MOSQUITO AND MALARIA CONTROL IN ILLINOIS.

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In 1924 a paper on mosquito and malaria control was read before this Society,* presenting some of the phases of the work including a discussion of malaria distribution in the State, the life history of mosquitoes, methods of mosquito control, and an outline of two malaria control projects which were carried out under the supervision of the State Department of Public Health. A brief review of the former paper will facilitate a clearer understanding of the present discussion inasmuch as the contents of this paper are somewhat of a continuation of the former article considered in the light of more advanced and accurate data obtained from a rapid expansion of this important and now clearly recognized public health activity.

In the former paper it was shown that although mosquitoes were quite widely distributed over the entire State, malaria was confined principally to the "malaria belt" comprising the southern 12 counties in Illinois. It was shown that some counties were suffering 3,000 or more cases of malaria each year and that the annual economic losses due to the disease in such counties were in excess of a quarter of a million dollars. A brief history of the development of malaria and mosquito control in Illinois was given, beginning with the original warning published in the Illinois Health News in 1916 and following through the successive steps including the request by the Southern Illinois Medical Society and investigations by the State Natural History Survey that led to the establishment of the first effective anti-malaria and mosquito campaign at Carbondale in 1922. A discussion of the mosquito, its life habits and the various methods of control was given in considerable detail and

* Mosquito and Malaria Control in Illinois, by Harry F. Ferguson, Chief Sanitary Engineer, State Department of Public Health. Trans. Ill. State Acad. Science, Vol. XVII, p. 279.

the details of the work at Carbondale and Belleville were presented.

The purpose of this paper is to point out the progress which the work has made in this State, to review briefly the results of the several projects carried on since 1922 and to present the information obtained by a recent rural malaria survey in southern Illinois which indicates the seriousness of the problem yet remaining. No time will be devoted to the discussion of malaria and mosquito, methods of control or other similar matters that are already quite well understood by the members of this society.

PROGRESS OF MALARIA AND MOSQUITO CONTROL IN ILLINOIS.

The advance made in malaria and mosquito control since its inception in 1922 is admirably reflected by a brief chronological outline of the different projects carried on up to the present time. The fact that most of these projects have been started only as a result of active promotional efforts on the part of the State Department of Public Health plus financial assistance for the first season's work by the International Health Board and have been continued from year to year only by reason of the results obtained by the first season's work is encouraging from the standpoint of extending the work to other cities and areas where mosquitoes or malaria constitute a problem. Carbondale, for instance is now beginning its fifth consecutive year of mosquito control. The fact that this city has continued the work from year to year is a rather conclusive testimonial as to the effectivness of the work.

In the projects included in the tabulation mosquito control has been effectively accomplished by the application of drainage, oiling, paris green, clearing, fish control and inspection measures, adapted and varied to meet the particular needs. The essential data relative to these projects is given in the accompanying table.

It is to be noted that the foregoing projects are all town or city projects where effective mosquito control can be accomplished with a relatively small expenditure of money. No projects have yet been undertaken in the

TABLE OF MALARIA AND MOSQUITO CONTROL PROJECTS IN ILLINOIS.

Project.	Year	Area controlled square mile.	Population served.	Approximate cost	Comparative reduction in malaria cases*.	Remarks.
Carbondale	1922	6	6,300	$ 2,700.00	270	Mosquito nuisance prevented.
Des Plaines River	1922	72	100,000	90,000.00	.....	Nuisance project. Mosquito nuisance greatly reduced.
Carbondale	1923	6	6,300	900.00	278	Mosquito nuisance prevented.
Belleville	1923	6	24,000	3,000.00	38	Primarily nuisance project. Mosquito nuisance prevented.
Carbondale	1924	6	6,300	450.00	226	Mosquito nuisance partially prevented.
Belleville	1924	6	24,000	2,000.00	.....	Nuisance project. Mosquito nuisance prevented.
Herrin	1924	6	12,000	3,000.00	166	Mosquito nuisance prevented.
Carbondale	1925	6	6,300	600.00	246	Mosquito nuisance prevented.
Belleville	1925	6	24,000	1,500.00	.....	Nuisance project. Mosquito nuisance partially prevented.
Murphysboro	1925	6	12,000	6,000.00	220	Mosquito nuisance prevented.
Gorham	1925	3	400	1,500.00	33	Mosquito nuisance prevented.
West Frankfort	1925	8	18,000	7,000.00	425	Mosquito nuisance partially prevented.
Ravinia	1925	4	3,000	6,000.00	.....	Nuisance project. Mosquito nuisance greatly reduced.
Winnetka	1925	6	7,000	7,000.00	.....	Nuisance project. Mosquito nuisance greatly reduced.
Glencoe	1925	6	4,000	6,000.00	.....	Nuisance project. Mosquito nuisance greatly reduced.
Evanston	1925	10	37,000	2,000.00	.....	Nuisance project. Mosquito nuisance partially prevented.
Highland Park	1925	.....	6,000	.....	.....	No information.
Kenilworth	1925	3	1,100	1,300.00	.....	Nuisance project, partially prevented.
Des Plaines	1925	.....	3,500	.....	.....	No information.
Riverside	1925	.....	2,500	.....	.....	No information.
Maywood	1925	.....	12,000	.....	.....	No information.
Oak Park	1925	.....	39,000	.....	.....	No information.
Forest Preserve	1925	.....	.....	.....	.....	Favorable reports. No detailed information.
Skokie Creek	1925	.....	.....	10,000.00	.....	Favorable reports. No detailed information.
Des Plaines River	1925	.....	.....	15,000.00	.....	Favorable reports. No detailed information.

