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ENVIRONMENTAL SANITATION IN THE CONTROL OF COMMUNICABLE EYE DISEASES

by

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The environment influences communicable eye diseases in two ways : one is direct, the other is indirect. The social and economic conditions of a population are undoubtedly reflected on the living conditions especially as regards housing and overcrowding. Poverty and ignorance are the direct outcome of the low standards of life in the community. Poor communities cannot afford sanitary housing facilities for avoiding overcrowding or facilities for cleanliness of the house. Personal hygiene, however, is not as much impeded by poverty as it is by ignorance. It might be pointed out here, that ignorance does not essentially mean lack of education or illiteracy because washing of the face or driving flies away from the eyes does not need any degree of education; it ishealth education that is required. A poor individual can be taught the primitive basic principles of personal hygiene, i.e. cleanliness in the same way as a better-off person, if only a real effort is made by the health worker. It is thus clear that many of the factors inherent to the environment which bear a direct relation to the transmission of communicable eye diseases can be solved simply by health education, namely by imparting knowledge on the basic principles of cleanliness, personal hygiene and the avoidance of direct contact with patients. Some need a slight improvement of

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their economic and sanitary conditions, e.g. the procurement of clean water, soap, special personal towels and veils for the children's faces, better housing conditions with less overcrowding.

The factors that bear an indirect relationship to transmission of communicable eye diseases are those which help the spread of house-flies. Broadly speaking these comprise : the problem of disposal of refuse, sewage and animal manure.

The breeding places of flies were studied in Egypt by Hafez, Madwar, Zahar, Moharram, Gahan and Peffly. It was concluded that flies breed extensively in soils covered with humid organic matter especially animal dung, human excreta, bird droppings and decayed food residues. The potentiality of such breeding sites varies in the village from the town. The main sources in towns are refuse and stables. In slum areas and in districts near abattoirs, human droppings and remains of carcasses also give rise to large numbers of flies. In the villages, on the other hand, the breeding places were classified by Holway (1951) into latrine dumps (where latrine contents are disposed of), compost piles (manure heaps), animal rooms (cattle sheds), fuel cakes (cow dung mixed with straw and formed into discs which are used for fuel after drying up) and scattered human stools. Workers of Insect Control Section, Cairo (1952) and Peffly (1953) came nearly to the same conclusions as to the number of larvae contained per unit area of such breeding places. Arranged according to larval content in a descending order, they were : Human stools, fuel cakes, latrine dumps, compost piles and animal rooms. Naturally their relative importance as sources of fly production varies also according to their size and hence each village has its own circumstances. The season of the year influences such breeding sites in the form of rapid drying up e.g. fuel cakes in summer or complete removal e.g. of manure heaps for fertilising purposes or the frequent cutting of the animal room or the removal of the contents of the pit latrine to the latrine dumps. Such seasonal variation will change their

potentiality in different seasons. Peffly (1953) concluded from studies of the species produced by each breeding medium that human faeces rates first, then latrine dumps, animal rooms and compost piles. Refuse is rapidly consumed in the village as the vegetable contents are fed to animals and the dry parts are used as fuel. Animal droppings made into fuel cakes do not form an important source for fly production except probably in the colder and more humid season of the year because when they dry up quickly the larvae die before pupation. Besides the flies produced from them were mainly M.Crassirostris and Paragle cinerella which are non domestic and so of little importance to man, Sabrosky (1952), Peffly (1953). According to Insect Control Section data 1953 the ordinary privy pit latrine produces 5 times as many flies as the bore hole latrine.

In relation to towns also, sewage farms produce very large numbers of flies especially when the method used for purification is sedimentation and sludge drying. The drying beds produce innumerable flies that could not be controlled by any method. For instance in the Gabal Asfar Sewage Farm of Cairo the area of the drying beds amounts to five acres of sandy soil and the fly pupae were seen to extend all over the area to a depth of about 20 centimeters. No wonder therefore if the near-by village "Khankah" complains of an uncontrollable fly nuisance.

