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SILICA OF RICE CULTIVARS, *ORYZA SATIVA* (LINN.) VERSUS FEEDING BY *OXYA NITIDULA* (WALKER)

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The present investigation aimed at evaluating the effect of silica content in eighteen rice cultivars to the feeding of *Oxya nitidula* (Walker). Food consumption by *O. nitidula* was carried out on all the selected cultivars fed through "no-choice" basis. IR 50 was the most preferred in comparison to the other cultivars. The silica content of each cultivars had a negative role with respect to the food consumption by *O. nitidula*. High silica content in the plant seemed to interfere with feeding of the insect and showed a negative correlation.

INTRODUCTION

Oryza sativa Linn. is an important crop plant grown in large hectors (426 lacks hectors) in India. About 22.79 lakh hector is under paddy cultivation in the state of Tamil Nadu (South India). Nearly thirty rice cultivars are grown commonly throughout the year in this state. Several spices of grasshoppers attack the rice crop. The real damage is caused by the small rice Grasshopper, *Oxya nitidula* (Walker). This species is widely prevalent in the rice growing areas of Tamil Nadu. It causes severe damage to the rice crop (Chandramohan & Manoharan, 1989). Ambethgar & Kumaran (1998) have reported that a single *O. nitidula* grasshopper can damage 50 or more rice hills in its lifetime. In early April 1997, grasshoppers plagued the mature rice crop, cultivar ADT 36, at the State Seed Farm, Madur, Karaikal, Tamil Nadu, India. The common symptoms are defolitation but at times of severe infestation, it can even damage the plant and eat the entire shoot system and destory the entire plant (Ghose *et al.*, 1961). One of the physical hindrance to feeding by *O. nitidula* is due to silica content which according to Meera Muralirangan & Muralirangan (1990) plays an important role in reducing the food consumption of *O. nitidula*. Hence, the present investigation aims at the evaluation of silica on the food consumption by *O. nitidula* to some of the commonly grown rice cultivars from the state of Tamil Nadu.

MATERIALS AND METHODS

Insects Collection and Rearing Technique

The insects were collected from paddy fields in and round Chennai (13^0 04' N - 80^0 17' E) and mass reared separately on all the eighteen cultivars in wooden cages (25 x 25 x 30cm) at room temperature and under normal lighting condition. Each cage was provided with a cup containing sieved garden soil, which served as an ovipositional site. The leaves were kept immersed in Knop's solution to maintain their freshness. Fresh leaves were provided every day and care was taken to remove all excreta and unfed leaves regularly so as to prevent fungal infection. Adult females were drawn from this stock culture for food consumption analysis as it has a higher feeding rate. Preconditioned females starved for 6 hour were provided with a known amount of weighed leaves of one of the selected paddy cultivars on which they were previously reared . After 24 hours, the food consumption was assessed individually for each cultivar and used as an index for host selection.

The data obtained on the food consumption with respect to different hosts was statistically analyzed using oneway ANOVA to establish the difference in food preference pattern of *O. nitidula*.

Silica distribution on the leaves

Whole leaf spodogram : A bit of leaf of 1 cm length was cut out from the central part of the leaf and was placed in between two glass slides after carefully removing the midrib. It was then heated over an electric heater for 15 minutes till the material was burnt to ashes. It was then cooled and the slide above the tissue was removed. The material was moistened with a drop of xylene and mounted in Canada balsam. Since the chlorophyll of the leaf clouded the tissue and interfered with the observation of the silica deposition, the tissue were previously teated with Carnoy's fluid by boiling gently for 10-15 minutes (Mohamed Hanifa *et al.*, 1974). The spodogram prepared from such treated leaves clearly showed the silica crystals and the silica chains.

RESULTS

Some of the commonly grown rice cultivars from the state of Tamil Nadu were identified as potential hosts for *O. nitidula*. But there was an observable difference in the degree of acceptance and feeding among the hosts. This prompted analysis of the feeding preference of *O. nitidula* through quantitative estimation ,over a period of 24 hours ,of the food intake on eighteen cultivars. The data on no choice feeding experiment for the adult females of *O. nitidula* is presented in Fig.1. The eighteen cultivars tested fell into ten statistically significant categories with respect to food consumption. Food consumption ranged from a maximum of 191.3 mg/insect/day on IR50 to a minimum of 122.7 mg/insect/day on TKM9. Numerically the consumption was highest on IR50 followed by IR36 and CO45. The consumption of ADT and ASD cultivars were more different than CO and IR cultivars. The consumption between IR20 and IR64 did not differ significantly from each other, but it was significantly different when compared to IR50 and IR36. The consumption was significantly high on ADT39, when compared to any other ADT cultivars.

