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Genotype Difference of Plant Regeneration from Dormant Bud Culture in *Colocasia esculenta* Schott.

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ABSTRACT

This study was conducted to obtain the basic breeding information of *Colocasia esculenta* Schott. Effect of supplemental plant growth regulators and genotype difference were investigated on dormant bud tissue for proliferation. The plant regeneration ratio, plant height and root length were the best upon mixed treatment of 0.8mg/L IAA and 2.0mg/L zeatin. Both leaf weight and root weight were heavy upon culture in a dark condition. The leaf and root weights were heaviest in 6% sucrose concentrations. In several collected area the heaviest one was Binnangxin and then in the order of Suwon, Wanju and Puan. Genotype differences of tuber diameter and tuber weight were found in Suwon. Tuber weight was found in the order of Suwon(862mg)>Wanju(723mg)>Puan(649mg)>Binnangxin (424mg).

Key words : *Colocasia esculenta* Schott., plant regeneration, genotype

INTRODUCTION

The characteristics of all living organ are controlled by genetic factors and are maintained in their individual preservation and transmission to future generations. Recently, there have been ecological disasters due to various environmental changes, and these disasters may be overcome only with genes of good resistance. With genes of various useful characteristics, cultivated species, relatively wild species and undeveloped, botanical genetic resources may form the basis of plant rearing and life science. However, with the spread of new cultivar, native species are rapidly decreasing. In particular, with an abnormal change of weather due to the destruction of nature accelerated by industrialization, botanical genetic resources are being lost gradually(Chang, 1983; Hardon, 1991; Soule, 1991; Swanson, 1995).

Regarding improvement of new varieties of plants, the most difficult problem in using biotechnological methods is plant regeneration(Huang et al., 1996). *Colocasia esculenta* Schott.(taro cultivar) whose habitat is known as India and Malaysia is a perennial plant of the Araceae(Tanimoto and Matsumoto, 1986). It has been studied partly in the field of regeneration by tissue

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culture(Plucknett, 1970). Plant regeneration of taro varies in the extent of regeneration by varieties and strains, and is generally low in frequency(Malamug et al, 1992). Therefore, many problems are found in utilizing how to improve a new variety of plants which introduced foreign genes, through the transformation of inherited characters and the development of a new variety using tissue culture technologies.

The purpose of this study was to examine the differences in plant regeneration from dormant bud culture of taro cultivar, according to culture conditions suited to plant regeneration, genotype, variety and concentrations of plant growth regulators.

MATERIALS AND METHOD

For the test, this study elected to use three indigenous varieties collected from Suwon, Wanju and Puan, and Binnangxin, a species distributed from Taiwan Agricultural Research Institute. The test taro cultivars were washed in running water, digested in 75% alcoholic solution for 3 minutes, digested in 0.5% sodium hypochlorite solution for 20 minutes, washed three times in sterilizing water, in turn, and then the dormant buds were extracted and cultured. For auxin, IAA and NAA of 0.8mg/L were put in the MS, a standard culture medium, and for cytokinin, BA and zeatin were added after mixing in the concentrations of 0.1, 1.0, 2.0 and 4.0mg/L respectively. The culture mediums were obtained by 0.8% agar in every treatment and then sterilized in high pressure at 121℃ for 15 minutes. The culture room temperature was regulated to maintain 25±1℃. For a test on optimum culture conditions, culture was performed by adding sucrose of 3, 6 and 9% each in separation of light and dark culture. Differences in plant regeneration between genotypes were investigated, using two varieties and one strain, 8 weeks after culture, the plant regeneration ratio, plant height, root weight, leaf weight, tuber diameter, and tuber weight were investigated.

RESULTS AND DISCUSSION

The effects of plant growth regulators on dormant bud culture were investigated, and the findings are shown as in Table 1. On the mixed treatment test of IAA and zeatin in the MS standard culture medium, the effects of plant growth regulators on plant regeneration and root length were the best upon 0.8mg/L IAA + 2.0mg/L zeatin(Fig. 1). The plant height showed the highest at the treatment block with 8mg/L IAA + 1.0-2.0mg/L zeatin. Meanwhile, on the mixed treatment test

Table 1. Effect of growth regulators on the callus induction and plant regeneration from dormant bud cultured for 8 weeks

Growth regulator(mg/L)				No. of bud cultured (ea)	Plant regeneration (%)	Plant height (mm)	Root length (mm)
IAA	Zeatin	NAA	BA				
0.8	0.1			45	71	34^{b*}	49^{c}
0.8	1.0			45	84	42^{a}	56^{b}
0.8	2.0			45	100	45^{a}	69^{a}
0.8	4.0			45	76	36^{b}	58^{b}
		0.8	0.1	45	59	26^{c}	41^{c}
		0.8	1.0	45	69	30^{b}	50^{c}
		0.8	2.0	45	83	37^{a}	64^{a}
		0.8	4.0	45	72	24^{c}	59^{b}

* : Duncan' s multiple range test at 5% level.

