably is extremely necessary. Our research initially identified a number of rice lines / cultivars resistant to weeds (Echonochloa Crus-Galli) such as: BT7DB, Gia Loc 26, HT7DB, DH18, BC15-02, CL. 9DB, XH1, 18NP2, TD. This will be a rich and valuable starting material source, effectively serving the selection and creation of weed-resistant rice varieties in sustainable food production.*

Keywords: *Rice, antagonism, grass, environment.*

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1. INTRODUCTION

Vietnam is one of the leading major rice exporting countries in the world. However, Vietnam's main rice export markets are developing countries, including Southeast Asia (about 40-50%), African countries (about 20-30%), there are also other markets such as the Middle East and North America (FAO, 2013) [3]. One of the reasons that the rice export market in Vietnam is limited is the impact of biotic and abiotic adverse factors that reduce the yield and quality of rice. Among these unfavorable factors, weeds are a major biological limitation on rice production in Vietnam, especially increases the economic losses seriously (reducing about 30% - 50% of rice production in the Mekong Delta) (Chin, 2001) [2].

The use of herbicides can reduce weed control time and stabilize rice yields. However,

overuse of synthetic herbicides to kill weeds is currently a serious problem in Vietnam, leading to environmental pollution, especially the soil environment (imbalance of soil microbiota). , change the physical and chemical properties as well as reduce nutrients in the soil), agricultural products are unsafe and affect human health, in addition, some weeds have become resistant to drugs. herbicide (Khanh and Cs, 2013) [8] According to statistics since 1991, the amount of synthetic herbicide was 900 tons, in 2012 it was 42,000 tons, equivalent to 300 million USD (ILS, 2013) [4].

Weed inhibition through plant antagonism (Allelopathy) is one of the most optimal solutions to reduce dependence on synthetic herbicides (Rice, 1984) [6]. Thus, by this solution, it is possible to significantly increase the yield and quality of crops without losing environmental costs. Recent research directions on the evaluation and selection of rice varieties with potential for plant antagonism are currently of interest to domestic and foreign scientists. Stemming from the above reasons, we carried out the project "Research on resistance to weeds (Echinochloa Crus-Galli) of some new quality rice lines/cultivars under laboratory conditions"

The researches were carried out to evaluate the plant antagonistic potential of 20 new quality rice lines / cultivars in Vietnam under laboratory conditions from which to identify the rice varieties with weed resistance potential. in laboratory conditions, for weed control in the field. The research results of the topic will be an important database and material for the next scientific research on antagonism in rice, and also contribute to the selection of rice varieties with inhibitory ability. weeds, suitable for rice farming conditions in Vietnam, help farmers increase income, reduce poverty and ensure human health. In Vietnam, the research on plant antagonistic activity (Allelopathy) is a new area that has not been studied much. Therefore, this topic gives a new direction in plant breeding with potential for weed inhibition. Evaluation of a number of Ban Da rice varieties with potential for weed inhibition. Paving the way for further studies on plant antagonism (Allelopathy). The combination of antagonistic (inhibitory) activities (Allelopathy) with traditional herbicides instead of herbicides will reduce environmental pollution, increase crop quality and preserve health. healthy people with the goal of developing sustainable agricultural products. The rice lines and varieties with high antagonistic potential selected in this topic will be the starting materials for the selection and breeding of rice varieties with weed resistance.

2. MATERIALS AND METHODS

2.1.1. Preparation of rice landraces and barnyard grass seeds

Research material consists of 20 new quality rice lines/cultivars collected from many different ecological regions and selected from modern methods of Biotechnology. The list of collected lines/cultivars is shown in Table 1.

Barnyandgras seeds are collected in the fields of the Center for Technical Equipment Transfer and Agricultural Extension (Vinh Quynh, Thanh Tri, Hanoi, 2020). Seed preparation: Remove all badger seeds and flat seeds by placing them in water, collecting

firm seeds at the bottom.