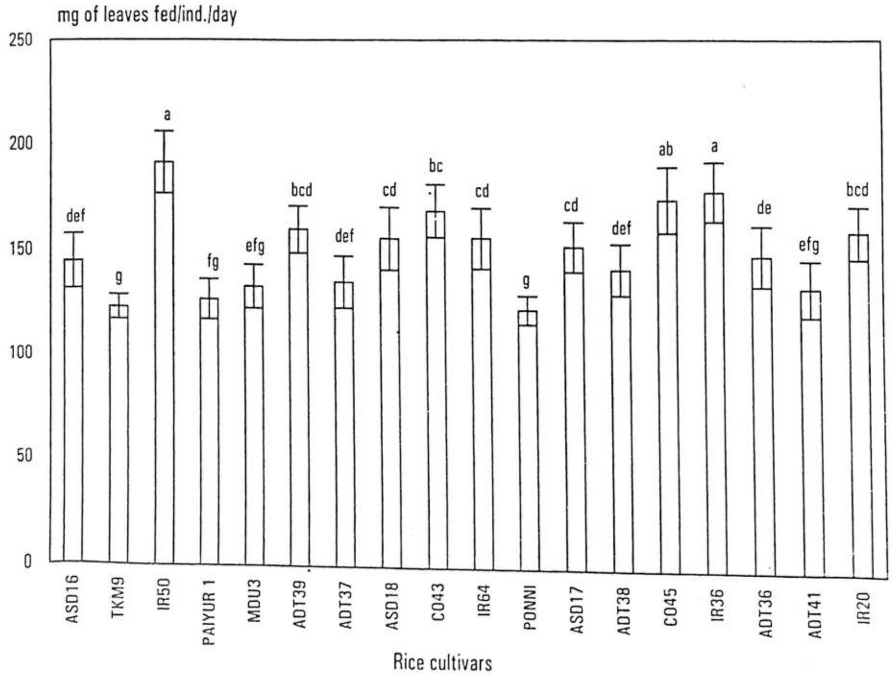

Fig. 1: Food consumption of *Oxya nitidula* on different rice cultivars (mean of 10 replicates ± SD; values followed by similar letters are statistically inseparable at P > 0.05 level by DMRT).