Dispersion of flies is another important point in the town, as a clean district may be endangered by invasion of flies coming from a slum area especially by means of communication. The abattoir district of Cairo supplies all the surrounding districts of Kasr El Aini, Manial, Sayedah, Old Cairo, Rodah, Giza with good numbers of flies through means of transport. Flies coloured and released (Moharram 1955) in that district were caught at Ghamrah which lies 7 Kms. away. In the village, on the other hand, fly dispersion to other villages is not very great, they usually spread all over the village in about one hour from release at a central point. The radius

of the circle of dispersion is about 500 metres. Where there is direct communication between two villages, e.g. a road, coloured flies were caught after 48 hours from a village 2.5 Kms. from the point of release (Moharram 1955). Flies are after food and shelter e.g. when released in a field between villages they moved quickly in all directions to the nearest villages at 500 up to 2500 metres.

Role of the House Fly in Ophthalmia Transmission

On the assumption that flies breed on filthy contaminated material and are attracted to alight on varied types of sites either for feeding or oviposition, they were incriminated by various authors as important mechanical carriers of disease (Patton 1919, Austin & Mayne 1935, Lambourn 1940, Harris & Down 1946, Christenson and Oman 1947, Satchell and Harrison 1953, and Gaud et al 1954). From the point of view of ophthalmia in Egypt, Maxwell Lyons 1953, Bakri 1955, Hafez and Attia 1958, emphasized on epidemiological grounds the importance of the fly Musca sorbens as the main carrier. Bacteriologically Decoursey (1955-1956) isolated streptococci and staphylococci from flies (Musca sorbens and Musca vicina) caught on the faces and eyes of children.

In the Qalyoub Demonstration and Training Centre four villages were selected for studies on flies and ophthalmia. The fly levels were assessed by the Insect Control Section (M.P.H.) and the eyes of children were examined by the Qalyoub Ophthalmologist. Flies were collected from the faces of children (0-5 years) by special nets that covered the head and neck to the shoulders. They were sorted, counted and identified in the laboratory. The fly counts are given in Table I. About 3834 children were examined from the four villages during the whole year with 1957 positives i.e. about 51%. The monthly number examined in each individual village varied between 54 and 128 children. The total number of flies collected during the whole year was about 10,324 of which 37% was Musca sorbens. The average number

of flies found on the face of a positive child varied between 2.3 and 8, the lowest figures occurred in January, February and March and the highest figures occurred in April through November with a slight drop in August, September and December. This coincides almost exactly with the two fly peaks drawn by the regular Scudder Grid counts. These peaks occur in the spring and autumn with a comparative drop in July and August (Table II). The average number of flies by species (Musca sorbens and M.vicina) is also given. It may be noted that Musca sorbens out-numbered Musca vicina only during the spring (March to June inclusive). Fly samples collected by sweeping nets showed that the incidence of sorbens in nature amounts to about 3% or less of the total population. Samples collected from human stools showed about double that number (Insect Control Section). The high percentages of sorbens seen on the faces of children certainly point to special attractivity of the eyes to M. sorbens. This confirms the work of Bakri (1955) and Hafez (1958). The latter author proved experimentally that attraction is through an olfactory rather than a humidity response. Considering the degree of contribution of each species in the formation of the two fly peaks on the faces of children one might conclude that Musca sorbens forms most of the spring peak until June while Musca vicina contributes more both to the autumn peak and to the comparatively high figures of the summer, and also maintains the low figures of the winter months.

In the village of Bahada (one of the above mentioned villages), the available data on conjunctivitis are given (Table II) from the examination done by the Ophthalmologist in 1957 (July to December inclusive), together with the fly counts including the regular grid levels and the children's faces collections. It may be noted that the level of flies for both the grid and the faces run more or less parallel. The averages of the faces for musca sorbens also form the spring peak and M. vicina the autumn peak as mentioned

above. The incidence of ophthalmia was highest in July with a slight drop in August and a more pronounced one during September and October followed by a rise in November and a much greater drop in December.