* Comparison of malaria cases during control year with malaria cases existing in year previous to introduction of control measures.

rural areas. The work done thus far has been more of an educational and demonstrational nature and at the same time has given excellent relief from mosquitoes and protection from malaria in the towns. Malaria, however, is primarily a rural problem and it is in the rural areas that the decisive blow against malaria must be struck.

Control work in towns has progressed sufficiently far to leave no doubt as to the practicability of eliminating both mosquitoes and malaria in areas where there is enough money available to secure proper treatment of breeding places. Control work has cost on the average of $500 to $1,000 per square mile. Such a cost is easily assumed by a city because of the large number of people supported by each square mile. In the rural areas, however, there is seldom as many as 100 people per square mile and complete mosquito control is almost prohibited by the cost. There must be, therefore, some other way of attacking the rural malaria problem other than by the general comprehensive campaigns of mosquito extermination as have been conducted in the towns.

Fortunately, malaria in Illinois is carried largely by one species of *Anopheles,* namely *Anopheles quadrimaculatus.* There may be other species which transmit malaria to some extent but it is certain that *quadrimaculatus* acts as the principal vehicle for the transmission of the disease in southern Illinois. This fact simplifies the work of rural malaria control for it allows all of the forces to be concentrated against the one particular species of mosquito, responsible for the transmission of the disease. Again rural malaria control is favored by the fact that *Anopheles quadrimaculatus* are confined largely to certain definite types of breeding places and will respond readily to Paris green treatment which is probably the least expensive method of control. Further, the distribution of malaria is not uniform but more or less spotty in character and if the foci of malaria can be located, control can be directed against the particular centers with almost complete negligence of intervening areas.

As a preliminary to a definite program directed to the control of malaria in the rural areas of southern Illinois, the Department of Public Health carried out during the first three months of 1926, a survey to determine the incidence and distribution characteristics of malaria in the southern section. The survey was made by Dr. Henry P. Carr of the International Health Board assisted by the authors. A discussion of the survey should prove of interest to the members of this society for in addition to presenting for the first time, first hand and accurate information on the malaria problem of this section which is held by some to be of only minor importance, the methods illustrate in an excellent fashion the procedure taken in the field to collect important epidemiological data. The freest use has been made of the detailed report of the survey prepared by Dr. Carr.

THE INCIDENCE AND DISTRIBUTION CHARACTERISTICS OF MALARIA IN RURAL AREAS OF SOUTHERN ILLINOIS.

General. The most dependable data available up to the present time, as to the incidence of malaria in Illinois is found in the mortality reports. The inaccuracy inherent in mortality and morbidity reports in general and especially in regard to malaria is well known. Malaria cases are not generally reported and frequently deaths from malaria are not reported. Such statistics have, however, a considerable value when interpreted with caution, in suggesting where the problem is especially significant.

Fig. 1 shows the death rates from malaria by counties per 100,000 population for the years 1922-23 and 24 as compiled from mortality records of the Division of Vital Statistics. It may be seen at a glance that the heaviest infection occurs in the extreme southern counties. In the twelve southern counties which have about 5% of the total population of the State occurs about 60% of the total malaria of the State. The mortality records clearly show that the malaria problem of the State is confined principally to the southern counties but the reports do not show adequately the extent or distribution of malaria in any one county. Alexander County for instance had