Table 1. List of 20 new quality rice lines / cultivars used in the study

No	Line/breed name	No	Line/breed name
1	NPT3	11	18NP2
2	KD18DB	12	DH18
3	BT7DB	13	HYT100
4	HT7DB	14	CL.9DB
5	NPT4	15	CL.8DB
6	Gia Loc 26	16	XH1
7	BC15-02	17	XH3
8	TSL1	18	XH8
9	Thu Do 1	19	MT5
10	TD	20	MT6

2.1.2. Bioassay

Experimental conditions: After sowing rice-grass seeds into Petry dishes, transfer to the laboratory to ensure the following conditions: temperature 250C, light 4000 lux, lighting time 9.00 - 17.00 h. Experimental layout: The experiment was designed in a completely randomized block model with 3 replicates, 20 treatments on cage grass. The experiment is performed according to the following steps:

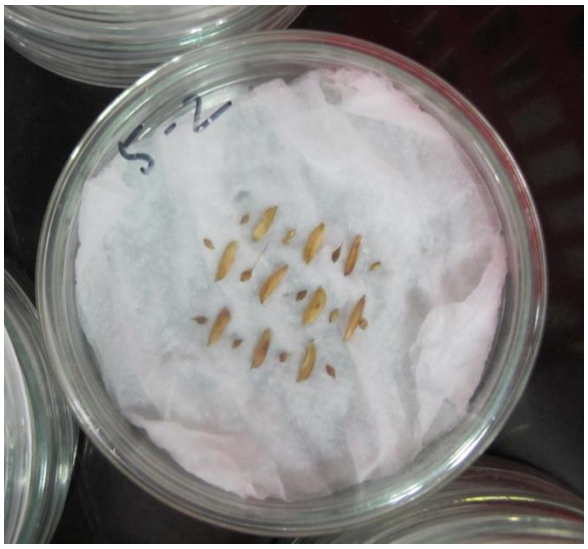

Figure 1. Diagram of sowing rice seed - grass seed

+ Prepare two types of petry dishes with diameters of 9 cm and 10 cm, respectively, that have been dried, lined with absorbent paper close to the bottom of the Petry dish with a diameter of 9 cm. Absorbent paper is used to maintain moisture inside the Petri dish to help the rice and grass seeds germinate.

+ Prepare 20 paddy seeds / 1 rice variety, 20 grass seeds for each rice variety and do not

treat any chemicals before using.

- Sowing seeds: Sowing method is conducted as follows: rice is sown in 3 rows, 4 seeds in the middle row and 3 seeds on each side. Grass seeds in the field are sown alternating between 2 grains of rice, so the middle row of rice will have 5 grass seeds and 4 grass seeds on the two sides.

For the control plate, only 13 seeds of grass in the field were sown.

- Add water: Each day add 5ml of water to each Petri dish.

Sampling and measurement of grass morphological parameters in the field

+ After 5 days of sowing, to measure morphological indicators of grass in the field, including: height of stems and length of roots.

2.1.3. Statistical analysis

+ Figures are calculated using Excel software.

+ Applying SAS software (2008) to analyze and compare experimental results.

The means were separated on the basis of the least significant differences (LSD) at the 0.05 probability level.

2.1.4. Results and Discussion

In the green soil environment, antagonists release antagonists from the roots into the environment, affecting the growth of surrounding plants. In the laboratory, young seedlings release plant antagonists through the root path into the blotting paper.

The results of the study to evaluate the antagonistic potential of the 20 new quality rice lines / cultivars under the laboratory conditions are shown in Table 2 and Figure 2.

Table 2. *Research results assessing the ability of 20 new quality rice lines / cultivars to inhibit grass in the laboratory conditions*

No	Name of rice strain / variety	Body length (cm)	Body length suppression%	Root length (cm)	Inhibition of root length%	Middle inhibitors jar (%)
1	HT7DB	4,57	24,34	2,56	57,85	45,37
2	BC15-02	4,36	28,05	2,12	65,10	46,05
3	KD18DB	4,30	21,98	2,26	61,11	40,54
4	BT7DB	4,15	30,72	2,07	67,15	48,35
5	NPT3	7,88	-31,95	3,32	42,96	5,46
6	NPT4	5,00	10,95	2,34	55,24	32,10
7	Gia Loc 26	3,65	29,65	2,05	65,07	47,75
8	Thu Đo 1	4,87	10,97	2,72	47,54	30,07
9	TSL1	4,95	12,15	2,64	48,97	31,16
10	CL.8DB	4,30	14,05	2,66	54,66	33,75
11	TD	4,66	21,00	2,07	63,05	41,55
12	18NP2	4,75	20,95	2,16	63,25	42,24

