

## INCOMPATIBILITY TESTS OF INDIAN AND BRAZILIAN POPULATIONS OF *CULEX PIPIENS FATIGANS* \*

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### INTRODUCTION

The increasing problem of insecticide resistance of pest insects and the concomitant concern with the environmental impact of insecticides has led to increased attention to other methods of insect control. These include such diverse techniques as the time proven mechanical means to integrated control. However, from the standpoint of cost and environmental impact, the ideal system of control is one which, once initiated, is essentially self-perpetuating. The use of innate genetic mechanisms or the induction of genetic changes in a pest species provide a potential for such a control system.

In the case of mosquitoes, specifically in the *Culex pipiens* complex, it has been demonstrated that cytoplasmic incompatibility exists between populations of the same species and can be used as a method for control (Dobrotwors-

### RESUMO

Durante os estudos de genética formal de *C. p. fatigans* no Brasil, foram feitos levantamentos sobre a incompatibilidade citoplásmica entre várias populações de *C. p. fatigans* originárias do Estado da Bahia e uma população proveniente de Nova Delhi, Índia.

Todos os cruzamentos mostraram completa compatibilidade e produziram híbridos férteis. Isto confirma os resultados de Espinola e Consoli (1973), os quais demonstraram completa compatibilidade entre sete populações brasileiras. A compatibilidade do material brasileiro com a linhagem de Los Angeles, California (USA), aumenta o nosso conhecimento das relações evolucionárias no complexo *Culex pipiens* com referência à incompatibilidade citoplásmica.

Um fator que parece atuar como deformador sexual foi também encontrado na colônia do Uruguai em Salvador, Bahia, e a qual está sendo estudada.

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ky<sup>1</sup>, 1955; Laven<sup>5-10</sup>, 1951, 1957, 1959, 1967a&b, 1969; Roubaud<sup>11</sup>, 1956; Thomas<sup>12</sup>, 1971. The exact mechanism producing this incompatibility most certainly has a genetic basis, but the exact manner of operation is not well understood. It may be, as suggested by Laven<sup>9</sup> 1967, a physiological incompatibility between gametes or as more recently presented, the result of a rickettsial infection (Yen and Barr<sup>13</sup>, 1971). Regardless, this mechanism can and does produce species isolates.

In the course of a research program on the formal genetics of *Culex p. fatigans* for the purpose of developing a method of genetic control we were puzzled by the limited area of the foci of *Wuchereria bancrofti* in Salvador, Bahia, Brazil. Specifically, why with the ubiquitous population of *C. p. fatigans* in the area are the filariasis foci limited to one specific area?

This question may have an answer in the socio-economic situation of the foci, but the possibility exists that there is some genetic difference between the populations of the foci and other populations. Laven<sup>9</sup> 1967 has suggested that populations of mosquitoes showing differences in vector potential may in fact be species isolates within a larger population. The isolating factor being cytoplasmic incompatibility.

The aim of this study was to determine if this is the case in Salvador and to explore the possibility of finding incompatible strains. To do this, reciprocal crosses were made between the foci

population of *C. p. fatigans* and other populations of the state of Bahia, Brazil and New Delhi, India.

#### METHODS AND MATERIALS

Laboratory colonies of three populations of *C. p. fatigans* from the Salvador area (Uruguai, Itapagipe and Pirajá) and other parts of the state of Bahia (Valença and Miguel Calmon) were established from field collected females. In addition a wild strain of *C. p. fatigans* from New Delhi, India was established. All colonies were maintained in the standard manner for *C. p. fatigans* (Gerberg,<sup>3</sup> 1970) at a temperature of  $25 \pm 2^\circ\text{C}$  and relative humidity of  $72 \pm 3\%$ .

Reciprocal crosses were made between all populations from Brazil while the India strain was only crossed with the Uruguai or filariasis foci population of *C. p. fatigans*. Number of eggs deposited larvae hatched and resulting adults were enumerated. The F1 progeny of the initial crosses were then intracrossed to assure hybrid fertility.

#### RESULTS AND DISCUSSION

All of the crosses made between the various Brazilian populations and the Indian population of *C. p. fatigans* demonstrated compatibility (tables 1 and 2). In addition all of the hybrids showed fertility when intracrossed.

