



a 66560

STUDY ON LABORATORY BREEDING OF ANOPHELES BALABACENSIS BALABACENSIS BAISAS¹

by *Anopheles - growth & dev.*

Jia-fu Pan, Tian-rong Yu and Hong-kan Zhu
Shanghai Institute of Entomology, Academia Sinica, Shanghai, China

China

WHODOC 2/2

1. INTRODUCTION

Anopheles balabacensis balabacensis Baisas (1936) is widely distributed in South-East Asia, in Taiwan, and in Yunnan Province and Hainan Island, Kwangtung Province, China. The positivity rate of salivary glands of A. b. balabacensis collected from Hainan Island is 2.2-6.1%, making this one of the most dangerous local malaria vectors. To facilitate the study of related epidemiology as well as the control of this species, it is useful to establish a laboratory strain by natural mating.

2. SOURCE OF THE MOSQUITOS

A. b. balabacensis was collected from Bai Sha area on Hainan Island, in 1976.

3. FEEDING MATERIAL

Larvae are fed with powdered dried rabbit liver and yeast and adults with a mixed solution of honey (5%), multi-vitamin glucose (2.5%), and glucose (2.5%).

4. METHOD OF REARING

The insectary should be kept at a temperature of 26°C and a relative humidity of 55-60%. When larvae hatch, yeast powder is spread on the water surface 2-3 times a day. After the second instar, the larvae are separated into a number of bowls each containing 400-500 specimens. Liver powder in the form of a paste is introduced into the bottom of the bowls and yeast powder sprinkled on the top of the water as feeding material. After the third instar, the larvae are placed under a light bulb (100W) for 24 hours a day until the emergence of adults. Larvae become pupae in 8-10 days, and the pupal stage lasts 1-2 days.

Adults are kept in plastic-gauze cages (30 x 25 x 20 cm) in which is laid a piece of cotton gauze, soaked with a fresh mixed sugar solution. The adult mosquitos feed on mice 3-4 days after emergence. In the course of the present study artificial mating was used to maintain the stock for 16 generations. When an adequate amount of mosquitos had been obtained, cages of three different heights were used: (a) 60 x 60 x 40 cm; (b) 60 x 60 x 200 cm; and (c) 60 x 60 x 320 cm. Each contained 5000-10 000 adult mosquitos consisting of an equal number of males and females. They were illuminated under fluorescent light for 13-14 hours daily and under blue light for one hour (9.30-10.30 p.m.) every night to induce natural mating.

¹ This investigation received financial support from the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases.

The issue of this document does not constitute formal publication. It should not be reviewed, abstracted or quoted without the agreement of the World Health Organization. Authors alone are responsible for views expressed in signed articles.

Ce document ne constitue pas une publication. Il ne doit faire l'objet d'aucun compte rendu ou résumé ni d'aucune citation sans l'autorisation de l'Organisation mondiale de la Santé. Les opinions exprimées dans les articles signés n'engagent que leurs auteurs.

Prior to the induction of mating, the blue light (220V) placed 50 cm above the top of the cage was switched on, and at the same time all the lights in the laboratory were turned off. Several minutes later, the voltage was gradually lowered to 60-80V within 1-2 minutes and kept at this level for half an hour. It was then adjusted gradually to 40V and maintained at this level until the next morning. Following the induction of mating under blue light for 4-7 days, adults were allowed to feed on mice and a bowl for ovipositing was placed in the cages.

The propagation index of A. b. balabacensis for each cage may be estimated in the following way:

$$\text{Propagation index} = \frac{\text{Number of 1st instar larvae from filial generation}}{\text{Number of adults from parental generation}}$$

On the basis of this index, the effect of the different cage heights on the process of natural mating may be compared.

After the seventeenth generation, cages 320 cm high were selected for the rearing of adults, and the induction of natural mating under blue light was used for propagation. For each generation, 50-100 females per cage were dissected and spermathecae were examined to check the proportion of females mating.