13	DH18	4,35	29,08	2,18	63,75	46,36
14	HYT100	4,68	18,00	2,54	55,98	36,72
15	CL.9DB	4,15	25.10	2,15	60,10	41,98
16	MT5	4,64	17,05	2,25	60,05	38,09
17	MT6	4,76	21,54	2,54	53,10	36,73
18	XH1	4,56	21,00	2,11	66,58	46,05
19	XH3	5,10	13,05	2,10	62,94	39,08
20	XH8	5,05	14,08	2,07	61,72	38,05
Control		5,86		5,35		
TB ức chế		4,32	18,00	2,34	57,94	38,17
$LSD_{0,05}$			0,76		0,95	0,83

Note: (-) Stimulate grass growth laboratory

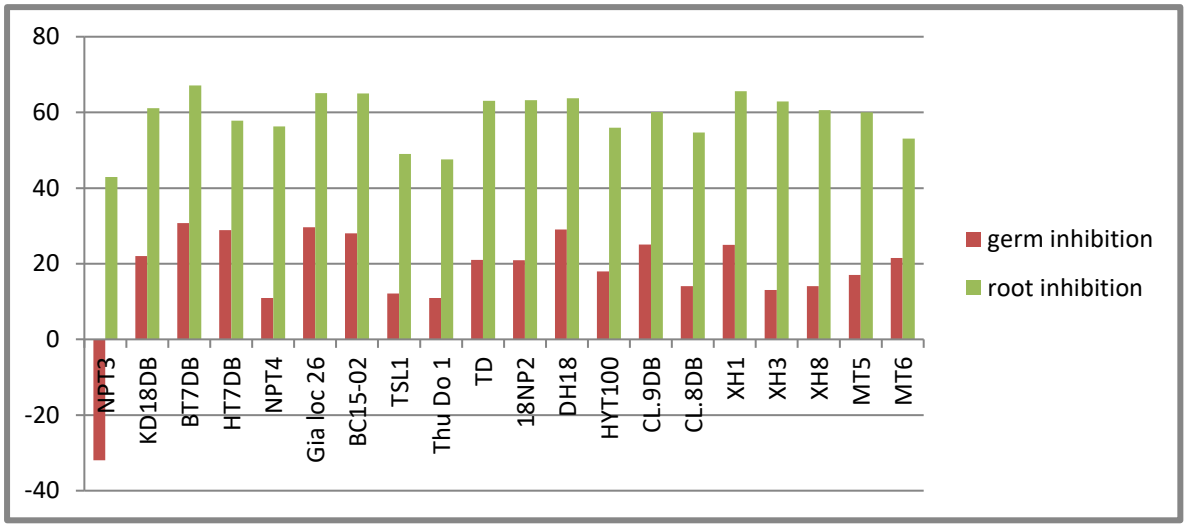

Figure 2. Diagram of percussion grass inhibition under conditions

Effects of 20 rice lines / cultivars on height development of plants and trees in cages.

The results obtained in Table 2 and Figure 2 we see:

The plant antagonists contained in the cultivated rice varieties released reduced the average height in the field grass by 30.72% (4.15 cm) compared to the control of 5.86 cm.

- According to the collected data, it is found that in each different rice variety, inhibition is different. The rice variety with the highest inhibitory ability to plant height is BT7ĐB (30.72%).

- The rice variety with the lowest inhibitory capacity is Thu Do variety (10.97%).

Among these, there are 11 varieties that reduce plant height by over 20% such as: BT7DB (30.72%), Gia Loc 26 (29.65%), HT7ĐB (28.84%), DH18 (29.08%). , BC15-02 (28.05%), Quality guarantee (25.10%), XH1 (25.00%), KD18DB (21.98%), 18NP2 (20.95%), TD (21.00 %), MT6 (21.54%).

- There are 8 rice varieties with inhibitory capacity of less than 20% such as HYT100 (18.00%), MT5 (17.05%), XH8 (14.08%), CL8.DB (14.05%), TSL1 (12.15%),

XH3 (13.05%), NPT4 (10.95%).

- NPT3 variety stimulates body height development -31.95% (7.88 cm).

- With the value of LSD.05 reaching 0.75, it shows that the formulas have different values and are significantly different from the control formulas at the 90% confidence level.

Effect of 20 rice lines / cultivars on the development of grass roots length.