These results add to the previous work of Espinola and Consoli<sup>2</sup> 1973, who demonstrated complete compatibility among se-

TABLE I

CONTROL CROSSES OF *CULEX PIPIENS FATIGANS* FROM THE SAME LOCALITIES

Cross	Nº of eggs	% of eggs hatched	Nº of adults	% larval survival	Sex ratio
Valença	599	84	419	83	1-1
Miguel Calmon	1,353	94	512	40	1-1
Uruguai	1,400	86	1,040	87	1-1
Itapagipe	674	82	129	23	1-1
Pirajá	1,131	79	401	45	1-1
New Delhi	850	95	620	76	1-1

ven diverse populations of *C. p. fatigans* from Brazil. In addition it was demonstrated that there is compatibility between the Indian and selected Brazilian population. This same situation has been reported by Narang (personal communication) who crossed a *C. p. fatigans* strain from Brasilia with a marker strain of this species which originated from Los Angeles, California, USA.

In the case of those crosses made between populations of different continents, the fertility and degree of hybrid vigor is surprising. These crosses add more questions to the evolutionary relationships of the *Culex pipiens* complex relative to cytoplasmic incompatibility. For example, Thomas<sup>12</sup> 1971, demonstrated no incompatibility between populations of Malaysia, however he could show unidirectional incompatibility in all of this test populations when they were crossed with a strain from Paris, France. Laven<sup>7</sup>, 1959, has also shown unidirectional

incompatibility between *C. p. fatigans* populations of the United States and populations from India and Malaysia.

The results above, with the work of Espinola and Consoli<sup>2</sup> 1973, add more information about the relationships between populations in the complex. Information we must have, if in the future cytoplasmic incompatibility is to be used for control, but, as stated, the picture is not complete. Many more test crosses must be made between diverse populations before definitive statements can be made about the evolution of cytoplasmic incompatibility in the *Culex pipiens* complex and the use of this factor for control.

In addition to demonstrating compatibility between the various populations the Uruguai colony, from Salvador, Bahia, appears to contain a factor acting as a sex distorter, possibly similar to that found in *Aedes aegypti* (Hicky and Craig<sup>4</sup>, 1966). The distorter is expressed as an increase in the



TABLE II  
CROSSES BETWEEN *CULEX PIPIENS FATIGANS* FROM DIFFERENT LOCALITIES

CROSS		N.º of eggs	% of eggs hatched	N.º of Adults	% larval survival	Sex ratio
Male	Female					
Valença	x Miguel Calmon	534	76	404	99	1-1
Valença	x Uruguai	120	93	52	47	2-1*
Valença	x Itapagipe	188	97	180	98	1-1
Valença	x Pirajá	340	46	85	55	1-1
Miguel Calmon	x Valença	1,615	96	1,033	67	1-1
Miguel Calmon	x Uruguai	115	84	79	82	2-1*
Miguel Calmon	x Itapagipe	125	92	98	85	1-1
Miguel Calmon	x Pirajá	584	96	350	62	1-1
Uruguai	x Valença	1,672	84	1,320	94	1-1
Uruguai	x Miguel Calmon	569	81	323	71	1-1
Uruguai	x Itapagipe	886	75	468	70	1-1
Uruguai	x Pirajá	1,075	98	784	75	1-1
Itapagipe	x Valença	615	83	253	50	1-1
Itapagipe	x Miguel Calmon	433	94	268	66	1-1
Itapagipe	x Pirajá	630	99	282	45	1-1
Pirajá	x Valença	1,402	41	396	69	1-1
Pirajá	x Miguel Calmon	176	87	147	96	1-1
Pirajá	x Uruguai	528	98	514	99	1-1
Pirajá	x Itapagipe	375	97	349	96	1-1
Uruguai	x New Delhi	1,291	73	652	75	1-1
New Delhi	x Uruguai	1,253	92	1,049	92	1-1
Itapagipe	x Uruguai	648	99	578	90	1-1

\* Ratio of males females

ratio of males to females in the progeny of a cross (table 2). This factor is currently being investigated in our laboratory and will be reported on at a later date.

#### SUMMARY

#### INCOMPATIBILITY TESTS OF INDIAN AND BRAZILIAN POPULATIONS OF *CULEX PIPIENS FATIGANS*

In the course of formal genetic studies of *C. p. fatigans* in Brazil a sur-

vey for cytoplasmic incompatibility between various populations of *C. p. fatigans* from the state of Bahia and a population from New Delhi, India, were made.

All of the crosses showed complete compatibility and produced fertile hybrids. This adds confirmation to the results of Espinola and Consoli<sup>2</sup> 1973, who showed complete compatibility between seven Brazilian populations. The compatibility of the Brazilian material with the New Delhi strain and also with a strain from Los Angeles, California (USA) add to our knowledge of the evolutionary relationships in the *Culex pipiens* complex

in regards to cytoplasmic incompatibility.

A factor which appears to act as a sex distorter was also discovered in the Uruguai colony and is being investigated.

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