5. RESULT

The propagation indices for 40 cm and 200 cm high cages were 0.45-0.82 and 0.77-1.23 respectively; but, when the 320 cm high cage was used the propagation index was 2.44-3.07, and the adult mating rate 4%. This cage height was therefore adopted and mating rates of 24% in the twenty-second generation and 56% in the forty-fourth generation were reached.

6. DISCUSSION

It takes time to produce a natural mating strain of A. balabacensis in the laboratory. The most important findings in our laboratory rearing of A. b. balabacensis are the adoption of blue light in the induction of mating and the breeding of adults in cages with a height of 320 cm or over. There are a number of reports concerning the induction of mating of Anopheles under blue light, e.g. in the rearing of A. fluviatilis and A. pharoensis. Pan & Hang (1979) used a similar method to induce natural mating of A. sinensis in small cages in the laboratory. However, the intensity of the blue light used for Anopheles may differ in different laboratories. With A. b. balabacensis it was noted that they mated better under low intensity blue light which prolonged the swarming time.

Regarding the duration of mating, it has been reported that A. philippinensis needs 10-15 seconds (Russel & Rao, 1942) and A. culicifacies 15 seconds, these mating times being much longer than the 5-8 seconds of A. sinensis sinensis and the 3-6 seconds of A. lesteri. A. b. balabacensis tended to fall while mating in the swarm and would drop to the bottom of the cage if small-type cages were used so that they were forced to separate before the completion of insemination. Cages must therefore be sufficiently high in order to facilitate natural mating. This method may be helpful in the breeding of Anopheles species which are difficult to adapt to laboratory conditions.

RESUME

ETUDE DE LA REPRODUCTION EN LABORATOIRE

D'ANOPHELES BALABACENSIS BALABACENSIS BAISAS

Pour la présente étude, on a d'abord obtenu la quantité voulue de moustiques par l'élevage en laboratoire et l'accouplement artificiel. Ces moustiques ont ensuite été placés dans des cages de différentes hauteurs : a) 60 x 60 x 40 cm; b) 60 x 60 x 200 cm; et c) 60 x 60 x 320 cm; chaque cage contenant 5000 à 10 000 moustiques adultes et un nombre égal de mâles et de femelles. Avant de provoquer l'accouplement, une lumière bleue placée à 50 cm au-dessus du sommet de la cage a été allumée et l'on a éteint toutes les autres lumières du laboratoire.

L'effet de la hauteur des différentes cages sur le processus d'accouplement naturel a été comparé sur la base de l'estimation suivante :

$$\text{Indice de propagation} = \frac{\text{Nombre de larves au premier stade larvaire de la deuxième génération}}{\text{Nombre d'adultes de la première génération}}$$

Les indices de propagation pour les cages de 40 cm et de 200 cm de hauteur ont été respectivement de 0,45-0,82 et de 0,77-1,23, alors que pour la cage de 320 cm de haut, il a été de 2,44-3,07 et le taux d'accouplement des adultes de 4 %.

Les deux faits nouveaux les plus importants ont donc été l'emploi d'une lumière bleue pour provoquer l'accouplement naturel et la reproduction d'adultes dans des cages de 320 cm de haut ou plus. Pour faciliter l'accouplement, les cages doivent être suffisamment hautes car les moustiques A. b. balabacensis ont tendance à tomber au cours de l'accouplement dans l'essaïm et si l'on utilise de petites cages, ils tombent au fond et sont obligés de se séparer avant la fin de l'insémination.

Cette méthode peut être utile pour la reproduction des espèces d'Anopheles difficiles à adapter aux conditions de laboratoire.

REFERENCES

- Pan, C.-F. & Hang, L.-C. (1979) Studies on laboratory rearing of Anopheles sinensis Wied, Acta entomologica sinica, 22 (1): 41-44
- Russel, P. F. & Rao, T. R. (1942) On the swarming, mating and ovipositing behaviour of Anopheles culicifacies, American journal of tropical medicine, 22: 417