

THE GENETICS OF PROTEIN DISTRIBUTION IN THE F₁ RICE HYBRIDS

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Selection and hybridisation work in rice have led to the evolution of varieties with an average increase of 10 to 15 per cent yield than the local material Parthasarathy 1970. But many of these varieties lack good grain quality. Of late, the importance of screening selections for quality before they are released has been recognised. Some observations on protein distribution, cooking quality and other characters of an F₁ hybrid of the cross Cherumodan (a local variety of indica) and Adt-27 (an improved strain of japonica x indica) are presented in this paper.

Materials and Methods

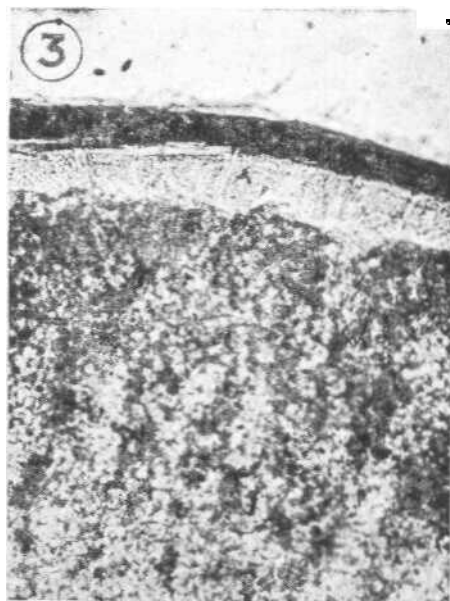
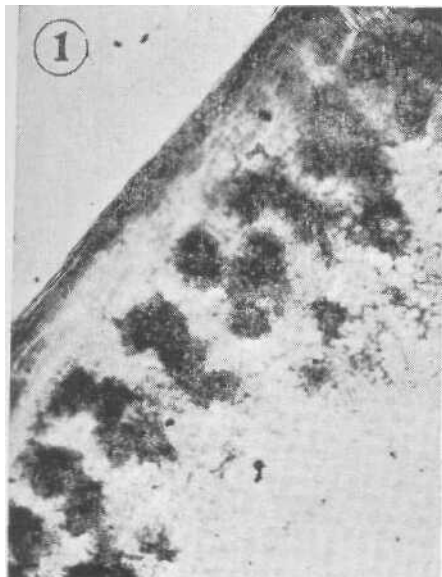
The study was conducted at the Calicut University Campus on hybrids planted in pots in 1971 during the kharif season. Sterility was determined by pollen-stainability in acetocarmine (0.5 per cent). Cooking tests were performed under uniform conditions. One gram of grain from each variety, in duplicate, was cooked at 98°C in 1 ml water for 25 minutes. All the cooked rice samples were tested and swelling number and length/breadth (L/B) ratio were recorded. Microscopic screening technique developed by Kaul *et al* (1969) was followed in this study for characterisation of the protein distribution in rice grain sections. Bromophenol blue was used as protein specific dye. Total nitrogen was determined on dry weight basis by the Kjeldahl method.

Results and Discussion

The mean values of the different attributes of the hybrid and its parents are given in Table 1. The hybrid resembled the female parent in height. Early flowering was found to be dominant over late flowering. L/B ratio before cooking was found to be related to L/B ratio after cooking. With the increase in 1000 grain weight in the parent Cherumodan, the volume expansion tended to decrease. Similar results have been reported by Sivasubramanian *et al* (1973). Cooking quality of the F₁ hybrid was found to be very good. Spikelet sterility in the F₁'s was slightly high ranging from 10 to 15 per cent. Hybrid sterility had been recorded by many workers in intervarietal crosses involving parents with wide genetic diversity. According to Jennings (1964) heterotic sterility in indica-japonica hybrids had been one of the hurdles in breeding successful homozygous derivatives in the tropics. However, in the present study fully fertile segregants have been bred out by rigorous selection in the F₁ generation.

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- 1 Protein pattern. Dense peripheral protein bodies and dispersed membranous characterization.
- 2 Protein pattern. Deep distributed dense protein bodies.
3. Protein pattern. The idealmost characterization having body proteins and dispersed proteins with equal intensities.

Table 1

Yield components and other characters of F₁ and its parents

Plant character	Cherumodan	F, hybrid	Adt-27
Duration (from sowing date to harvest)	80-90	80-90	105-120
Habit	Spreading	Erect	Erect
Stand	Lodging	Non-lodging	Non-lodging
Height of the plant (cm)	80	85	105
Panicle: Length (cm)	14	23	23
Spikelet number per panicle	138	167	162
Spikelet sterility (%)	7-10	10-15	5-9
Kernel size (Length (mm)	5.80	4.35	4.22
(Breadth (mm)	2.40	2.12	2.11
(Length/Breadth)	2.41	2.07	2.00
Paricarp	red	red	white
Starch iodine value	36.5	46.9	47.0
Cooking quality	good	very good	acceptable
Protein (g per 100 grains)	9.31	10.95	10.87
Weight of 1000 grains (g)	1845	17.75	17.53
Straw weight per plant (g)	63	80	77