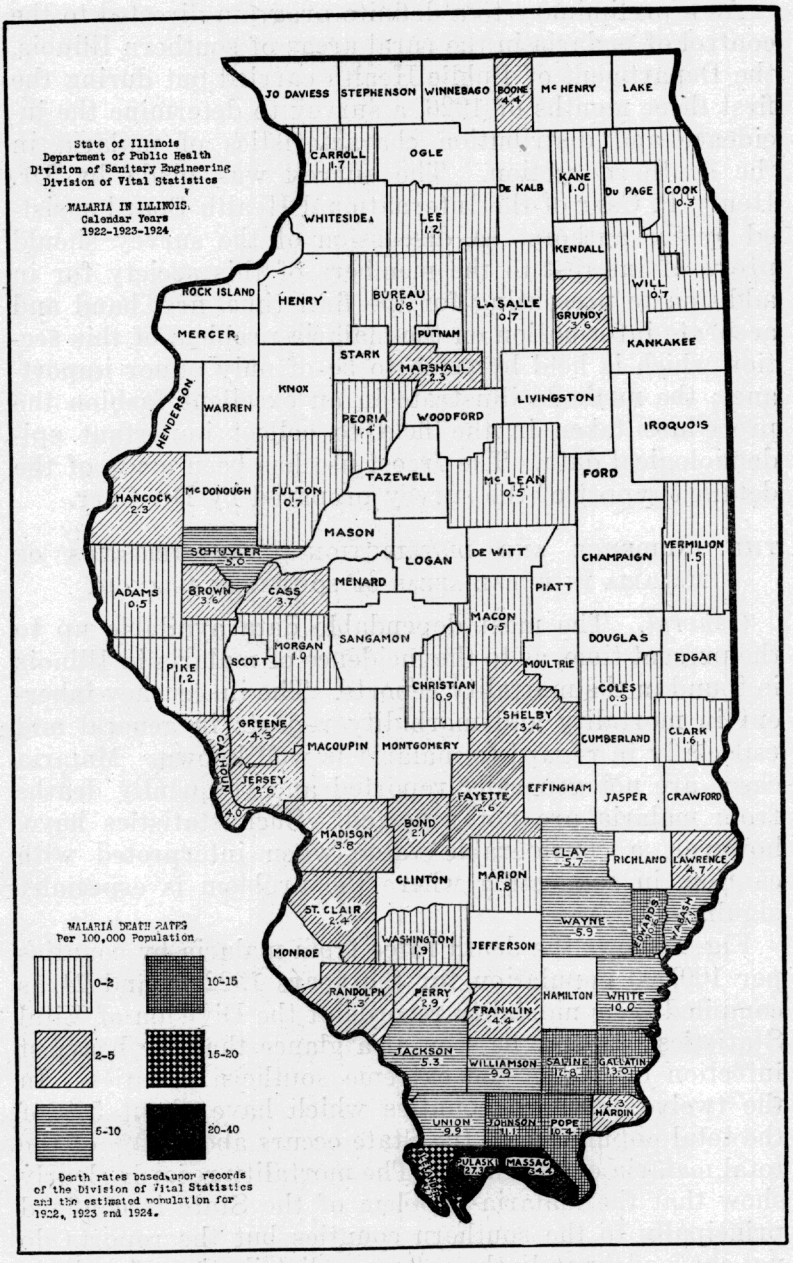

Fig. 1. Distribution of malaria in Illinois.

a death rate for the triennium of 7.7 per 100,000. This is equivalent to a case rate of about 2,300 per 100,000. Since the county has a population of about 25,000 the actual number of cases occurring annually in the county as indicated by the mortality reports would be about 9,200 or the case rate would be about 36%. This percentage seems quite high and yet the results of the recent survey in that county indicate that the figure of 36% is not greatly in error.

The malaria survey embraced representative sections of Jackson, Union, Alexander, Pulaski, Massac and Gallatin Counties. In addition investigations were carried on in two cities of Williamson County.

In interpreting the results of the studies made of these areas some consideration should be given to the general topographical features upon which the occurrence of breeding places of the transmitting anopheline depends. A central ridge extends east to west across the southern part of the State. This ridge is broadest and sharpest near its western extremity and as it enters the eastern half of the State it tapers down into a lower prairie-like area of considerable extent. The highest portion of the ridge is very hilly and rugged and lies between elevations 600 and 800 feet. The southern and eastern edges of this ridge blend into the prairie-like section which lies between elevations 400 and 600 feet.

This hill and prairie section is surrounded on the west by the Mississippi River with its contiguous lowlands, and on the south and west by the Ohio and Wabash Rivers and their valley lands. It is cut across in its western half by the Cache and Big Muddy Rivers and in its eastern part by the Saline River and other small tributaries of the Ohio. Surrounding all these rivers is an area of valley lowlands. This area is low, flat, and the natural drainage is poor. Every part of it visited by the writers appeared to furnish, except where artificial drainage has been carried out, breeding places suitable for the propogation of the transmitting anopheline. It contains swamps, sloughs, bayous and many natural still-water ponds.