- Through Table 2 and Figure 2, we see that the plant antagonists released from rice lines / cultivars reduced the average length of grass roots by 66.58% (2.10 cm) compared to control was 5.35 cm.

- The rice line with the highest ability to inhibit the root length is XH1 (66.58%).

- The variety with the lowest root length inhibition ability is NPT3 (42.90%).

- Out of a total of 20 rice lines / cultivars with: most of the lines / cultivars are more than 50% able to inhibit the weeds, arranged in the following order: XH1 (66.58%), Gia Loc 26 (65 , 07%), BT7DB (67.12%), BC15-02 (65.00%), DH18 (63.75%), XH3 (62.94%), 18NPT2 (63.25%), TD (63 , 05%), XH8 (61.72%), High quality (60.10%), MT5 (60.05%), HT7DB (57.85%), HYT100 (55.98%), NPT4 (56 , 25%), High quality (54.66%), MT6 (53.11%).

In addition, the remaining lines / cultivars inhibited more than 40% such as: TSL1 (48.97%), Thu Do 1 (47.54%), NPT3 (42.90%).

- Based on the results obtained above, we see that the inhibitory capacity is different for different varieties and the highest root length inhibitory line is XH1 (66.58%).

Most rice lines / cultivars have the ability to inhibit weed growth. The highest average inhibition was Gia Loc 26 (47.75%);

The lowest mean of inhibition was NPT3 (5.46%). There are 10 varieties with over 40% inhibitory ability: Gia Loc 26 (47.75%), BT7ĐB (48.35%), DH18 (46.38%), BC15-02 (46.05%), XH1 (46.05%), HT7DB (45.37%), 18NPT2 (42.24%), Special quality (41.98%), TD (41.55%), KD18DB (40.54%).

There are 9 varieties with inhibitory ability from 29% to less than 40%: XH3 (39.08%), MT5 (38.09%), XH8 (38.05%), MT6 (36.73%), HYT100 (36.72%), Quality 8 (33.75%), NPT4 (32.10%), TSL1 (31.16%), Capital 1 (30.07%).

- The results obtained in Table 2 Figure 2 shows that are consistent with the results reported by Olofsdotter and Navarez (1996) on the evaluation of the antagonistic potential of some rice varieties under the laboratory conditions. Fruit inhibits root length greater than tree height inhibition.

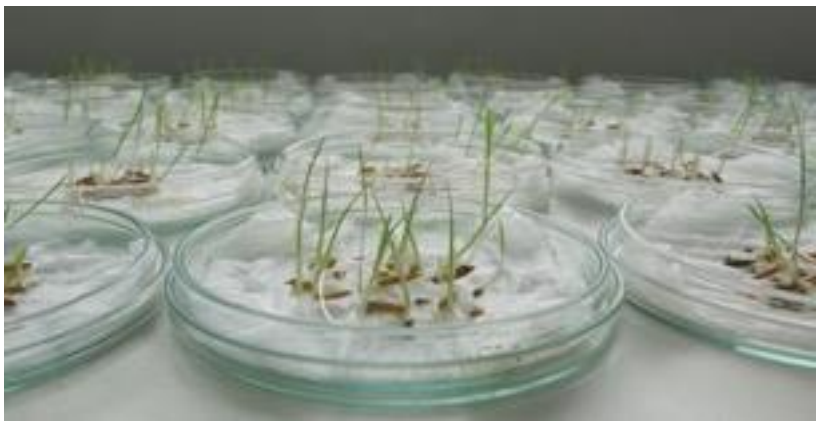

Figure 3. Growth of rice varieties and basal grass after 5 date of sowing on Petri dishes

Green plants produce many secondary substances including plant antagonists. Plant antagonists are capable of affecting the growth of neighboring plants. Both plants and weeds possess such substances. These substances are released from plants into the environment, in the soil by secreting their roots or by the decay products of their dead cells. Many rice varieties release plant antagonists and inhibit the growth of many plants under laboratory conditions.

