ANNUAL PROGRESS REPORT

SEATO Medic Study No. 45	Association of Diptera with Incidence of Trachoma and Conjunctivitis
Project No. 3A 025601 A 811	Military Medical Research Program S. E. Asia
Task 01:	Military Medical Research Program S. E. Asia
Subtask 01:	Military Medical Research Program SEASIA (Thailand)
Reporting Installation:	US Army-SEATO Medical Research Laboratory APO 146, San Francisco, California
	Division of Medical Research Laboratories
	Department of Medical Entomology
Period Covered by Report:	1 April 1963 to 31 March 1964
Principal Investigator:	Major John E. Scanlon, MSC
Associate Investigators:	Dr. Satnam Singh*
	Dr. Curtis Sabrosky**
Reports Control Symbol:	MEDDH-288
Security Classification:	UNCLASSIFIED

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* World Health Organization, Trachoma Control Pilot Project
** United States National Museum

BODY OF REPORT

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FINAL REPORT

Objective: To determine the population levels of flies attracted to putrescent animal tissue in the Korat area, in relation to the incidence of conjunctivitis and trachoma. To determine which species of Diptera are taken in the various types of traps.

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Description: Two types of fly traps were constructed and furnished to technicians of the WHO Trachoma Control Pilot Project in Korat. The first of these was a standard fly trap, based on designs developed by the U.S. Public Health Service. A smaller trap, designed to capture eye-gnats, was constructed locally from various designs. It consisted of a tin can with screened access holes along the lower edge, and a vial inserted in a hole in the upper part of the can. Traps were set several days each week in four villages in the vicinity of Korat. Multiple sites were used to give as accurate a sample of the fly population as possible with limited facilities. Technicians operated the traps in addition to their regular duties. Cattle entrails, fish waste, liver, and similar material was used as bait, as available. The flies were removed from the traps after approximately 24 hours and forwarded to the Entomology Department for counting. Samples of all of the collections were sent to the United States National Museum for identification. Total fly counts for the large and fly traps were tabulated for the year. Data on conjunctivitis were accumulated by WHO personnel.

Progress: Four villages were selected in the vicinity of Korat (figure 1) for fly trap studies. Three were selected for convenience, since technicians would be visiting them for examination of children, and an additional village, Ban Tanode, was selected as a check site, in the event control proceedures interfered with trapping. No fly control work was, however, organized during the twelve month study period. Korat is a large city located on the Korat Plateau northeast of Bangkok. The plateau is rimmed with moderately high mountains to the south and west, and falls away gradually to the Mekong River to the north and east. The plateau proper is rather poorly watered through the year, although there is a tendancy toward flooding during the latter part of the rainy season (October-November). The average hieght of the plateau is 500 feet. The area was originally covered by dry monsoon forest, but this has been altered extensively by agriculture. In the immediate vicinity of Korat extensive rice paddies are found wherever sufficient water is available. However, insufficient rainfall and rapid run-off through the porous soil and sandstone, tend to make agriculture somewhat hazardous. The average income is quite low.

Children under ten years of age were examined monthly in the study villages, and the percentage of those showing acute and sub-acute conjunctivitis was recorded (fig. 2). Trachoma positive individuals were also recorded, and the maximum period of conversion was found to be from May to June. That is, this percentage of the children negative in May were positive when examined in July. In other two month samples only 1.8 to 3.2% of the children became positive. As can be seen from the figure, conjunctivitis from all causes reached a peak at about the