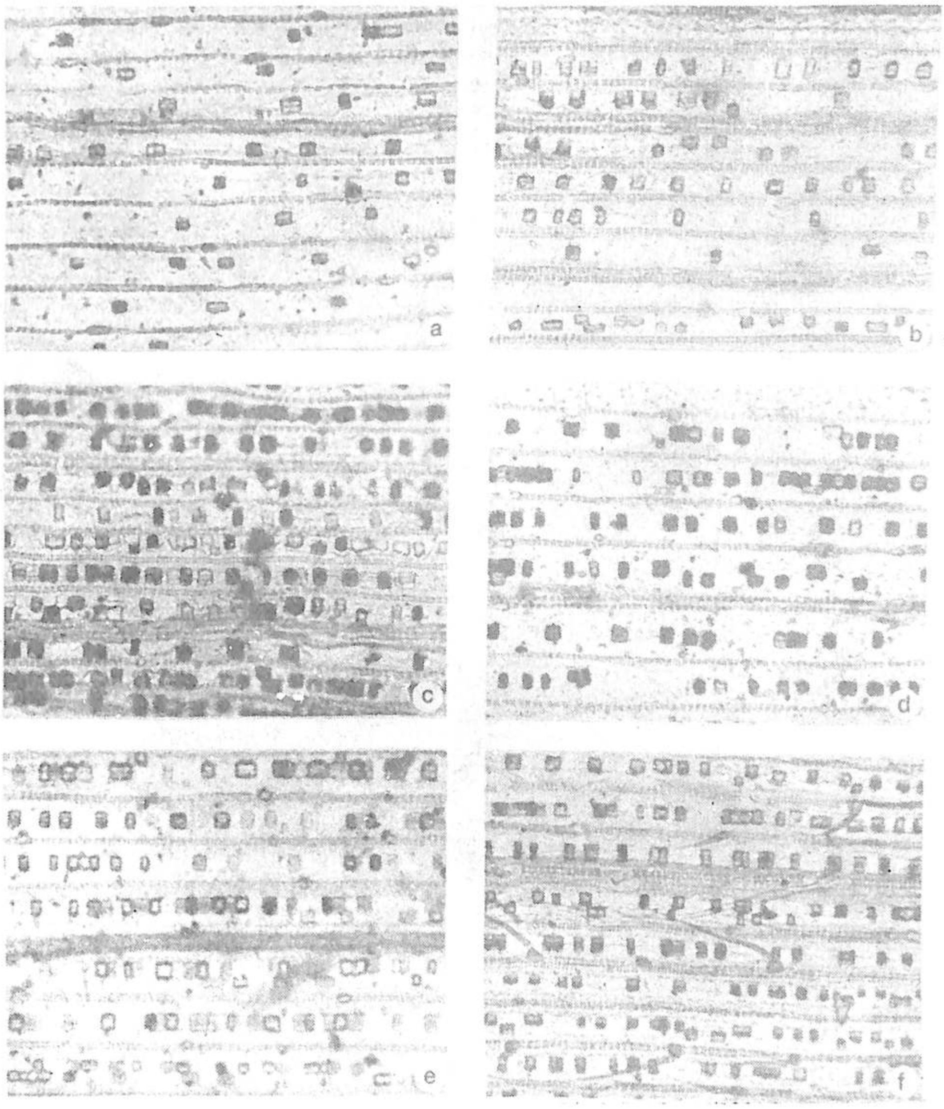

Fig. 2a - f : Photomicrographs of silica granules in the cultivars (100x). **(a)** IR20; **(b)** IR36; **(c)** IR50; **(d)** IR64; **(e)** MDU3; **(f)** Paiyur1.

the ASD cultivars the consumption was significantly less on ASD16 when compared to ASD17 and ASD18. TKM9 was the least consumed but it did not differ statistically from Ponni, Paiyurl, MDU3, ADT41, and ADT37.

The leaf spodogram distribution of silica pattern (Fig. 2) in the eighteen cultivars showed that the silica varies differently. The number of silica granules/500μ^2 was analyzed in each of the cultivars (Fig. 3) and the data reveals the number of silica granules is more in ASD16 and TKM9 (70.2 & 65.2/500μ^2 respectively). TKM9 was the least consumed plant and had a relatively higher silica granules contrarily, IR50 which was the most consumed had 51.2/500μ^2 of the leaf area. The distribution of silica varied differently among the cultivars and they fell into thirteen statistically different categories. However, a regression analysis (Fig.4) was done, which showed the R^2 value to be 0.09447. The role of Silica for this18 cultivars was found to be a negative factor for feeding.