3. CONCLUSION

From the above research results, we draw the following conclusions:

- The results of assessing the growth inhibition ability of 20 new quality rice lines / cultivars on caged grass by in-room experiments showed that the indigenous rice varieties were capable of inhibiting the growth of roots and height. tree

- The rice varieties have good ability to inhibit plant height growth such as: BT7DB, Gia Loc 26, HT7ĐB, DH18, BC15-02, CL.9DB, XH1, 18NP2, TD, MT6;

- Rice lines / cultivars have the ability to inhibit root length growth such as: XH1, Gia Loc 26, BT7DB, BC15-02, DH18, XH3, 18NP2, CL.9DB, XH1, TD;

Thus, through research, evaluation and survey, we found that the lines / cultivars have the ability to inhibit plant height and root length are: BT7DB, Gia Loc 26, HT7DB, DH18, BC15-02, CL.9DB, XH1, 18NP2, TD.

Thereby, continuing to evaluate plant antagonistic activity in net house conditions and in the field to accurately determine the varieties with the highest antagonistic potential with the highest wild type. Isolation, identification of antagonistic compounds related to the ability to inhibit weeds. Synthesize antagonistic compounds to create a basis for development of natural herbicides to help develop agriculture, increase productivity to serve people's life.

REFERENCES

1. Ahn J.K., Hahn. S.J., Kim. J.T., Khanh. T.D., Chung. I.M. (2005), *Evaluation of allelopathic potential among rice (Oryza sativa L.) germplasm for control of Echinochloa crus galli P.Beauv*

in the field. Crop Protection. 24:413-419.

2. Chin. D.V. (2001), "Biology and management of barnyard grass. red sprangletop and weedy rice". *Weed Biology and Management*. 1:37-41.
3. Khanh T.D., Cong L.C., Chung I.M., Xuan T.D. (2009), "Variation of weed-suppressing potential of Vietnamese rice cultivars against barnyard grass (*Echinochloa crus-galli*) in laboratory". *Greenhouse and field screenings. Journal of Plant Interactions*. 4:209-218.
4. Khanh T.D., Linh L.H., Linh T.H., Quan N.T., Trung K.H., Cuong D.M., Hien V.T.T., Ham L.H., Xuan T.D (2013). "Integration of allelopathy to control weeds in rice. In: Herbicides" – *Current Research and Case Studies in Use*. Andrew. J (eds). 75-99.
5. Khanh T.D., Xuan T.D., Chin D.V., Chung I.M., Abdelghany E.A., Tawata S. (2006), "Current status of biological control of paddy weeds in Vietnam". *Weed Biology and Management*. 6:1-9.
6. Khanh T.D., Xuan T.D., Chung I.M. (2007), "Rice allelopathy and possibility for weed management". *Annals of Applied Biology*. 151:325-339.
7. MARD –Ministry of Agriculture and Rural Development (2016). *Annual report of rice production*. December. 2016.
8. Rice E.L, (1984), Allelopathy.2nd ed. Academic Press Inc. Orlando. FL, p.422.

NGHIÊN CỨU KHẢ NĂNG KHÁNG CỎ DẠI (CỎ LỒNG VỰC-ECHINOCHLOA CRUS-GALLI) CỦA MỘT SỐ DÒNG GIỐNG LÚA CHẤT LƯỢNG MỚI TRONG ĐIỀU KIỆN PHÒNG THÍ NGHIỆM

Tóm tắt: *Nghiên cứu và sản xuất lúa gạo sạch, chất lượng và năng suất cao, bảo vệ môi trường bền vững là nhiệm vụ cấp thiết quan trọng hàng đầu của nhiều quốc gia trên thế giới cũng như ở Việt Nam hiện nay. Vì vậy việc nghiên cứu, chọn tạo ra các giống lúa vừa có năng suất chất lượng cao, vừa có khả năng kháng sâu bệnh, cỏ dại, chống biến đổi khí hậu, nhằm hạn chế tối đa sử dụng thuốc trừ cỏ, thuốc trừ sâu… bảo vệ sức khỏe người dân và môi trường bền vững là vô cùng cần thiết. Nghiên cứu của chúng tôi bước đầu đã xác định được một số dòng/giống lúa có khả năng kháng lại cỏ dại (cỏ lồng vực- Echonochloa Crus-Galli) như: BT7ĐB, Gia Loc 26, HT7ĐB, DH18, BC15-02, CL. 9ĐB, XH1, 18NP2, TD. Đây sẽ là nguồn vật liệu khởi đầu phong phú có giá trị, phục vụ đắc lực cho công tác chọn tạo các giống lúa có khả năng kháng cỏ dại trong sản xuất lương thực bền vững.*

Từ khóa: *Lúa gạo, đối kháng, cỏ lồng vực, môi trường.*