In selecting the areas for survey, therefore, two divisions of the entire territory were considered, first the river valley sections lying between elevations 300 and 400 feet and the hill and prairie sections lying between elevations 400 and 800 feet. In all instances adequate samples from both types of areas were taken.

Methods used. The method selected for making the individual diagnosis which make up the mass diagnosis, was that of examination of children for the presence of enlarged spleen. There is at present sufficient evidence in the literature as to the value of the spleen index as a mass diagnosis method to justify its use for this purpose even in areas of light malaria incidence.

The examination of blood films is usually not practicable on a large scale because of the expense involved. Furthermore it has been shown that the spleen index when carried out according to certain technique furnishes a more sensitive measurement of malaria than the blood index. In the survey some blood examinations were made, however, and these will be reported upon.

The elicitation of histories of malaria in individuals, another method of mass diagnosis is of value, but is open to so many fallacies that it cannot be wholly relied upon. The method has the disadvantage of being highly subjective. Although as has been indicated the chief reliance in this survey was placed upon spleen examinations, histories were taken as a matter of routine and this data will also be presented. In order to standardize histories, only a history of a definite chill within the previous year was classified as positive. Further no history was taken from children until after the spleen examination was completed and no histories were elicited when it seemed evident that the individual was not capable of giving at least a fairly definite statement.

In the survey the spleen examinations were made only upon boys from two to twelve years of apparent age usually, although sometimes older individuals were examined. The average age examined was about nine years.

Nearly all of the examinations were done in the schools for the reason that a larger number of individ-

uals would be examined. All of the examinations were made by Dr. Carr and the residence of the patient in most cases was accurately located upon a map.

For the spleen examination the child was placed supine, the thighs sharply flexed upon the abdomen. Belts and other clothing were loosened so as not to interfere with deep breathing and the clothing over the upper abdomen was pulled aside. The hands of the examiner were always in direct contact with the abdominal wall when examining for splenomegaly. The child was instructed how to breathe and the examination made.

Spleens were classified as positive only when they were palpable beyond all question of doubt and the writers believe that if there is any error in the spleen diagnosis it is an error of under estimation of numbers rather than over estimation.

FINDINGS CONCERNING MALARIA IN SOUTHERN ILLINOIS.

Malaria in former years. Although, as will be shown, there is at the present time a very considerable incidence of malaria in certain parts of the areas studied, there is evidence to suggest, at least, that in former years there was very much more than at present and that the malaria rate in the southern part of the State has declined markedly in the last two decades. The evidence upon which one must base estimates of the amount of the disease which was present twenty years ago is of necessity not absolutely conclusive. It rests for the most part upon statements of physicians and well-informed laymen who have been living in the areas under consideration for many years. Upon interviewing a large number of such individuals during the progress of this survey we found the universal statement to be that twenty or more years ago the disease was very much more common and severe than at present. Many of the descriptions which we elicited of malaria conditions twenty or more years ago, especially those obtained from physicians practicing for many years in their respective communities, are so vivid and so clear that one feels them to be essentially accurate.

Of course, such statements must be interpreted and evaluated with caution, but one cannot escape the conviction that in the main they are true and that there was present in southern Illinois two or three decades ago very much more malaria than at present. During this period agricultural drainage has been extensively carried on in some of these areas and the diminution in malaria has apparently proceeded concomitantly with such work. It seems reasonable at least to conclude that agricultural drainage has been a great factor in the diminution of the malarial incidence of these sections.

Malaria incidence determined by survey. Table I appended presents the complete spleen and history findings in the 104 schools which were examined.

In examining this data it will be perhaps most instructive to study it first from the point of view of the topographical classification previously mentioned. The type of terrain in which are located the majority of homes comprising each school district is indicated in the table opposite each school by the letters H (for hills) or V (for valleys). Schools drawing the majority of their pupils from the valley district or hill district are designated accordingly as valley or hill schools.

A summary of the spleen data from the valley schools shows that out of 914 individuals examined for enlarged spleen, 134 or 14.6 per cent were found positive. In the hill schools out of a total of 569 spleen examinations only 21 or 3.7 per cent were found positive. In the valley schools out of 891 histories taken there were 224 or 25.1 per cent positives. In the hill schools, out of 513 histories taken there were 89 or 17.3 per cent positives. Thus in the valley schools the history rate was 1.71 times the spleen rate and in the hill schools the history rate was 4.67 times the spleen rate.