This curve appears to have one month lag behind both the face averages and the regular fly grid counts. This is obscure in the case of a mechanical carrier in which no incubation takes place in the vector. It is very unfortunate that no such data could be found for the winter and spring months.

Nevertheless these data might point out that Musca vicina in that part of the year was at least just as important in the transmission as Musca sorbens. The latter showed only low averages from July until December. This conclusion does not agree exactly with the statement given by Hafez and Attia (1958) who mentioned that Musca vicina in winter and probably in other seasons does not play an important part in the dissemination of eye diseases. Their conclusion was presumably based on their monthly mean counts of both species on diseased eyes (Table III). Considering the percentages for Musca and also the averages compiled from Qalyoub 1956 (Tables I and II) one might conclude that though in the months of August and October in Table III, the figures of Musca vicina are comparatively lower than those of sorbens yet the reduction is not such as to exclude vicina altogether as being unimportant. The fly figures given by Decoursey (1955-1956) in Table III also do not exclude such importance.

Besides the bacteriological examination of pools for both fly species (Decoursey 1956) point at least to equal importance and even it was found that bacteria associated with M. vicina were approximately twice as much as with M. sorbens. This investigation also showed that most of the bacteria found were steptococci and staphylococci which are known to be associated with non-specific conjunctivitis. Swabs from children's eyes collected during July and August showed the same bacteria found on flies. A study of the morbidity of the disease in Rod El-Farag Eye Disease Hospital as an example

(Table IV) would show that ophthalmia forms about 37-58% of all eye diseases examined in the out-patients. The highest percentages were found during the spring, summer and autumn. Analysis of the figures shows that about 51981 ophthalmia patients were examined during 1957. The winter patients (December, January and February) were 5857, i.e. 11.3% of the patients of the whole year. The spring figures (March, April and May) formed 23.7% and the summer 34.4%, while the autumn constituted 30.6%. Thus despite the fact that about 60% of all the cases occur during spring and autumn yet the summer which has comparatively low fly counts has a higher ophthalmia figure than either the spring or autumn, i.e. the fly peaks. This shows that flies are only a factor in ophthalmia transmission and the part played by the fly is probably an initial propagation of cases during the spring peak which is helped by other factors of spread during the rest of the months.

TRIALS OF FLY CONTROL

With the introduction of the modern persistent insecticides in 1946, trials were made all over the world to control house flies by their use. But wherever basic sanitation measures were lacking, the result achieved was the same in all parts of the world, that is complete failure after a preliminary temporary success. Flies very quickly developed resistance to all available insecticides not only the chlorinated hydrocarbons, e.g. DDT, BHC, Dieldrin, but also against the more recent and more toxic ones of organophosphorus, e.g. resistance to Diazinon both in Italy and Denmark. In towns where sanitation was much below any reasonable standards, where breeding places were so immense as to produce large numbers of flies, even in the absence of resistance, residual insecticides did not show any appreciable effect as the production in such cases much exceeds the number that is killed by the insecticide. In such instances, in Egypt, attack with the insecticides was also directed on the breeding places but this very rapidly enhanced resistance development. Many examples can be given from our experience in Egypt both from the work of the Insect Control

Section (Madwar, Zahar and Moharram) and that of the Rockefeller Foundation (Weir) or the Naval American Medical Research Unit No.3 (Holway, Gahn, Peffly and others). All these workers tried different formulations of the different insecticides and different combinations of methods and arrived always at one conclusion, that it was essential to consider control in terms of basic sanitation. Fly breeding material must be removed immediately or treated in such a way as to be completely dried or heavily moistened; in either case the larvae are destroyed. Human stools and promiscuous defaecation should be carefully looked after and the instalment of bore-hole latrines is recommended. Cattle-sheds should be sanitary and separated from human habitation. Besides any measures of fly control that are short of proper health education are apt to fail through lack of public cooperation resulting from ignorance. Every person who has any concern in creating, removing or dealing with fly breeding media has to know clearly the purpose and objective and methods he is applying. In China the claimed successful fly control was based on cooperation of every individual in the community to destroy flies wherever found and avoid the production of any breeding places. Refuse and sewage were properly collected and dealt with. Not only promiscuous defaecation was prohibited but also animals were not allowed to soil the street by a special device of a fixed impervious bag applied by the owner to the hind end of the animal.