The rice grains of Cherumodan showed dense peripheral protein bodies and dispersed membrane (fig. 1). The rice grains of Adt-27 showed deeply distributed dense protein bodies (Fig. 2) and the rice grains of the hybrid showed an ideal characterisation with body proteins and dispersed proteins in equal intensities (Fig. 3). Rice is mostly consumed in the milled or polished form, and polishing results in varying extent of loss of the outer layers of endosperm. Since the distribution of protein in hybrid starts from the peripheral region to the interior, the loss of protein on milling is much less. The protein content in the hybrid is the same as Adt-27, the male parent, which is the better parent. Selection for early heading may or may not be consistent with selection for high proteins. For these reasons, relaxation of selection for traits other than protein content may be desirable, a

method which seems to be well suited to the above limitations in the single seed descent method combined with rapid generation advance as outlined by Goulden (1939). In breeding programme the regionally adapted commercial varieties have to be utilised widely for incorporation of good quality. Further selections from the present hybrid between the two commercial varieties are, therefore, likely to be advantageous.

Summary

The present work deals with the preliminary observations on protein distribution, cooking quality and other characters of the F₁ hybrids between Cherumodan and Adt-27. The hybrid resembled Cherumodan in height and flowering habit. Cooking quality was better than either of the parents. The protein distribution in Cherumodan was peripheral, while in Adt-27 it was deeply distributed with decreasing intensity from the periphery towards the interior. In the hybrid the protein bodies were uniformly distributed from the periphery towards the interior of the grain. The protein content, was the same as that of Adt-27, but due to its well distributed nature, protein loss due to milling and polishing of the grain would be much less. The results indicate that breeding and selection for improving the protein profiles of the grain could be effective and that utilization of the established varieties in such breeding programmes would be desirable.

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സംഗ്രഹം

ചെറുമോടൻ എന്ന ഇൻഡിക് വിത്തിനവും, Adt-27 എന്ന ഇൻഡിക് ജപ്പോണിക്ക ഇനവും തമ്മിലുണ്ടാക്കിയ F₁ സങ്കരവർഗ്ഗത്തെപ്പറ്റിയുള്ള ചില പ്രാഥമിക പഠനങ്ങളാണ് ഈ ഗവേഷണക്കുറിപ്പിൽ ഉൾക്കൊള്ളുന്നത്. സങ്കര വർഗ്ഗച്ചെടികൾക്ക് വളർച്ചയിലും പുറമ്പിതരീതിയിലും ചെറുമോടനുമായി സാമ്യമുണ്ടായിരുന്നുവെങ്കിലും, പാചക ഗുണത്തിൽ മറ്റു രണ്ടിനത്തേക്കാളും മേന്മയുള്ളതായി കണ്ടു. മാംസ്യകണികകളുടെ വിതരണ രീതി *roil can* ലും പ്രധാനപ്പെട്ട വ്യത്യാസങ്ങളുണ്ടായിരുന്നു. ചെറുമോടനിൽ മാംസ്യകണികകൾ ധാന്യത്തിന്റെ ഉപരിതലത്തിലും, ADT-27 ൽ ഉപരിതലത്തിൽ നിന്നും *g*ളളിലേക്ക് സാന്ദ്രത കുറഞ്ഞു വരുന്ന രീതിയിലുമാണ് സംവിധാനം ചെയ്തിരിക്കുന്നത്. F₁- ൽ *ffIW*-*9jCT*5, ധാന്യത്തിന്റെ ഉപരിതലത്തിൽ നിന്നും ഉൾഭാഗത്തേക്ക് മാംസ്യകണികകൾ സമീകൃതമായി വിന്യസിക്കപ്പെട്ടിരിക്കുന്നു. സങ്കരവർഗ്ഗത്തിലെ മാംസ്യത്തിന്റെ അളവ് Adt 27 നേർതിന് തുല്യമായിരുന്നുവെങ്കിലും, മാംസ്യകണികകളുടെ സമീകൃത വ്യത്യാസരീതികൂലും, അരിവെളിപ്പിക്കുമ്പോഴുണ്ടാകുന്ന മാംസ്യനഷ്ടം വളരെ കുറഞ്ഞുകിട്ടുന്നു. ഇതൊരു പ്രധാനനേട്ടമായി കണക്കാക്കാവുന്നതാണ്. മാംസ്യത്തിന്റെ വിതരണരീതി അഭിവൃദ്ധിപ്പെടുത്തുവാനുള്ള പ്രജനന രീതികൾ വിഭജനമായി തിരഞ്ഞെടുക്കുമ്പോൾ ഉപയോഗപ്പെടുത്തുവാൻ കഴിയുമെന്ന് അനുമതിക്കാം.

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