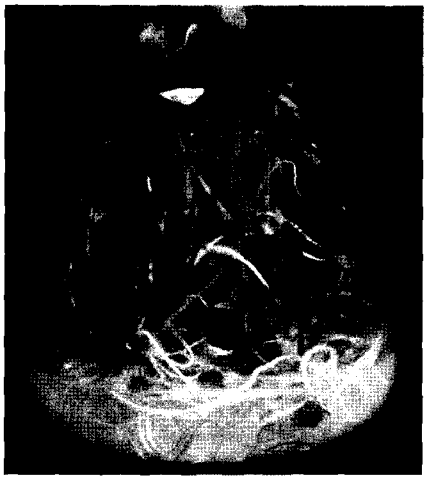

Fig. 1. Plant regeneration of *Colocasia esculenta* Schott. after 8 weeks of culture medium with 0.8mg/L IAA + 2.0mg/L Zeatin.

of NAA and BA on MS medium, the effects of growth regulator on plant regeneration ratio, plant height and root length were the best when treated 0.8mg/L NAA + 2.0mg/L BA. In view of these results, regarding mixed treatment of dormant bud with auxin(IAA, NAA) and cytokinin(zeatin, BA) on MS medium, the effects growth regulator content on plant regeneration ratio, plant height and root length were the best upon mixed treatment of 0.8mg/L IAA and 2.0mg/L zeatin.

Light and darkness affecting aboveground and underground parts of a plant, as well as proper culture conditions such as sucrose concentrations, upon dormant bud culture of taro, were investigated and the results are shown as in Table 2. Both leaf weight and root weight were heavier upon culture in a dark condition, regardless of sucrose concentrations, than in a light condition. Leaf and root weights were heaviest in the condition with a 6% sucrose concentrations. As sucrose concentrations was higher, leaf and root weights showed a decreasing trend. According to Hu and Wang(1987), they suggested that the formation of a tuber was the best in a 6-8% sucrose concentrations, which is in accord with this study. Regading leaf and root weights, some differences were found between varieties. In several collected varieties, the heaviest one was Binnangxin and then in the order of Suwon, Wanju and Puan. According to Dumas Devaulx et al.(1981), they suggested that there were differences in the organic

Table 3. Effect of different genotypes on tuber diameter and tuber weight from dormant buds of *Colocasia esculenta* Schott.

Genotype	Tuber diameter (mm)	Tuber weight (mg)
Suwon	9.0^{a*}	862^{a}
Puan	7.3^{b}	649^{c}
Wanju	7.9^{b}	723^{b}
Binnangxin	5.1^{c}	424^{d}

* : Duncan' s multiple range test at 5% level.

Table 2. Effect of cultural condition on the growth of dormant buds of *Colocasia esculenta* Schott. after 60 days of subculture♪

Condition	Sucrose concentration (%)	Leaf weight (mg)				Root weight (mg)			
		Suwon	Puan	Wanju	Binnangxin	Suwon	Puan	Wanju	Binnangxin
Light	3	425^{a*}	318^{a}	385^{a}	451^{a}	900^{b}	663^{b}	857^{b}	1060^{b}
	6	376^{a}	249^{a}	364^{a}	395^{a}	1448^{a}	1066^{a}	1297^{a}	1584^{a}
	9	229^{b}	197^{b}	203^{b}	242^{b}	699^{c}	447^{c}	654^{c}	731^{c}
Dark	3	981^{a}	662^{a}	793^{a}	1033^{a}	1221^{b}	988^{b}	1102^{b}	1342^{b}
	6	505^{b}	380^{b}	419^{b}	637^{b}	1532^{a}	1123^{a}	1355^{a}	1611^{a}
	9	394^{c}	288^{c}	324^{c}	470^{c}	704^{c}	464^{c}	663^{c}	846^{c}

♪ : *MS medium containing* 0.8mg/L IAA + 2.0mg/L zeatin were used

* : Duncan' s multiple range test at 5% level.

standard of plant regeneration between varieties and between strains, to which this study also found differences in various characteristics between genotypes.

Genotype differences in tuber diameter and tuber weight among the quantifying factors were investigated and the results are shown in Table 3. The widest difference in tuber diameter between species was found in Suwon and the narrowest in Binnangxin, while no significance was found in Puan and Wanju. Meanwhile, difference in tuber weight between varieties was found in the order of Suwon(862mg)>Wanju(723mg)> Puan(649mg)>Binnangxin(424mg).

LITERATURE CITED

Chang T. T. 1983. Genetic resources of rice. Outlook on Agriculture 12:57-62.

Dumas Devaulx R. Chambonnet D. Pochard E. 1981. Culture in vitro d' antheres de piment(*Capsicum annunm* L.) Agronomic 1:859-865.

Hardon J. J. 1991. Intellectual property protection and genetic resources. Crop Networks : 29-36

Hu, C.Y. and Wang P. J. 1987. Meristem, shoot tip and bud culture. p.177-227. *In* Ammirato, PV., D. A. Evance, W. R. Sharp. and Y. Yamada(eds.). Handbook of plant cell culture, Vol. 3, Collier Macmillan publishers, London.

Huang D, Zhu B and Yang W. 1996. Introduction of cecropin B gene into rice(*Oryza sativa* L.) by particle gun bombardment and analysis of transgenic plants. Sci China Ser C, 39:652-661

Malamug, J.J.F., Yazawa S. and Asahira T. 1992. Plantlet regeneration from taro(*Colocasia esculenta* Schott) callus. J. Japan Soc. Hort. Sci. 60:935-940.

Plucknett, D.L.1970. *Colocasia, Xanthosoma, Alocasia, Cyrtosperma* and *Amorphophallus*. Proc. 2nd Int. Symp. Trop. Root Tuber Crops, Honolulu, Hawaii.

Swanson T. 1995. Global values of biological diversity : The public interest in the conservation of plant genetic resources for agriculture. Plant Genetic Resources Newsletter 105:1-7

Soule, M. 1991. Conservation : Tactics for a constant crisis. Science 253:744-752.

Tanimoto, T. and Matsumoto, T. 1986. Variation of morphological characters and isosyme patterns in Japanese cultivars of *Colocasia esculenta* Schott and *C. giganter* Hook, Japan J. Breed. 36:100-111.

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