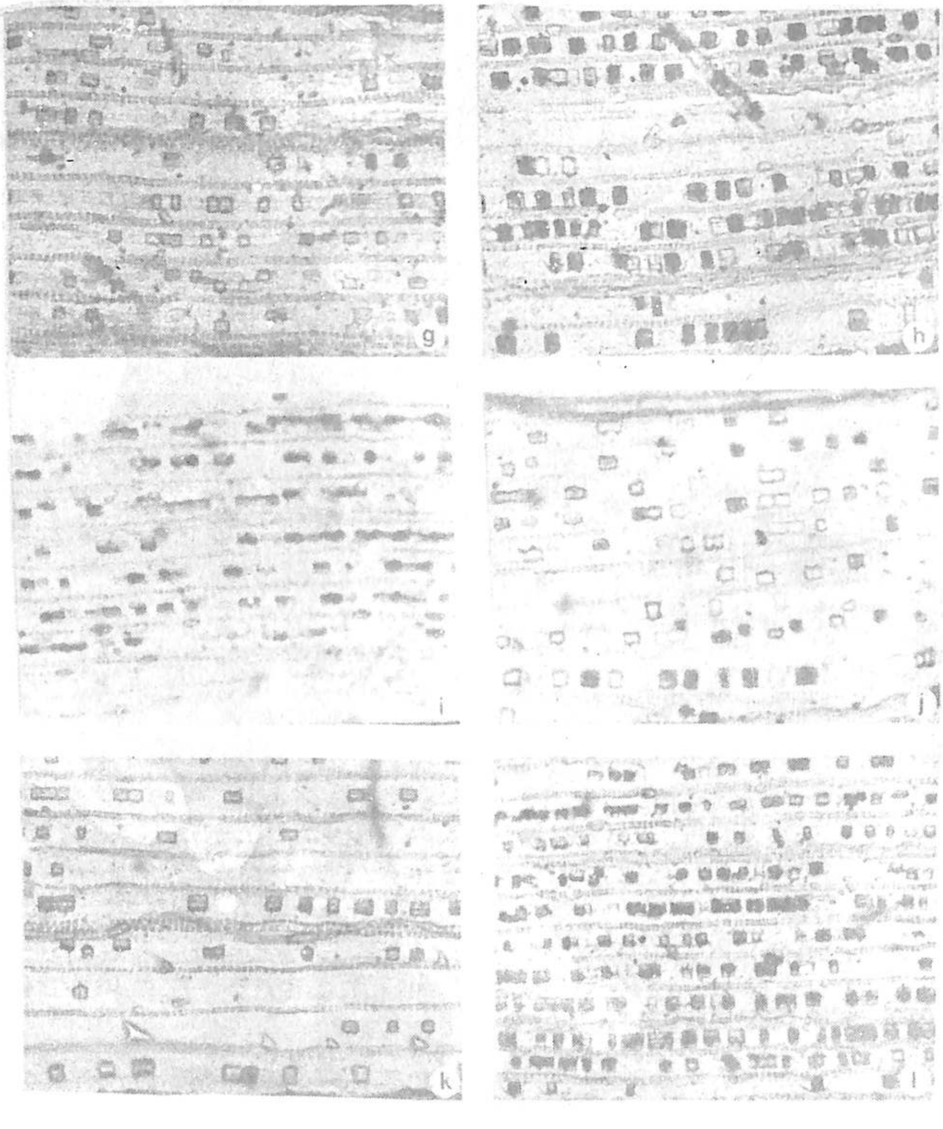

Fig. 2g - l : Photomicrographs of silica granules in the rice cultivars (100x). **(g)** ADT36; **(h)** ADT37; **(i)** ADT38; **(j)** ADT39; **(k)** ADT41; **(l)** TKM9.

DISCUSSION

Several workers have reported the silica content of the plant to impart resistance to pests. Sasamoto (1961) recorded an increase in the percentage of total silica in rice plants when grown in a soil treated with silica gel or slag material and a parallel decrease in the rice borer. *Chillo suppressalis* (Walker) susceptibility. Nakano *et al.* (1961) observed heavy rice borer infestation in areas where available silica in the soil was low. Mohamed Hanifa *et al.* (1974) studied the role of silica as a resistant factor for the leaf roller *Cnaphalocrocis medianalis* Guenee, in rice as the mandible of this insect had been found to be worn out due to the silica content . In yet another experiment Ponnaiya (1959) working with sorghum shoot fly *Atherigona varia soccata* Rond. had found that the early deposition of silica in the intercoastal area in the leaf sheath of sorghum to be

