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BIOTECHNOLOGY IN FOOD PRODUCTION AND BIODIVERSITY CONSERVATION

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ABSTRACT

"Without Food crops, mankind would starve. Science has done much to enhance this vital source. But has it done more harm than good". The above stated lines succinctly give the main thrust of the paper. The paper is specifically focused on the applications of Biotechnology in the Food Industry and Biodiversity conservation. The paper also highlights some of the problems militating against self-sufficiency in food production in Nigeria and goes on to show how Biotechnology can help in the Nation's quest for increased production of basic food items issues of Biodiversity as they affect food production are also treated.

1.0 INTRODUCTION

Undoubtedly, the desire for Food has been, and still is one of the main courses of great political events according to Bertrand Russel. Equally true in these modern firms is the fact that the true components of a nation's security are not to be found in the sophisticated weaponry acquired from the industrialised world, but in the collective perception of its citizenry as regards their individual securities against hunger, malnutrition, poverty, disease and ignorance.In Nigeria, Food is not sufficiently accessible to a very large segment of the population, the types of food consumed are often nutritionally inadvisable and the quality very poor. The country lacks an explicit and comprehensive food policy and this has led to several problems resulting in insufficiency in basic food needs of its citizenry.

2.0 PROBLEMS OF FOOD PRODUCTION

2.1 COLONIAL ERA

In the colonial period, a large part of the lands was used to cultivate exports crops such as cocoa, rubber, palm-oil, groundnut were used to cater for the food needs of the populace. In the post-colonial period, agricultural production of the traditional food sector was neglected in favour of white-collar jobs due to the windfall from oil discovery. Since, Nigeria has been relying on imports for much of its food requirements this is an unstable situation as the capacity to import depends on the state of the country's foreign exchange.

2.2 DEVELOPMENT PROJECTS

Development projects often have detrimental effects on the traditional food sector since the so-called modernization and industrialisation are accorded greater priority over food cultivation land that had been cultivated with food crops for generations is displaced to make way for individual sites, modern housing estates and the construction of highways

2.3 GOVERNMENT PROPENSITY FOR FOREIGN MACHINES: INAPPROPRIATE TECHNOLOGY

The introduction of inappropriate modern technology has also had negative effects on food production. Many of the modern technologies adopted in Nigeria are found to be inconsistent with the social structures of existing communities and societies and the preservation of the ecological system.

2.4 FOREST DEGRADATION

The forest is being chopped down at an alarming rate with little regard for potentially disastrous environmental consequences. With the elimination of the forest, much of the agriculturally invaluable topsoil is being eroded and washed down into rivers. No food crops can be cultivated on the barren land while the silting of the rivers results in frequent flooding which destroys large tracts of food crops.

2.5 GOVERNMENT AND FOOD PRODUCTION EFFORTS

As a result of the growing decline in agricultural activities and the consequent rise in food import bills from the early seventies, the Federal Government promoted a large number of agricultural programmes over the years to tackle the problem of food security. The most note-worthy of these programmes include:

(i) The FAO sponsored fertilizer trails

(ii) The National Accelerated Food Production Programme (NAFPP)

(iii) The Operation Feed the Nation (OFN)

(iv) The Green Revolution Programme

(v) The River Basis Development Authority Scheme (PBDA)

(vi) The Integrated Agricultural Development Programme (ADP)

(vii) The Commodity Boards

(viii) The Government Sponsored Food Production Companies

(ix) The Directorate of Food, Roads and Rural Infrastructures (DFRRI)

All of these schemes and programmes ended up as a sysmal failure, because of large scale corruption and fraud planlessness and inefficiency. Infact some of the River Basin Authority Schemes are now causing problems to the environment and communities where they are sited.

2.6 HARMFUL PRACTICES

In Nigeria, the systems producing plants that produce the food on which we all depend are not being sustained indeed there is a growing recognition that they are not, without modification sustainable.

All over the place we are putting concrete and asphalt over some of our best cropland, bulldozing fertile earth to get at the energy that lies beneath it and letting much of the rest of the topsoil run off into rivers.

2.7 THE FARMER: AN "ENDANGERED SPECIES"

Since 1970, the number of people employed in agricultural has plummeted in Nigeria by more than 80 percent Nigeria now has fewer farmers than Area Boys. What is causing this exodus from the land. Major factors are:

- Ø Falling income
- Ø Rising rural debt
- Ø Growing poverty
- Ø Displacement and Replacement
- Ø Ageing of erstwhile farmers.
- Ø Unpredictable climate

A wheat farmer says World Watch, "gets just 6 cents of the dollar spent on a loaf of bread". This means that customers/ consumers pay about as much for the wrapper as they pay the farmer in Europe may be able to borrow a bank to tide him over a bad year a Nigerian farmer may not be able to try again. He might not even survive the bad year.

