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PLANTS SUSCEPTIBLE TO DWARF DISEASE OF RICE PLANT

BY

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The symptoms of dwarf disease of rice plant closely resemble those of corn stripe disease in Cuba and likewise those of streak disease of maize and sugar cane in South Africa. The latter diseases are transmitted by the agency of the leafhoppers, *Peregrinus maidis* ASHM. (STAHL 1927) and *Cicadulina mbila* NAUDE (STOREY 1925), respectively. According to STOREY (1925) various species of cultivated and wild grasses are subject to the attack of streak disease of maize. The writer, accordingly, attempted to transmit dwarf disease of rice plant to corn and several other grasses by the agency of the leafhopper, *Nephotettix apicalis* MOSTCH. var. *cincticeps* UHL.

All the inoculated plants were raised in 5-inch pots in insect proof cages and young plants 2 to 10 days after germination were exposed to the infestation of leafhoppers in cages or glass tubes. The cages employed were 30 cm. square and 60 cm. high. The potted young plants were placed in the cages and a definite number of leafhoppers were introduced therein. When the plants were unfavorable food plants for the leafhopper, certain individual insects would not migrate to the plants to feed upon them but remained on the wall of their cages eventually to be starved to death. In the later experiments, therefore, glass tubes were used instead of cages, allowing 3 or 4 plants to be grown in a glass tube and a definite number of infective leafhoppers were transferred on to these plants. The glass tubes were about 30-40 cm. long by 3 cm. in diameter, closed at the upper end with a thin cotton cloth and put on plants to be inoculated. The leafhoppers were allowed to remain there until they all died or the symptom of the disease began to appear.

The results of these experiments are shown in the following table.

Table 1 Results of attempted transmission of dwarf disease
of rice plant to cultivated and wild grasses.

Series I Cage Experiment

date	name of plant	No. of insect per plant	length of feeding period	No. of plants	
				inoculated	affected
	<i>Zea mais</i> L.				
July 9 '28	unnamed variety	2	5-12 days	28	0
June 20 '30	Longfellow & Sapporo Hachigyô	3	7-14	10	0
	<i>Setaria italica</i> BEAUV.				
June 30 '30	Yûshi	3	7-14	5	0
	<i>Echinochloa Crus-gali</i> BEAUV. subsp. <i>colona</i> var. <i>edulis</i> HONDA				
June 30 '30	Shiro Sangoku & Shiratama	3	20	10	5
July 31 "	Shiro Sangoku	2	21	10	9
	<i>Panicum miäaceum</i> L.				
June 30 '30	Wase	3	20	5	5
July 31 "	"	2	20	10	7
Jan. 23 '33	"	1	20	10	6
	<i>Hordeum sativum</i> JESS. var. <i>vulgare</i> HACK. subv. <i>coeleste</i> HACK.				
Feb. 2 '33	Marumi	1	5	10	0
Oct. 3 '33	<i>Poa pratensis</i> L.	2	30	20	6

Series 2 Glass Tube Experiment

date	name of plant	No. of insect per plant	length of feeding period	No. of plants	
				inoculated	affected
	<i>Zea mäs</i> L.				
Mar. 1 '33	Sapporo Hachigyō	1	7-10 days	5	0
"	Longfellow	1	7-10	6	0
Mar. 3 "	"	1	7-10	5	0
Mar. 20 "	Sapporo Hachigyō	3	5-7	10	0
Mar. 21 "	"	10	5-7	5	0
	<i>Hordeum sativum</i> JESS. var. <i>vulgare</i> HACK. subv. <i>coeleste</i> HACK.				
June 14 '33	Marumi	2	7-13	10	0
	<i>Hordeum sativum</i> JESS. var. <i>hexastichon</i> HACK.				
Mar. 11 '33	Chevalier	1	7-10	10	0
June 14 "	"	2	7-15	5	0
Mar. 11 "	Golden Melon	1	7-10	10	0
June 14 "	"	2	7-15	10	0
	<i>Avena sativa</i> L.				
Feb. 28 '33	White Belgium	1	7-10	10	0
May 14 "	"	1	7-15	10	1
Mar. 13 "	Race Horse	1	7-15	10	1
May 14 "	"	1	5-7	10	2
	<i>Secale cereale</i> L.				
Mar. 16 '33	unnamed variety	1	7-10	10	3
May 14 "	"	1	5-8	10	0
Nov. 20 "	"	3	4-16	10 (-6*)	1
	<i>Triticum vulgare</i> VILL.				
Mar. 16 '33	Sapporo Harukomugi	1	7-10	10	2
May 25 "	"	3	7-20	3	0
June 7 "	"	2	7-20	10	0
Nov. 20 "	"	3	4-16	10 (-5*)	2
Mar. 17 "	Martin's Amber	1	7-10	7	0
May 25 "	"	3	7-20	5	0
June 7 "	"	2	7-20	10	0
	<i>Setaria italica</i> BEAUV.				
Mar. 16 '33	Yūshi	1	5-10	10	0
Mar. 17 "	Hōten 20-gō	1	5-15	10	0