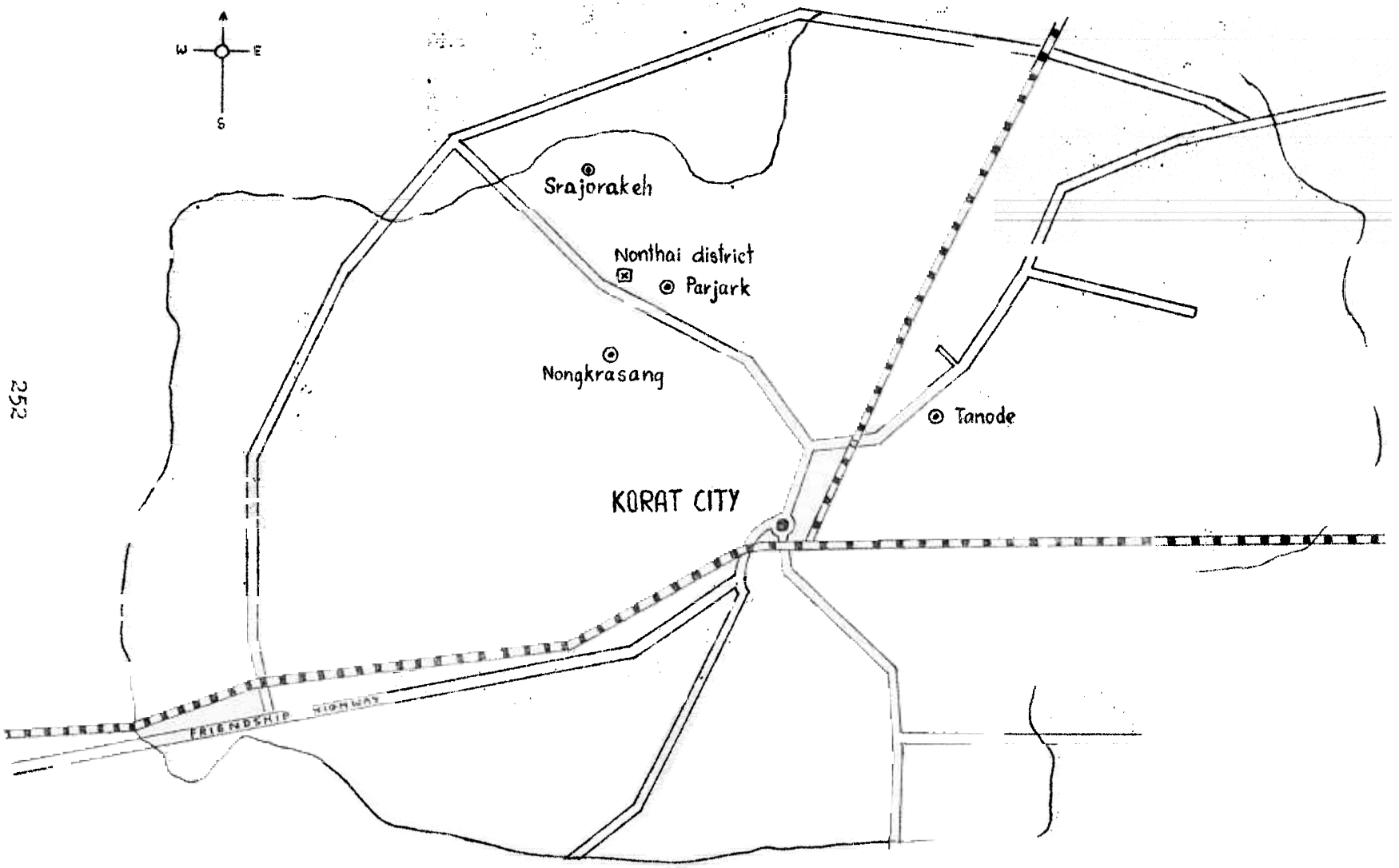

Figure 1. Location of fly collection sites- Korat, Thailand

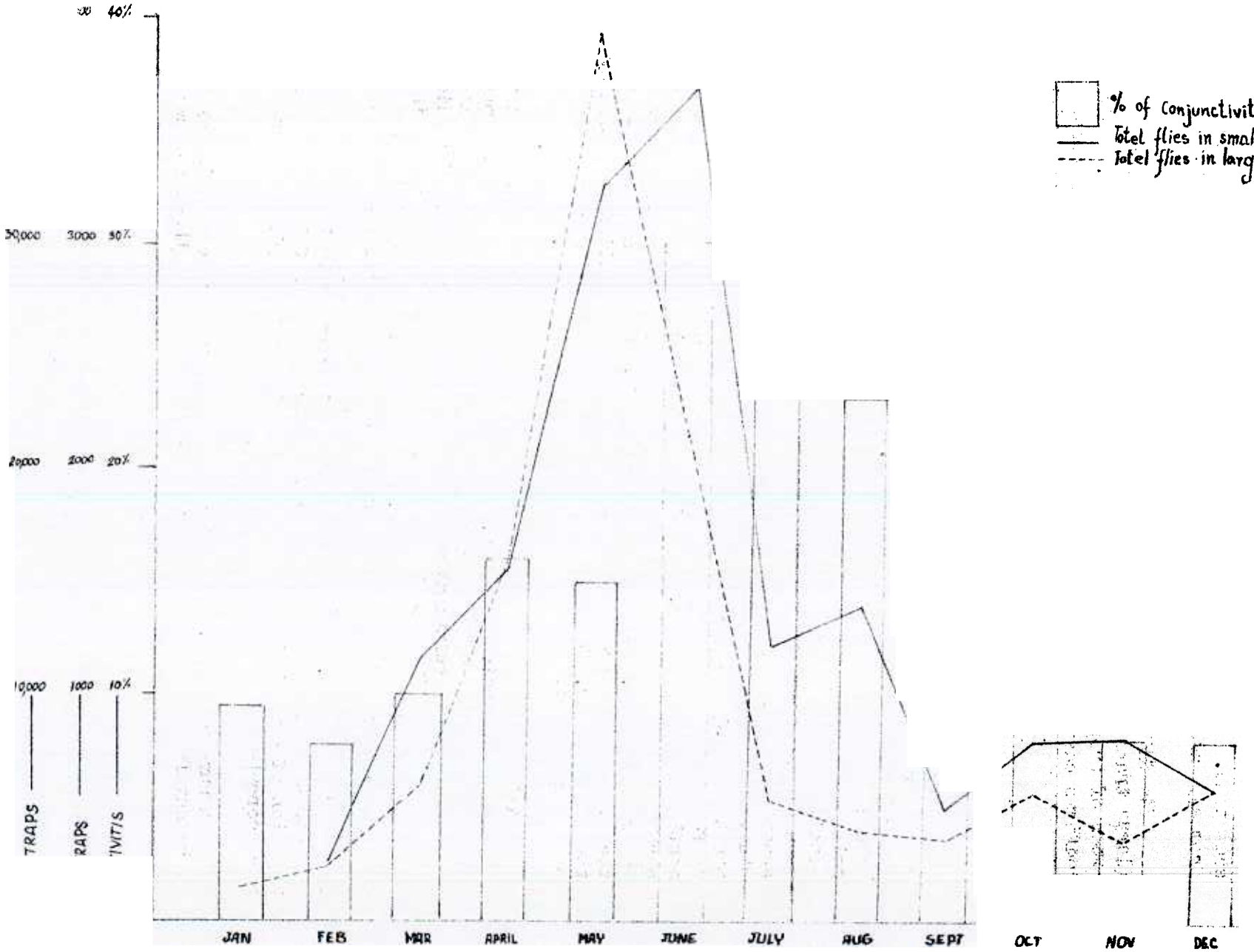
40%
30,000
3000
30%
20,000
2000
20%
10,000
1000
10%
TRAPS
RAPS
VITIS
JAN
FEB
MAR
APRIL
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
% of Conjunctivitis
Total flies in small traps
Total flies in large traps

Figure 2.

same time. Repeated observations confirmed the fact that conjunctivitis from all causes closely paralleled the incidence of trachoma.