2.8 TECHNOLOGICAL EDUCATION

There has been a steady decline in enrollment of students for Agriculture/Agricultural Engineering as a field of study in our Universities and Polytechnics over the years. Statistics show that students enrollment in Agriculture and allied courses in the Lagos State Polytechnic, Ikorodu has been slashed by 78% over a period of ten years.

The decline is attributable to the distorted and blurred perception of agriculture and its allied courses by students as being unattractive less challenging and unmarketable. Agricultural Engineers have over the years laid emphasis on soil and water management and "touched" on engineering aspects involved in growth, harvesting and processing of crops including post-harvest technological problems.

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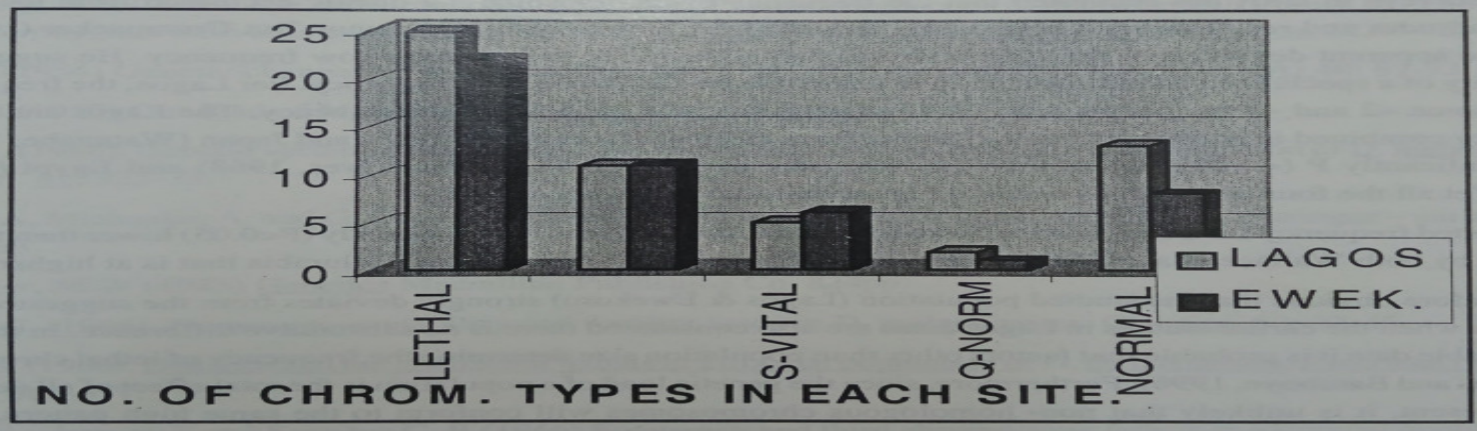
      DO  16 I=1,N
      IF (D ( I ).EQ. 'LETHAL' )THEN
      WRITE (3,23) A (I,1),A(I,2), B (I,1),B (1,2),C( I), D (I)
      ELSE
      WRITE (3,17) A (I,1),A (I,2), B (I,1), B (I,2),C (I), D (I), E (I)
      END IF
23    FORMAT (2X,4 (2X,13),2X,F5.1,2X,A15)
17    FORMAT (2X,4 (2X, 13), 2 X F5.1, 2X, 2 (A15,2X)
16    CONTINUE
      STOP
       END
```

SITE	NUMBER OF CHROMOSOME TESTE	LETHAL (%)	SEMI LETHAL (%)	SUB VITAL (%)	QUASINOR MAL (%)	NORMAL (%)
LAGOS	56	25(44.64)	11(19.64)	5(8.92)	2(3.57)	13(23.21)
EWEKORO	48	22(45.83)	11(22.45)	6(12.24)	1(2.04)	8(16.33)
TOTAL	104	47(45.19)	22(21.15)	11(10.58)	3(2.88)	21(20.19)



DISCUSSION

The no significant differences recorded between the two study sites strongly suggest an unimpeded gene flow among the sites (Lagos and Ewekoro), consequently making the sites one large homogeneous population.

The high frequencies of drastic (lethals + semi lethals) chromosomes in this study (66%) and detrimental (80%) implies that ~ 73% of the chromosomes – 2 have a negative effect on viability, a very large genetic load is therefore suggestive. Moreover, the low frequency of subvitals and quasinormals, which only slightly depress viability, does not have a direct effect on the genetic load.

The conclusion of high genetic load and free flow of genes in a large homogeneous population is strongly supported by the results of test of allelism. The frequency of allelism recorded in this study is not significantly ($P>0.5$) different from the frequency of 0.76% reported by Adekoya and Williams (1998) and 0.95% reported by Williams and Akpabio (1993a). It is also not significantly different ($P>0.5$) when compared to the values reported for chromosome – 3 (Williams and Bamboye, 1996). The low frequency of allelism is therefore consistent with the expectation of large D. melanogaster population in the area.

Although the frequency of lethals in this study is significantly (P<0.005) higher than the 8% reported for 2 sites in Lagos by Williams and Akpabio (1993a) but not significantly different (P>0.1) different from those recorded for 6 sites by Adekoya and Williams (1998). The differences in frequencies observed could be as a result of the fact that Williams and Akpabio considered only balanced lethals stocks as lethals but this study conforms with the sensu strictu consideration of lethals by Rieger et al (1965). Another possible reason for the deviation could be as a result that Williams and Akpabio did collection during dry season.

The frequency of lethals in this study is not significantly different (P>0.1) from those reported for comparable parts of the world such as the American Samoan (Allen, 1969) and Turbo, Columbia (Hoenigsberg et al, 1968). The frequency is however significantly higher than reported for Egypt (Dawood, 1961) and far less than 55% reported for Bogota, Columbia close to the equator but on a high cold Plateau (Wallace et al 1966)