There is thus found to be considerable difference between the percentage incidence in the valleys and in the hills, the incidence in the valleys being approximately 4 times by the spleen index and 1.5 times by history index, the incidence of the hills. Considered in relation to probable error this difference is statistically sound.

If the numbers representing the two samples, namely, 914 and 569, with their respective observed incidences of enlarged spleens of 134 and 21, be compared with the table of sampling limits which have been published by Pearl, it will be found that the true incidence in the first or valley district group is not as low as 10 per cent and not as high as 20 per cent, while in the second or hill district group, the true incidence is less than 10 per cent. The samples are, therefore, adequate and we may conclude that in the hill section there is a very much smaller incidence of enlarged spleens.

The incidence of 3.7 per cent in the hill section is also significant. An incidence of 3.7 per cent when derived from a sample of 569 is from a statistical standpoint, significally different from a rate of one per cent if the figure of one per cent is derived from a sample as large as 100. If, therefore, we accept the figure of one per cent as being the incidence of non-malarious splenomegaly among children generally, then we can conclude that the 3.7 per cent for the hill districts represents a positive malaria incidence. If it is a real and positive malaria incidence, then it is by no means an insignificant one. It is important to note that there is in general the same correspondence between spleens and histories in the hill districts as in the valley districts. This is confirmatory evidence that the 3.7 per cent rate represents a real malaria incidence and the writers feel justified in concluding from the data presented that the hill section of southern Illinois has a positive and significant malaria rate which combined with the much larger rates of the valley sections makes the malaria problem of the southern counties, one of major sanitary importance.

Malaria incidence by counties. In considering the rates by counties we must take into consideration the variable which has been demonstrated to be significant, namely, whether the valley or the hill district of the county is being considered. The following table presents this arrangement of data.

The information in the above table is almost self-explanatory. It shows an essential similarity of conditions in the counties listed which is not surprising for the type

INCIDENCE OF ENLARGED SPLEENS AND HISTORIES BY COUNTIES.

County.	Valley sections.				Hill sections.			
	No. spleen examinations.	Percent positive.	No. histories.	Percent positive.	No. spleen examinations.	Percent positive.	No. histories.	Percent positive.
Jackson	231	15.5	265	15.1	0	.....	0	.....
Union	88	10.2	77	22.7	136	2.9	126	11.9
Alexander	369	15.4	326	30.0	225	3.1	197	16.2
Pulaski	34	5.8	34	38.2	99	5.0	95	28.4
Massac	82	25.6	76	32.8	85	5.8	77	11.7
Gallatin	137	6.5	122	18.0	22	0.0	18	27.7

of county is quite similar throughout. In interpreting the table the size of the individual samples should be taken into consideration. Some of them are too small to admit of direction comparisons.

Focal distribution of malaria. It has been shown that the severe malaria problem in this territory lies in the great river valleys, the Mississippi, Ohio, Wabash, Cache, Saline and Big Muddy. When spot maps covering this area are studied they show definitely that the infection is not evenly distributed through the area, but that the cases tend to group themselves in small foci. This is a fact of great importance to be known in planning remedial measures.

These small foci probably represent some local area, perhaps comparatively small, of *quadrimaculatus* breeding which is responsible for that particular outcropping of malaria. This seems to be true, especially in those areas where agricultural drainage has been carried out to a considerable extent. Even where drainage has been carried out to the greatest extent we have observed small bodies of permanent and semi-permanent water left behind because the reclaim value of that particular bit of land was not great enough to justify from an agricultural standpoint, its permanent drainage. It may be that in some of these areas the malaria control effort will be to search out these particular bits of "left-over" undrained areas, determine which are the malaria haz-

ards, and attempt to secure breeding control in the latter as a public health measure where it would not be justified as an agricultural reclamation measure. If such should be the case, spot maps should be of value in pointing to the location of such areas.

It has been shown that there is a significant amount of malaria in the hill section. In regard to the malaria in the hill sections, spot maps show a most important point. If they be examined from the point of view of malaria incidence in the hills, it is seen that nearly all the cases occur in individuals living either within anopheline flight range from the valley section or else near a smaller stream valley within the hills. Our maps show so clearly the relationship between the occurrence of malaria in the hills and proximity of a stream valley that one feels justified in concluding that in the hill section, the malaria anopheline is probably breeding chiefly in the smaller valleys and that here some local condition, perhaps the formation of pools in stream beds through the drying up of the main stream, may be responsible for providing a suitable breeding place for *quadrimaculatus*.

It should also be mentioned that artificially impounded waters, stock ponds, etc., in the locality may possibly provide *quadrimaculatus* breeding places. Malaria in towns of the hill section may be accounted for by other local breeding conditions.