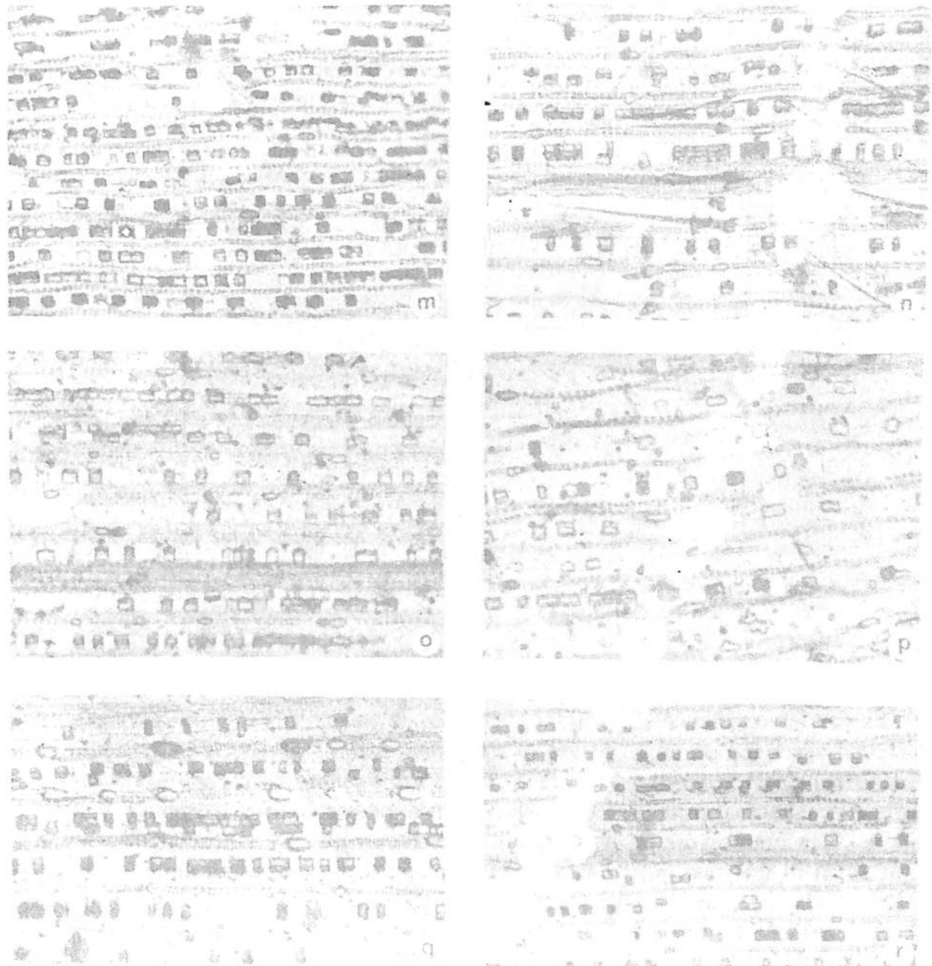

Fig. 2m - r : Photographs of silica granules in the rice cultivars (100x). **(m)** ASD16; **(n)** ASD17; **(o)** ASD18; **(p)** CO45; **(q)** CO43; **(r)** Ponni.

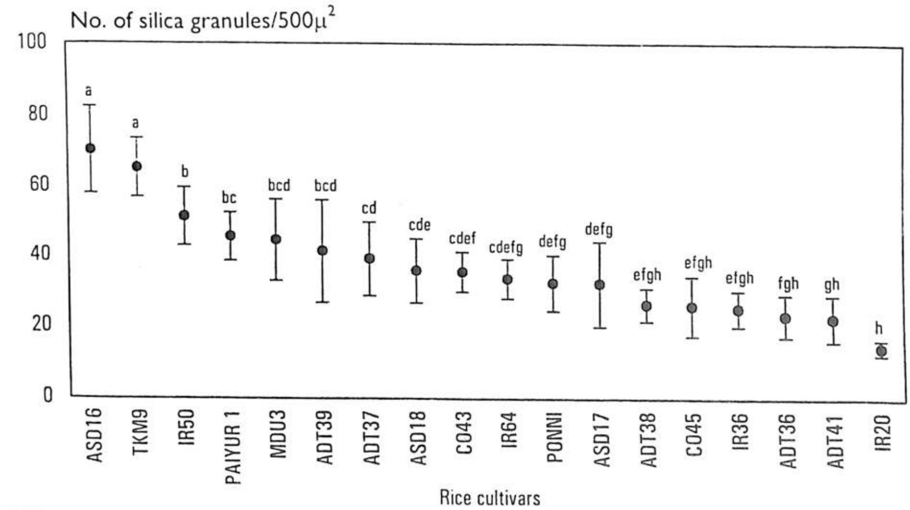

Fig. 3 : Silica granules in the 18 rice cultivars. (Values followed by similar letters are statistically inseparable at P>0.05 level DMRT; n = 5 ± SD)

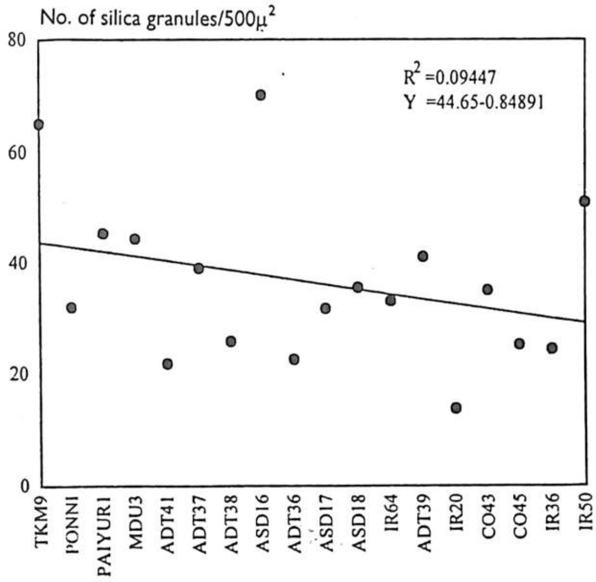

Fig. 4 : Role of silica on the food consumption by *O. nitidula.*

one of the causes for resistance. In grasshoppers like, *Eyprepocnemis alacris alacris* (Serville) seldom survived when fed on tough leaves of *Panicum maximum* Jacq. With high silica content, but survived satisfactory on more tender leaves of the same plant which had lesser silica granules (Muraligrangan & Ananthakrishnan, 1977). Meera Muralirangan & Muralirangan (1990) observed *O. nitidula* being a gramnivorous insect feeds on plants with low silica content because, the presence of silica in the host plant has a great bearing on the inner morphology of the insect. These investigations suggests that silica content of host plants seems to be one of the deciding factors on the hosts selection by this insect and hence such studies could be recommended for thew use of cultivars which have higher silica content as it is more practical in reducing the infestation.

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