The fly populations in the villages reached a maximum in May (large traps) and June (small traps), and if the figures for the two types of traps are combined, the peak clearly falls in June. This confirms casual observation of the fly populations in other parts of Thailand. In Bangkok during most of the year the fly population is very low, considering the mean temperature and the fly conditions found in other Oriental cities. During the hot season, however, from March to June, there is a very marked rise in the fly population, popularly associated with the mango season. The reason for this seasonal progression in the fly population is not clearly understood in the Bangkok region, but it is believed to be due to the extremely high water table during most of the year. While this promotes mosquito breeding it may retard the reproduction of filth flies by making the soil too wet to support maggot growth and pupation. Controlled and detailed studies of the filth fly populations in Thailand have not been made, nor has the taxonomic study of the higher Diptera here made great progress. The seasonal progression of the fly population in the study villages followed much the same pattern as had been observed in Bangkok. That is- a rather low population in the cool months of December to February, followed by a rapid and marked rise in the hot "summer" months of March to June. The fall in population levels is even more abrupt than the rise, and appears to be associated with the onset of the rainy season. The eye-gnat population, which is measured by small traps, peaked somewhat later than the larger filth flies (measured by the large traps). There was good agreement in the curves for both types of traps from all villages as can be seen in figure 3.

Aliquots of the collections from various months were sent to the United States National Museum. It had been hoped to identify a much larger percentage of the total population in order to detect qualitative changes in the populations as well as quantative changes. This did not prove to be possible due to extensive damage to the collections in transit due to attacks by mold and ants. In addition, the classification and description of the higher Diptera of SE Asia is still very poorly developed, and at best only a few species can presently be described with the information at hand. For these reasons, and because it is impossible to assess the role of various species of filth feeding flies in the transmission of conjunctivitis and trachoma, the results (figures 2 and 3) are reported by total fly population.

A number of species and genera of Diptera were identified by Dr Sabrosky from the material sent to him, and notes on these follow:

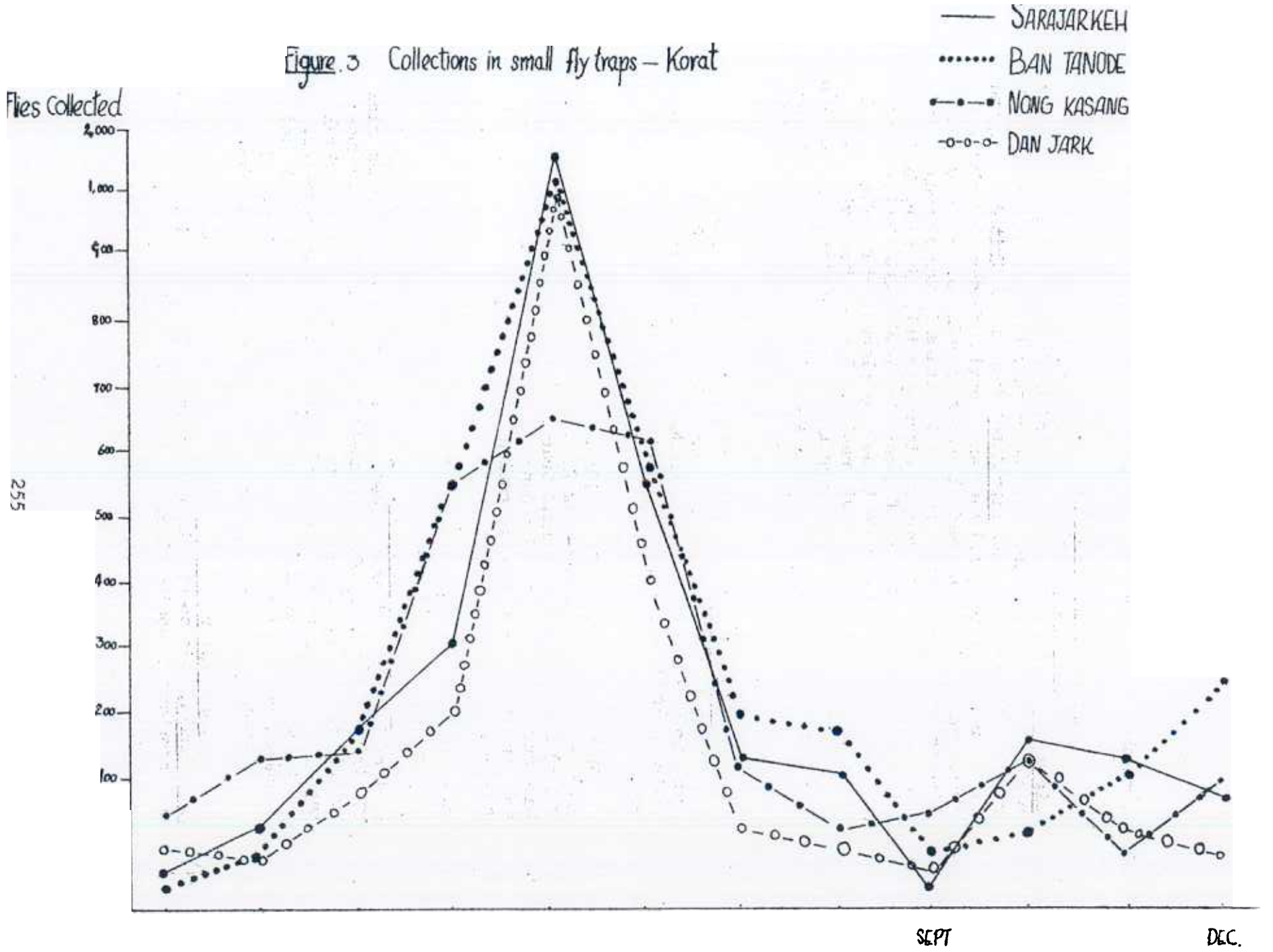

Figure 3 Collections in small fly traps – Korat

From the small (eye-gnat) traps:

Family Chloropidae-

Siphunculina signata (Woll.)

Siphunculina species undetermined. Members of the genus Siphunculina are known as "eye flies" in India, Ceylon, and other parts of the Orient. In this respect they fill the same ecological niche as the related genus Hippelates does in the United States and elsewhere. They are persistant and annoying feeders especially around the eyes and the genital organs of animals. The evidence linking members of these genera to the transmission of conjunctivitis and trachoma is almost entirely circumstantial. However, it is the observation of coincidence of population levels with incidence of these diseases has been made in so many places and so often that it seems to deserve serious consideration. Both conjunctivitis and trachoma are probably spread largely by direct contact, and the rise during the hot season in Thailand, for instance, may be due to some factor unrelated to the rise in fly populations, such as increased perspiration.

Cadrema pallida (Lw.). This member of the Chloropidae is strongly attracted to decaying flesh and excrement. It has been found to be extremely abundant on Guam in May, but almost nothing is known of its habits. It does not appear to be attracted to the eye.

In addition to the Chloropidae, small numbers of other flies such as Otitidae (picture-wing flies) and Drosophilidae (pomace flies) were taken in the small traps. It is doubtful that these have any relation to the incidence of eye infections, as they are not strongly attracted to secretions of the eye, being mainly fruit feeders.

From the large traps:

Family Calliphoridae-

Chrysomya megacephala. By far the most common species in most of the collections examined. This is an extremely common blow fly in the Orient. It feeds on meats and sweets, and may produce myiasis of wounds. It may be the most important carrier of fecal pathogens in many parts of the Orient. Under the circumstances, it is possibly involved in the transmission of conjunctivitis and trachoma, but its large size would probably preclude its playing as important a role as the smaller eye gnats and the house fly.

Chrysomya rufifacies Macg. Smaller and less common than megacephala, this species is a sheep maggot in Australia. Probably not important in conjunctivitis for the reason given above.