Examinations of the frequency of lethal and semi-lethal chromosome – 2 compiled by Watanabe (1969) and those by Adekoya (1991) show that frequency of lethals among drastic could be calculated in 14 studies. The frequency was between 13% and 78% except in 2 cases 8% in a study in Lagos and 82% in Israel. In spite of the fact that the frequency of drastics in Egypt, Bogota and earlier report in Lagos were different, a 2 x 2 contingency $?^2$ tests showed that the frequency of lethals among drastics in these populations were not significantly different from the frequency in the present study.

Williams and Bamboye (1996) had reported that from their study and others of other investigators, lethal chromosome – 3 constituted 63-79% of drastic in most studies. It seems that for each chromosome, there is some equilibratory relationship between the frequency of lethal and semi-lethal chromosomes, in spite of the overall frequency of drastic in the population.

Earlier Surveys in USA has suggested that the frequency of chromosome – 2 drastic decreased from the lower to higher latitudes and results from Korea, Japan and USSR seemed to be in agreement. But Crumpacker (1967) also noted the apparent deviation of the American Samoan populations, which had a low frequency. He suggested the peculiarity of a specialized island population as a possible reason for the low frequency. For Lagos, the frequency for chromosome –2 and –3 are contradictory; chromosome – 3 has expected high frequency. The Lagos and Ewekoro frequency combined is not significantly different from those of Korea (Paik; 1966) and Japan (Watanabe, 1969) but it is significantly P (<0.005) lower than the frequency in both USA (Band and Ives, 1968) and Egypt (Dawood, 1961). Yet all the four populations occur at higher latitudes than Lagos.

The reported frequency for Lagos and Ewekoro for chromosome – 2 is also significantly (P<0.05) lower than frequency reported by both Wallace et al (1966) and Hoenigsberg et al (1968) for Bogota, Columbia that is at higher latitude.

It is therefore obvious that the studied population (Lagos & Ewekoro) strongly deviates from the suggested pattern. However when the earlier studies in Lagos areas are also considered there is no substantive difference. In the light of the available data it is probable that factors other than population size determine the frequency of lethal chromosomes (Williams and Bamboye, 1996). Furthermore, since the genetic load of a population is the total effect of all detrimental genes present, it is unlikely that non- homologous chromosomes will conform to the same high pattern, rather it seems that there is a corroborative mechanism. For example 70.6% for chromosome –3 detrimentals (Williams and Bamboye, 1996) may be ameliorated by 38:2% for chromosome –2 (Adekoya & Williams, 1998).

The no significant difference between the frequency of chromosome types in Lagos and that at Ewekoro suggests that the expectedly high genetic load of Ewekoro due to the mutagenic effects of the cement dust of the factory on the flora & fauna situated in the environs, were not accounted for in the study. According to data on frequency of inversion in chromosomes-2 and 3 (Williams and Akpabio, 1993b; Williams and Bamboye, 1996) one expects a higher frequency of detrimentals or drastics in Ewekoro than Lagos.

The differences in the frequency of inversion report from different chromosomes and the differences in data of frequency of lethals and detrimental reported for different times and the difference from population to population suggests therefore that different types of chromosomes do not individually give a true picture of the genetic load in a population, hence any generalizations must be based on all the major types of chromosomes in the species as well as the different types of detrimentals in the population.

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