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FACTORS AFFECTING THE SUSCEPTIBILITY OF MAIZE-GRAINS TO THE ATTACK OF *SITOTROGA CEREALELLA* (Oliv.) LARVAE.

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Susceptibility of eight maize cultivars was compared with the physical and chemical nature of their grains. 90% of the susceptibility variations, in the grains, were found to be due to the moisture, protein and fat contents.

The effect of moisture and the protein contents, on the grain susceptibility to *Sitotroga cerealella* (Oliv.) larvae was, however, opposite to that of the fat, which was negative. Based on these conclusions, the practical implications of these studies were also discussed.

INTRODUCTION

The susceptibility of eight maize cultivars to the attack of Angoumois grain moth, *Sitotroga cerealella* (Oliv.) was found to vary significantly from 3.05 to 5.41% (Wahla *et al*, 1978) in the following order:

B.S.I early = B. S. IV early < Soan ≤ B.S. III late = Agaiti-72 = Synthetic-551 = Akbar ≤ Neelam.

The differences in the nature of grains had been, in the past, considered to be the only basic cause of such variations (Gupta *et al*, 1970; Dobie, 1974; Ortega *et al*, 1975 and Schoonhoven *et al*, 1976). As none of these workers have, as yet, sorted out the collective role of all the components of grain-nature, in maize, the present studies were imperative to be taken up in this perspective.

Thus, a detailed study of the physical and chemical nature of the maize cultivars, under reference, was undertaken. The main aim of this attempt, however, was to locate the most critical of the physical and chemical links of the grains with their susceptibility and to guide the maize breeders, in the light of these findings, to produce the genetic lines of more desirable characteristics.

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MATERIALS AND METHODS

The principal materials comprised eight maize cultivars, already referred to in the preceeding section. A clean sample of each variety was preconditioned for 14 days at 29 ± 2°C and 65 ± 5% R.H. and used in these tests.

The carbohydrate percentage was determined with the method used by Fong *et al.* (1953), whereas the moisture, protein and fat contents were estimated with the methods recommended by A.O.A.C. (Anonymous, 1970).

The estimates were presented in the form of a multiple comparison of their means with 95% confidence interval (Table-1) and the significance of the difference between them tested with the help of Duncan's Multiple Range Test (Steel and Torrie, 1960). The correlation of various parameters was, where possible, tested and the collective contribution of the grain components calculated, mathematically. The final conclusions were, however, based on the significance of the difference between the observed and estimated values.

Table1. A- *A Multiple Comparison of the means of weight loss and the Physical nature of Maize-Grains, from various varieties.*

S. No.	Varieties	Wt. loss (%)	Physical Nature of Grains	
			No. of grains/ 50 grams	Colour of grains
		**	**	
1.	B.S. I early	3.05 a	178.6 b	Yellow (Y)
2.	B.S. IV early	3.18 a	166.2 a	Y
3.	Soan	4.28 b	202.8 c	White
4.	B.S. III late	4.43 bc	196.0 c	Y
5.	Agaiti-72	4.55 bc	244.2 e	Y
6.	Synthetic-551	4.62 bc	226.8 d	Y
7.	Akbar	4.73 bc	204.0 c	Y
8.	Neelam	5.41 c	203.0 c	Y

Table 1. B-*A Multiple Comparison of the means of weight loss and the Chemical-nature of Maize Grains, from various varieties*

Varieties	Wt. Loss	Chemical Nature of Grains			
		Moisture	Carbohydrates	Fat	Portein
	(%)	(%)	(%)	(%)	(%)
	**	*	**	**	**
B.S. I early	3.05 a	10.54 a	68.06 a	5.21 d	13.58 a
B.S. IV early	3.18 a	10.56 a	69.03 b	5.41 e	13.64 a
Soan	4.28 b	11.29 b	68.67 ab	4.97 c	14.07 b
B.S. III late	4.43 bc	11.35 b	68.27 a	3.89 a	15.72 d
Agaiti-72	4.55 bc	11.31 b	70.10 c	4.90 c	14.69 c
Synthetic-551	4.62 bc	10.90 ab	71.43 d	4.21 b	14.64 c
Akbar	4.73 bc	11.38 b	69.90 c	4.19 b	16.21 e
Neelam	5.41 c	11.09 ab	68.47 ab	3.86 a	16.35 e

* = Significant at 5% and ** = Significant at 1% level.