date	name of plant	No. of insect per plant	length of feeding period	No. of plants	
				inoculated	affected
	<i>Andropogon Sorghum</i> BROT. var. <i>vulgaris</i> HACK. subv. <i>japonicus</i> HACK.				
Mar. 14 '33	Jagan	1	7-10	10	0
May 15 "	"	1	5-7	20	0
	<i>Andropogon Sorghum</i> BROT. var. <i>obovatus</i> HACK.				
Apr. 5 '33	Kuromi Baraho	1	7-10	5	0
	<i>Panicum miliaceum</i> L.				
Mar. 11 '33	Wase	1	10	7	7
Mar. 16 "	Manshū Shiro	1	10	10 (-8*)	2
Apr. 5 "	"	1	12	10 (-6*)	4
	<i>Echinochloa Crus-galli</i> BEAUV. subsp. <i>colona</i> var. <i>edulis</i> HONDA.				
Apr. 5 '33	Shiro Sangoku	1	12	10	10
	<i>Alopecurus fulvus</i> L.				
Apr. 25 '33	"	1	10-15	10	7
May 9 "	"	1	10-15	5	1

* No. of plants prematurely died

In the experiments performed in 1928 and 1930, it was not definitely known whether the leafhoppers used were all viruliferous, although they all had been reared on dwarf diseased rice plants. Consequently the results may be regarded as inconclusive when negative. All the leafhoppers used in the experiments conducted in 1933 were progeny from infective female leafhoppers, which had been bred on diseased plants and so it is highly probable that almost all of them were viruliferous.**

As shown in table 1, it has been conclusively proved that *Panicum miliaceum* L., *Echinochloa Crus-galli* BEAUV. subsp. *colona* HONDA var. *edulis* HONDA, *Alopecurus fulvus* L. and *Poa pratensis* L. are subject to attack by the virus causing dwarf disease of rice plant. The symptoms on these plants closely resemble those on rice plant, being characterized by streak and spotting on leaves and stunting of the whole plant. These plants proved to be favorite plants for the leafhopper under consideration. Rye, wheat and oats are slightly susceptible to the disease, infection having been produced in only a small portion of the inoculated plants. This may be partly due to the fact that these plants

** cf. FUKUSHI, T., On the relation between *Nephotettix apicalis* var. *cincticeps* and dwarf disease of rice plant. Agric. & Hort. 9 : 669-676, 879-890. (in Japanese) 1934.

are uncongenial food plants for the leafhoppers which could not survive on them for longer than two or three weeks at most. The manifestations of the disease on these plants are generally less conspicuous but the severely affected plants are much stunted and the yellowish white spots and streaks on the leaves are striking when viewed by transmitted light.

The plants which gave negative results are corn, Italian millet, barley and sorghum, although some of them may in the future prove to be more or less susceptible, if the work is carried out on a large scale. These plants were apparently unfavorable as food plants for the leafhoppers. They could survive on these plants for less than 15 days and perished sooner or later.

In "Results of experiments with insect pests. Report 8" published by the Shiga Agricultural Experiment Station in 1908, it is briefly mentioned that dwarf disease of rice plant was successfully transferred to *Echinochloa Crus-galli* BEAUV. subsp. *colona* HONDA var. *edulis* HONDA but all the attempts to transmit it to *Panicum miliaceum* L. and *Setaria italica* BEAUV. failed. It appears that similar experiments were repeatedly conducted with invariably the same results during a period from 1904 to 1912 as briefly stated in that Experiment Station's Special Bulletin No. 2 and likewise in Annual Reports for the years 1908 to 1912.

It is worthy of note that *Alopecurus fulvus* L. is susceptible to dwarf disease of rice plant. Since this is a biennial wild grass abundantly growing on the rice fields throughout Japan, it is possible that the virus causing dwarf disease of rice plant may be carried over the winter in this wild grass. However, there are no records to indicate the occurrence of symptoms similar to those of dwarf disease of rice plant on wild grasses and the writer has never met with even one suspected case.

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