Phaenicia cuprina (Wied.). Another species which may cause primary myiasis of sheep and other animals. It has a widespread distribution in the temperature and tropical regions of the world. Since it invades the ear and sinuses, and must therefore be attracted to the face on occassion, it is possible that it plays some role in the transmission of eye infections.

Family Sarcophagidae- the flesh flies.

Sarcophaga sp. None of the species of this difficult group were identified to species in this study. As with some of the species listed in the Calliphoridae, larvae have been found in the nasal passages and sinuses of man, and it must be assumed that the adults are attracted to the face. Thus, they may serve as vectors of eye infections.

Family Muscidae- the domestic flies and allies.

Musca domestica Linn. The house fly- This is the familiar domestic fly, which is practically world-wide in distribution. It is a known transmitter of enteric pathogenic organisms, and it has been reported to feed readily on body secretions and exudations. Thus it may be involved in the transmission of infections of the eye. The bait used in the fly traps in this study was not particularly well adapted for attacking M. domestica, and it is probable that the species was much more common than would appear to be the case from our sample.

Musca sorbens. The bazaar fly- Widely distributed in the tropics and subtropics of the Old World, it is the common house inhabiting species in many areas. It is particularly noted for its habit of feeding on sweat, mucous and the exudates from wounds and infections. It has been reported to scrape sores and scabs until pus exudes, and then to feed on the liquid. Obviously, such habits fit it well as a transmitter of conjunctivitis or trachoma. It is probable that many of the reports of house flies as transmitters of eye infections in the tropics refer to this species.

Atherigona sp. Relatively large numbers of these anthomyid flies were captured in the large traps. These are small flies, which feed largely on decaying vegetable matter. Their habits are relatively poorly known. Their small size might permit them to feed fairly readily around the eyes, but this habit apparantly has not been reported.

A few specimens of Plagiostenopterina sp. of the family Platystomatidae were taken in the large traps. These are pictured-wing flies allied to the Otitidae, and relatively poorly known. The percentage distribution of the identified flies is given in table 1.

During examination of children small flies were noted landing on their eyes a number of times, and a few of these were captured. One photograp was taken showing a clearly recognizable eye-gnat *in situ* on an infected eye margin. The general impression gained was that landing and feeding of flies in the eye area was fairly common during the warm months. All of the data accumulated during the study, therefore, lead to the conclusion that flies play a role in the transmission of conjunctivitis and trachoma in Thailand. This is much the same sort of evidence that has been accumulated in other parts of the world, including Assam, Ceylon, India, Egypt and California. It is also well to assume that the organisms causing these diseases can be found in any of the fly species mentioned here, since flies are so adept at picking up various organisms. The finding of infected flies thus may add little to the understanding of the quantitative role flies in the transmission of these diseases. The most practical way to determine this point would be a control program spread over several seasons, in which certain villages would be subjected to fly control while the others were not, while the fly rates and eye diseases rates were followed very closely. A prerequesite for this study would be a much better understanding of the taxonomy of the higher Diptera in Thailand than is presently available.

Summary: The population levels of flies in villages in the Korat area reached a peak at a time when cases of conjunctivitis in school children were at a peak, and when the greatest number of new cases of trachoma were being contracted. At least three species of Diptera collected are known to feed readily on secretions and exudates of the eye, and thus may serve as vector of the organisms causing conjunctivitis and trachoma. These species are: the eye-gnat (*Siphunculina*), the house fly (*Musca domestica*), and the bazaar fly (*Musca sorbens*). However, none of the species collected in the traps can be excluded from a possible role in transmission of the organisms involved. The nature of the study did not permit a quantitative assessment of the importance of fly transmission of these diseases of the eye, as compared with direct mechanical contact, or fomites. A controlled experiment will be necessary to clarify this point.

Conclusions: The data obtained are not inconsistant with a conclusion that Diptera may play some role in the transmission of conjunctivitis and trachoma in Thailand, based on the feeding habits and population curves of the fly species involved. A controlled experiment should be conducted to determine the importance of this mode of transmission in the Korat area.