RELATIONSHIP BETWEEN POSITIVE SPLEENS AND POSITIVE HISTORIES.

Table I shows that there is in general a correspondence between the history rate and spleen rate. It will be interesting here to examine further the correlation.

In all there are 1,511 cases in which we have both a spleen observation and a recorded history. Of these 154 have an enlarged spleen, 326 have a history positive for chills and fever within the last year and 76 individuals have both an enlarged spleen and positive history.

In this series then the probability, on the basis of chance alone, of any individual having an enlarged spleen is $\frac{154}{1511} = 0.1019$. The probability for positive history is

$\frac{326}{1511} = 0.2157$. The probability, on the basis of chance alone, of any individual having both an enlarged spleen and a positive history within the preceding year is 0.1019 x 1511=33 cases having both positive spleen and positive history. But there were actually found 76 such cases or 2.3 times as many as would have occurred by chance. There is thus shown to be, in this series of cases, a definite correlation of considerable magnitude, between the occurrence of the enlarged spleen and the existence of a positive history in the same individual. Each type of data tends to confirm the other.

Malaria in towns of southern Illinois. Examinations were made in Johnston City and Marion, located in Williamson County. The results of these examinations are given in Table I. It is shown that Johnston City has an incidence of enlarged spleen of 4.4 per cent based upon a quantitatively adequate sample. In the examinations in these towns the street address of the patient was obtained. Such data reveals for Johnston City, the interesting fact that all of the positive spleens come from the western part of the town, suggesting immediately that the dangerous breeding is probably to be found in the west part of the city.

Marion was found to have a positive spleen rate of 7.7 per cent and the addresses of the cases clearly show as would be expected that most of the malaria is occurring in the peripheral sections of the town.

SIZE OF ENLARGED SPLEENS FOUND IN THE SURVEY AND INCIDENCE BY AGE GROUPS.

Of the total of 171 enlarged spleens found in the whole area, 161 or 94.1 per cent were classified as palpable on inspiration. Of the 10 larger spleens found 7 were classified as palpable, one as one finger's breadth and 2 as three finger's breadth below the costal margin. All degrees of enlargement are indicative of malaria infection.

The following table shows the incidence of enlarged spleens in different age groups. This table shows what has been found by other observers, namely, that the spleen rate in individuals comparable in every respect

TABLE III.
Incidence of Enlarged Spleens in Age Groups.

Age.	No. of examinations.	Per cent enlarged.
3—5	17	23.5
6—8	550	12.0
9—11	659	10.6
12—15	477	6.3
16+	18	5.5

except the factor of age will be higher in the younger age groups. There are probably two factors which account for this. The first is the less immunity to malaria possessed by the younger individuals and the second is the thinner abdominal walls of the younger children which enables abdominal palpitation to be more accurately performed.

Blood examinations. Out of 264 blood examinations only one was found positive, 15 minutes being devoted to the examination of each slide.

Of the 264 examinations by this method, 81 were done upon individuals with enlarged spleens, and 172 upon individuals with negative spleens, and 140 had histories positive within the previous year. The fact that only a small per cent of blood examinations were found positive does not in any way detract from the comparatively large spleen rate revealed for in the winter season as has been the experience of other observers, the malarial parasites do not appear frequently in the peripheral blood, and hence are not obtained when the blood film is taken.

SUMMARY AND CONCLUSIONS.

The survey has demonstrated that malaria in the areas studied constitutes a major public health problem; that the areas of heaviest incidence are in the valley sections, that there is a significant relation between positive histories and positive spleens and that malaria appears to be highly focal and localized usually in comparatively small areas.

During the summer several of the areas which now appear as foci for malaria will be studied in detail with the view of ascertaining the best and most economical method of control, after which definite steps will be taken to effect control of malaria in southern Illinois on as wide a scale as is compatible with the conditions and circumstances.

TABLE I.

Spleen and History Findings in Schools.

