PN-ABC-869

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

DATE: 9/9/88

MEMORANDUM

TO: AID/PPC/CDIE/DI, room 209 SA-18

FROM: AID/SCI, Victoria Ose

SUBJECT: Transmittal of AID/SCI Progress Report(s)

Attached for permanent retention/proper disposition is the following:

AID/SCI Progress Report No. CS-114
PR- July 87- July 88

Attachment

PN-ABC-869

האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM
Department of Parasitology

August 10th, 1988

Mr. B. Rock
Science Attache
Embassy of the U.S.A.
71 Hayarkon St.
Tel Aviv

re: US-Israel CDR Program Project No. C5-114;
contract No. DPE-5544-G-SS-6023-00;
Protection of animals from ticks by interference
in the feeding process of the ticks.

Progress Report: July 1987 to July 1988

c.c. Mrs. E. Slater A.R.D.

A. The feeding response of soft ticks offered solutions containing phagostimulating chemicals was studied for two reasons: a) To confirm the need for a phagostimulating chemical for successful feeding and evaluate the effect of starvation on this need, b) To determine the identity and concentration of a potent phagostimulant to be used as a ligand for the isolation of the cheliceral receptor protein.

Nymphs (3rd and 4th instars) of Ornithodoros tholozani and O. moubata were used. Ticks were tested at one month interval during 6 months. Glutathion (GSH) and adenosine triphosphate (ATP) have been reported to stimulate feeding in ticks. These chemicals were diluted in saline containing glucose (1 mg/ml) and 10^{-3} M sodium bicarbonate at concentrations of 10^{-5} to 10^{-3} M. Ticks were fed on warm solutions (36°C) through a silicon membrane. The feeding response was calculated as the percentage of ticks which increased their body weight over 4 times within an hour.

Results are given in tables 1 and 2. Ornithodoros tholozani responded best to GSH at 10^{-3} and 10^{-4} M and much less to ATP solutions.

However, the response fluctuated widely and no clear trend on the effect of starvation could be established. These species did not feed on the diluent solution in the absence

Table 1: The feeding response (percentage) of O. tholozani nymphs* to various concentrations of GSH and ATP

	time after last molt (months)					
	1	2	3	4	5	6
diluent+	0	0	0	0	5	0
GSH 10^{-3} M	80	40	40	20	15	60
GSH 10^{-4} M	30	70	10	20	80	45
GSH 10^{-5} M	20	10	20	15	60	10
ATP 10^{-3} M	10	20	15	30	45	35
ATP 10^{-4} M	5	0	15	10	0	5

* 3rd and 4th stage nymphs; 20 nymphs per trial; nymphs were considered fed if they weighted 4x their unfed weight.

\+ Saline with glucose (1 mg/ml) and sodium bicarbonate (10^{-3} M) pH 7.3.

Table 2: The feeding response (percentage) of O. moubata nymphs* to various concentrations of GSH and ATP

	time after the last molt (months)					
	1	2	3	4	5	6
diluent+	80	10	20	25	10	20
GSH 10^{-3} M	70	95	95	40	30	15
GSH 10^{-4} M	95	70	40	30	35	30
GSH 10^{-5} M	15	35	10	50	10	10
ATP 10^{-3} M	70	80	20	30	20	10
ATP 10^{-4} M	80	70	10	35	30	30
ATP 10^{-5} M	90	95	15	15	25	20

* 3rd and 4th stage nymphs; 20 nymphs per trial; nymphs were considered fed if they weighted at least 4 x their unfed weight.

\+ Saline with glucose (1 mg/1 ml) and sodium bicarbonate (10^{-3} M) pH 7.3.

of a phagostimulating compound. Ornithodoros moubata fed equally well on ATP and GSH solutions. However, a large number of them fed also on the diluent solution alone. A decline in the feeding response was noted starting at the 3rd month of starvation (Table 2).

Results indicate that some tick species will feed even in the absence of phagostimulating compounds. This discovery raises doubt as to the feasibility of interfering with feeding by immunologically blocking the cheliceral receptor protein, (which respond to phagostimulants in all tick species) as was originally assumed.

Therefore, before going ahead with the planned anti-receptor vaccination we are testing now the feeding response of several other species of soft and hard ticks. For the later, we are using the artificial feeding system which was very successfully developed at ICIPE (see ICIPE report). In addition we plan to confirm the results obtained by behavioral experiments by using electrophysiological methods to study the cheliceral receptor responses.

B. The data obtained during studies of the passage of host antibodies into tick's hemocoel was written up in a paper entitled: "Quantitative studies of host immunoglobulin G in the hemolymph ticks", which was submitted for publication in the Journal of Medical Entomology.

The International Centre for Insect Physiology
and Ecology

P.O. Box 30772 Nairobi.

US-ISRAEL CDR PROGRAMME - GRANT NO. DPE 5544-G-SS-6023-00

"Protection of Animals from Ticks by Interference in the Feeding Process of the Ticks"

Semi-annual progress report

Introduction

This report is necessarily brief since work did not commence until January 1988. This was due to late transfer of funds to ICIPE and recruitment of Dr Ernest Kamanga-Sollo in December.

Personnel

Dr Ernest Kamanga-Sollo was recruited to the programme in December 1987 and commenced studies under this grant in January 1988.

Recruitment of the technician under the grant has commenced and interviews have been scheduled for May 1988.

Progress

ICIPE has developed an *in vitro* feeding system for *Rhipicephalus appendiculatus*. Special treatment of the Badruche membrane encourages adult ticks to attach and feed. This apparatus will now be used to test the action of the phagc stimulants glutathion and ATP. Photographs of the apparatus are attached.

Whole cheliceral digits are being dissected to obtain sufficient amounts of protein for immunisation of rabbits. Attempts to extract proteins from these cheliceral suspensions with several detergents are under way.

Scanning electron Micrographs showing details of *Ripicaphalus appendiculatus* tick attached on the baudruche membrane

(a) Dorsal aspect of the Cheliceral hood (CH) penetrating the membrane (M) where it is almost embedded in the cement cone (CC) secreted by the tick during the attachment process. The palps (P) remain on the exterior.

(b) Features beneath the attachment site;

the cement cone (CC) material pervades the undersurface of the membrane to form a structure containing a lumen (L) through which the tick sucks the fluids below the membrane.

a
P
CH

b