CONTROL OF MUSCA SORBENS

Assuming that Musca sorbens plays an important role in ophthalmia transmission and in view of the fact that Musca vicina has developed resistance to most insecticides and that musca sorbens is mainly attracted to, and breeds on human faeces, it was thought to try a selective control on Musca sorbens and find out the effect of that procedure by itself on ophthalmia in two Qalyoub villages. The suggestion (made by Dr. W. Fay of the C.D.C. Savannah) was based on the concentration of human stools dropped inside and [illegible] certain localities and covering them with palm-reed baskets

50x30x30 cms. impregnated with 5% diazinon. The faeces will act as an attractant bait and oviposition media to flies which settle on the reeds and are thus killed by the insecticide. Before removal of the baskets to other places, the stools were treated with diazinon emulsion to destroy the larvae therein. This method was thought to be very economic from the point of view of man-power, equipment and insecticides. The dose per basket was 150 cc. of 5% solution and about one pound of diazinon will suffice for 65 baskets and impregnation was repeated at four weeks' intervals. This method caused some drop in the sorbens population in the treated villages but it did not show any apprcciable difference in the incidence of ophthalmia in the treated and controlled villages (Table V). The villages treated in that way were Halaba and Balaqs during the period March to September inclusive. The villages Shalakan and Sindibis were kept as controls. It was concluded from that experiment that selective control of Musca sorbens has not been successful and general fly control is to be recommended.

RECOMMENDATIONS

Undoubtedly the house fly plays an important role in the transmission of ophthalmia and its successful control would largely contribute to a reduction in its incidence. Nevertheless, it should be pointed out that the use of chemicals for fly control in the absence of basic sanitation would not be expected to lower the fly population below the winter levels. In spite of such low levels, the flies by an attractivity response to eye discharges will settle on the eyes and transmit ophthalmia which does not completely disappear in winter. Therefore in order to control ophthalmia we have to apply the following measures :-

1. Basic sanitation which includes proper collection and disposal of sewage, refuse and animal manure, installation of pure water supply, prevention of promiscuous defaecation and general personal cleanliness.
2. The use of chemicals (insecticides) for general fly control and this will

in the long run prove a failure in the absence of No.1 (basic sanitation).

3. Health education on personal hygiene and cleanliness, avoidance of flies by not allowing them to settle on the eyes and the prevention of promiscuous defaecation.

Considering the first two items it would appear that they need time, funds and raising the standard of living and improving the general economy. The third item does not need much money, it needs effort, patience and persistence. Besides it is vital even if the former two were being applied.

ANNEX I

TABLE I - Flies on children's faces (0-5 years) in four villages of Qalyoub 1956 (Baradah, Bahada, Balaks and Halaba)

Month	No. Exam.	No. +	%	Tot.	Aver. child	M. Sorbens	M. vic.	Av. sorb.	Av. vicina
January (1) (63-141)	383	169	49	385	2.3	1	384	0.01	2.29
February (63-99)	325	168	51	413	2.4	91	323	0.5	1.9
March (81-106)	305	159	52	582	3.6	237	345	1.8	1.8
April (54-114)	300	180	60	1145	6.3	519	626	2.8	3.5
May (37-95)	256	149	58	1114	7.5	603 2)	277	5.5	2.0
June (49-109)	280	161	57	1286	8.0	750	536	4.7	3.3
July (67-86)	302	162	53	1024	6.4	306	718	1.9	4.5
August (67-98)	350	163	46	681	4.1	158	523	0.9	3.2
September (68-120)	333	160	48	869	5.4	310	559	1.9	3.5
October (81-121)	366	200	54	1359	6.3	400	959	2.0	4.3
November (69-110)	311	160	52	823	5.1	261	562	1.6	3.5
December (58-128)	323	160	52	643	4.0	70	573	0.4	3.6
Total	3834	1957	51	10324	5.2	3706	6385	1.9	3.3

1) = Range of children examined for each of the four villages.