N. B = Any two means not having a common superscript are significantly different at 5% level of probability.

RESULTS AND DISCUSSION

A go through table-1 shall reveal that the physical and chemical nature of the grains varied significantly from one maize variety to an other. The colour of the grains which was, except in case of Soan, yellow in all cases, however, appeared to be the only exception.

A significant correlation of the moisture, fat and protein contents with the weight-loss would suggest that, of various grain components estimated, these three contribute the maximum towards the susceptibility or otherwise of a maize variety to the attack of this pest, during storage (Table 2).

Table 2- *Correlation Coefficient* (r) *between the weight loss and other Characters*

Sr. No.	Characters	1	2	3	4	5
1.	Wt. loss					
2.	Moistur contents	0.7360*				
3.	Carbohydrates	0.3035	0.1280			
4.	Fat	-0.8287*	-0.5766	-0.1437		
5.	Protein	0.8461**	0.6708	0.0558	-0.9032**	
6.	No. of grains	0.6497	0.5954	0.6623	-0.3515	0.3100

* = Significant at 5% level.

** = Significant at 1% level and a blank = Non significant.

A comparatively highly significant correlation of the protein % of the grains with the weight-loss would further suggest that the protein contents are rather more important than the moisture and fat contents in deciding the susceptibility response. A negative correlation of fats with the weight loss, however, suggests that the contribution of fat contents towards susceptibility is opposite to that of the moisture and protein contents. To sum up:

$$\text{susceptibility} \propto \%\ \text{moisture} \propto \%\ \text{protein} \propto^{-1} \%\ \text{fat.}$$

Thus, the ultimate susceptibility of the maize grains to *Sitotroga* larvae should be due to the combined impact of these three factors (Table 3).

Table 3- *The Observed and estimated weight loss of different maize varieties, due to the attack of S. cerealella (Oliv.), larvae.*

Name of Variety	Observed Wt. loss%	Estimated* Wt. loss%
B. S. I early	3.05	3.33
B. S. IV early	3.18	3.25
Soan	4.28	4.11
B. S. III late	4.43	5.03
Agaiti-72	4.55	4.27
Synthetic-551	4.62	4.32
Akbar	4.73	4.98
Neelam	5.41	4.97

* = Values calculated with the regression equation :
$Y = a + b_1x_1 + b_2x_2 + b_3x_3$; where, Y = %wt. loss, x_1 = % moisture, x_2 = % fat and x_3 = % protein contents.

The lack of significant difference between the observed and estimated weight loss, tested with a Chi-square (Table-4), confirms the above contention and a value of 0.8934 for the correlation coefficient, suggests that these three account for about 90% of the susceptibility responses, observed in these tests.

Table 4- *The magnitude of a combined-change and a mathematical relationship between the moisture (x_1), fat (x_2) and protein (x_3) contents of maize grains and the loss of their weight (y), due to the attack of S. cerealella (Oliv.) larvae, during storage.*

Estimates	Values
Coefficient of determination (R^2)	0.7982
Coefficient of multiple correlation (R)	0.8934
	N.S.
Chi-square	0.1944
Regression equation	$Y = 0.7468\,x_1 - 0.5217\,x_2 + 0.1848x_3 - 4.3834$

N.S. = Non-significant difference between the observed and estimated values of weight loss given in Table-3.

Although, the contribution of some other factors like that of the hardness of pericarp could not be tested for want of enough facilities, it may, on the basis of the facts discussed, be concluded that **THE SUSCEPTIBILITY CHANGES REPORTED WERE DIRECTLY RELATED TO THE MOISTURE AND PROTEIN CONTENTS AND INDIRECTLY TO THAT OF THE FAT.**

Thus, on the basis of these conclusions, it could be suggested that the breeders employed on maize improvement should develop new lines which are comparatively more rich in fat contents than those, in use today. This change if possible would significantly reduce the susceptibility of the produced cultivar to *Sitotroga* larvae.

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