Name of school.	County.	Designation of school on map.	Number examined.	No. enlarged spleens.		Per cent enlarged spleens (residents).	No. histories taken.	No. positive histories.		Per cent positive histories (residents).	*Section.
				Residents.	Non-residents.			Residents.	Non-residents.		
Grand Tower—white school	Jackson	V	57	2	0	3.5	62	4	1	6.4	V
Grand Tower—colored school	Jackson	V	19	0	0	0.0	16	1	0	6.2	V
Howardton	Jackson	W	21	5	0	23.8	42	9	0	21.4	V
Big Hill	Jackson	X	20	0	0	0.0	37	3	0	8.1	V
East	Jackson	Y	12	4	0	33.3	11	1	0	9.1	V
Grimsby	Jackson	Z	36	10	0	27.8	32	5	0	15.6	V
Crain	Jackson	ZA	13	4	0	30.7	13	2	0	15.4	V
Logan	Jackson	A	9	3	0	33.3	8	3	0	37.5	V
Sand Ridge	Jackson	B	21	1	0	4.7	21	5	0	23.8	V
Jacob	Jackson	C	11	2	0	18.1	12	2	0	16.6	V
Mifflin	Jackson	D	1	0	0	....	1	0	0	....	V
Neunert	Jackson	E	11	5	0	45.4	10	4	0	40.0	V
Tripp	Union	F	21	0	0	0.0	18	3	0	16.6	H
Ware	Union	G	33	4	0	12.1	29	9	0	31.0	V
Morgan	Union	H	9	1	0	11.1	10	5	0	50.0	V
Wolf Lake	Union	I	28	3	0	10.7	22	8	0	36.3	V
Big Barn	Union	J	18	1	0	5.5	16	4	0	25.0	V
Hambric	Union	K	15	1	0	6.6	15	0	0	0.0	H
Rendleman	Union	L	5	0	0	0.0	5	2	0	40.0	H
Cauble	Union	M	5	0	0	0.0	5	2	0	40.0	H
Beech Grove	Union	N	11	1	0	9.0	11	1	0	9.0	H
Gregory	Union	O	8	2	0	25.0	7	0	0	0.0	H
Mountain Glen	Union	P	12	0	0	0.0	11	3	0	27.2	H
Ellis	Union	Q	12	0	0	0.0	12	1	0	8.3	H
Mackay	Union	R	11	0	0	0.0	11	1	0	9.0	H
John Rich	Union	S	13	0	0	0.0	12	1	0	8.3	H
Lence	Union	T	11	0	0	0.0	8	1	0	12.5	H
Tygett	Union	U	12	0	0	0.0	11	0	0	0.0	H

McCraven	Alexander	AA	9	2	0	22.2	8	4	0	50.0	V
McClure	Alexander	AB	44	9	0	20.4	43	12	0	27.9	V
Cottner	Alexander	AC	9	2	0	22.2	9	6	0	66.6	V
Round Pond	Alexander	AD	10	1	0	10.0	10	1	0	10.0	V
Pence	Alexander	AG	12	0	0	0.0	11	3	0	27.2	H
Fayville	Alexander	AH	11	2	0	18.2	10	6	0	60.0	V
Lower Bend	Alexander	AI	7	5	0	71.5	7	7	0	100.0	V
Gale	Alexander	AE	16	0	0	0.0	14	3	0	21.4	V
E. Cape Girardeau	Alexander	AF	11	4	0	36.3	10	5	0	50.0	V
Twente	Alexander	AJ	12	0	0	0.0	12	2	0	16.6	H
Olive Branch	Alexander	AK	31	6	0	19.3	28	10	0	35.7	V
Thebes	Alexander	AL	78	3	0	3.8	61	13	0	21.3	H
Brownville	Alexander	AM	6	0	0	0.0	5	1	0	20.0	H
Tamms	Alexander	AN	76	11	0	14.4	52	9	0	17.3	H
Upper Elco	Alexander	AO	5	0	0	0.0	5	0	0	0.0	V
Elco	Alexander	AP	33	2	0	6.0	30	5	0	16.6	H
Dexter	Alexander	AQ	10	0	1	0.0	10	0	1	0.0	H
Hazelwood	Alexander	AR	29	0	0	0.0	26	3	0	11.5	H
Sandusky	Alexander	AS	21	4	0	19.0	20	9	0	45.0	H
Unity	Alexander	AT	12	1	0	8.3	12	4	0	33.3	V
Cache	Alexander	AU	23	3	0	13.0	21	2	0	9.5	V
Dunbar—colored	Alexander	AV	10	0	0	0.0	8	0	0	0.0	V
Phillips	Alexander	AW	8	1	0	12.5	8	2	0	25.0	V
Lake Milligan—colored	Alexander	AX	3	0	0	0.0	3	3	0	100.0	V
Lake Creek	Alexander	AY	8	0	0	0.0	7	1	0	14.3	V
Hulen	Alexander	AZ	16	2	0	12.5	14	2	0	14.3	H
Willard	Alexander	BA	19	4	0	21.0	19	4	0	21.0	V
Roth	Alexander	BB	5	0	0	0.0	5	4	0	80.0	V
Delta	Alexander	BC	16	0	0	0.0	15	1	0	6.6	H
Central Bend	Alexander	BD	11	1	0	9.0	8	1	0	12.5	V
Honey	Alexander	BE	8	0	0	0.0	8	0	0	0.0	H
Woodrow	Alexander	BF	6	0	0	0.0	6	2	0	33.3	V
Woodside	Alexander	BG	19	1	0	5.2	18	2	0	11.1	V
America	Pulaski	...	15	0	0	0.0	15	4	0	26.6	H
Cross Roads	Pulaski	...	5	0	0	0.0	4	0	0	0.0	H
Concord	Pulaski	...	13	1	0	7.7	10	2	0	20.0	H
Olmstead	Pulaski	...	32	0	0	0.0	32	9	0	28.1	H
Pleasant Grove	Pulaski	...	5	0	0	0.0	5	1	0	20.0	H
Grand Chain	Pulaski	BH	29	4	2	13.8	29	9	2	31.1	H
Black Hill	Massac	BI	10	6	0	60.0	10	2	0	20.0	V
Big Bay	Massac	BJ	13	3	0	23.1	12	9	0	75.0	V
Pleasant Union	Massac	BK	6	1	0	16.6	6	2	0	33.3	V