2) = In one village no identification of fly species was made in this month.

ANNEX II

TABLE II - Fly counts and Conjunctivitis in Bahada Village

Month	Grid reading		Flies on children faces (1956)						Conjunctivitis	
	Max.	Av.	No. Exam.	No. +	No. flies	Av./+ child	Av. sorb.	Av. visi.	Children exam.	
Jan.	14	7	81	43	69	1.50	0.0	1.50	Not done	
Feb.	18	8	77	40	90	2.25	0.12	2.13	"	"
March	26	14	54	30	99	3.30	1.70	1.60	"	"
April	96	48	72	50	28	5.60	2.80	2.80	"	"
May	116	58	54	40	200	5.0	3.8	1.2	"	"
June	237	100	55	40	284	7.1	5.1	2.0	"	"
July	77	39	66	40	155	3.9	1.5	2.4	275	20.7
August	60	30	93	40	171	4.2	1.6	2.6	233	13.3
Sept.	56	26	80	40	100	2.5	0.9	1.6	190	8.7
Oct.	138	60	83	50	262	5.2	1.14	4.06	226	7.5
Nov.	123	58	65	40	189	4.7	0.70	4.00	237	12.2
Dec.	29	16	69	40	78	1.9	0.00	1.90	196	4.6

ANNEX III

TABLE III - Flies collected from faces of children

Month	Hafez & Attia (954-955)			Decoursey (955-1956)		
	Total flies	Sorbens %	vicina %	Total flies	sorbens %	vicina %
January	336	32.8	67.2	834	1.4	98.6
February	190	68.7	31.3	432	11.3	88.7
March	134	80.5	19.5	458	31.1	68.9
April	212	83.7	17.0	1334	63.6	36.4
May	142	71.2	28.4	798	81.3	18.7
June	129	88.4	11.6	510	88.0	12.0
July	137	45.2	54.4	724	54.6	45.4
August	174	71.3	28.7	2323	53.9	46.8
Sept.	159	36.5	63.5	357	53.2	46.8
Oct.	166	55.4	44.6	288	49.7	50.3
Nov.	415	9.6	90.4	562	44.1	55.9
Dec.	350	18.4	81.6	149	14.8	85.2
Total	2544	45.5	54.5	8719	50.1	49.9

TABLE IV - Rod el Farag Hospital Out-patients

Month	1957			1958			1959		
	New Patients	Ophth.	%	New Pat.	Ophth.	%	New Pat.	Ophth.	%
January	3862	1454	37.6	4953	1902	38.4	6200	2223	35.8
Feb.	3732	1656	44.3	4461	2219	49.0	4416	1739	40.6
March	5296	2549	47.0	7427	3359	45.0	5108	2299	45.0
April	5047	2762	54.0	7579	3790	50.0	7703	2619	34.0
May	12064	7019	58.0	14679	7832	53.0	17426	7194	41.2
June	13899	7862	56.5	12686	4453	35.0			
July	8787	4899	55.0	14471	7269	50.0			
August	10429	5102	49.0	14369	6557	44.0			
Sept.	12571	5567	44.0	12800	5810	45.0			
Oct.	12421	5640	45.0	14614	7530	51.0			
Nov.	10333	4724	45.0	11400	6609	58.0			
Dec.	6318	2747	43.5	7116	2696	37.0			

ANNEX IV

TABLE V - The Incidence of Ophthalmia in villages of Qalyoub

		Bacteriological Conjunctivitis		Clinical Conjunctivitis	
		August	September	August	September
Treated Villages	(Halaba	55%	37.9%	38.6%	45.0%
	(Balaks	58%	?	51.0%	47.0%
Untreated Villages	(Shalakan	75%	33.6%	33.2%	41.4%
	(Sindibis	51.5%	27.9%	45.3%	23.8%

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