TABLE I.

Spleen and History Findings in Schools—Concluded.

Name of school.	County.	Designation of school on map.	Number examined.	No. enlarged spleens.		Per cent enlarged spleens (residents).	No. histories taken.	No. positive histories.		Per cent positive histories (residents).	*Section.
				Residents.	Non-residents.			Residents.	Non-residents.		
Enterprise	Massac	BL	9	2	0	22.2	9	4	0	44.5	V
Mermet	Massac	BM	7	0	0	0.0	7	1	0	14.3	V
Aiken	Massac	BN	9	1	0	11.1	8	1	0	12.5	H
Tucker	Massac	BO	11	0	0	0.0	9	0	0	0.0	H
Unionville	Massac	BP	28	6	0	21.4	24	7	0	29.1	V
Palmer	Massac	BQ	9	3	0	33.3	8	0	0	0.0	V
New Columbia	Massac	BR	10	0	1	0.0	9	1	1	11.1	H
New Hope	Massac	BS	10	1	0	10.0	9	1	0	11.1	H
Benton	Massac	BT	8	1	0	12.5	8	2	0	25.0	H
Mt. Mission	Massac	BU	11	1	0	9.1	8	0	0	0.0	H
Weaver Creek	Massac	BV	17	0	0	0.0	18	2	0	11.1	H
Karnak	Pulaski	BW	34	2	0	5.9	34	13	0	38.2	V
Central	Massac	BX	9	1	0	11.1	8	2	0	25.0	H
Junction	Gallatin	BY	35	3	0	8.5	31	5	0	16.1	V
Bradley	Gallatin	BZ	7	0	0	0.0	7	3	0	42.8	V
New Market	Gallatin	CA	8	1	0	12.5	6	0	0	0.0	V
Kane	Gallatin	CB	8	0	0	0.0	7	0	0	0.0	V
Daily	Gallatin	CC	17	1	0	5.9	16	6	0	37.5	V
Pickles	Gallatin	CD	12	1	0	8.3	11	1	0	9.0	V
Oak Grove	Gallatin	CE	8	1	0	12.5	8	0	0	0.0	V
Concord	Gallatin	CF	9	0	0	0.0	7	1	0	14.2	V
Elba	Gallatin	CG	6	0	0	0.0	4	0	1	0.0	V
Dickey	Gallatin	CH	13	0	0	0.0	11	0	0	0.0	V
Dorsey	Gallatin	CI	4	0	0	0.0	4	0	0	0.0	H
Greer	Gallatin	CJ	9	0	0	0.0	8	2	0	25.0	H
Goolsby	Gallatin	CK	9	0	0	0.0	6	3	0	50.0	H

Saline Mines	Gallatin	CL	9	2	0	22.2	9	5	0	55.5	V
Gum Spring	Gallatin	CM	5	0	0	0.0	5	0	0	0.0	V
Johnston City—First school	Williamson	...	50	0	0	0.0	47	8	0	17.0	..
Johnston City—Second school	Williamson	...	49	4	0	8.1	43	2	0	4 6	..
Marion—Logan school	Williamson	...	24	1	0	4.1	21	0	0	0.0	..
Marion—Jefferson school	Williamson	...	25	3	0	12.0	16	4	0	25.0	..
Marion—Lincoln school	Williamson	...	25	1	0	4.0	24	7	0	29.1	..
Marion—McKinley school	Williamson	...	35	3	0	8.6	23	3	0	13.0	..

* H—Hills.
V—Valley.