

OVA MEASUREMENTS OF *A. STEPHENSI* TYPE AND
A. STEPHENSI VAR. *MYSORENSIS**.

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A PREVIOUS article (Sweet and Rao, 1937) gave a preliminary report on five significantly different average ova measurements and of other differences in two forms of *A. stephensi* females caught in six parts of India, and suggested that this anopheline occurred in two varieties to which the names of *A. stephensi* type and *A. stephensi* var. *mysorensis* might be given. Since then reports have been made on the wing measurements and the cross-breeding of these two varieties and this paper will give further results of ova measurements of the two forms (Subba Rao, Sweet, and Rao, 1938; Sweet, Rao, and Subba Rao, 1938).

OVA MEASUREMENTS OF *A. STEPHENSI* TYPE.

Table I gives five average measurements for 4,707 ova of 105 female *A. stephensi* type, the new reports being of ova from 15 more females caught in Delhi and 22 caught in Lucknow. The average length of all *A. stephensi* type ova measured was 548 microns, with a standard deviation of 27 microns; the average breadth was 200 microns with a standard deviation of 12; average length of float was 290 with a standard deviation of 22 microns; there was an average of 18 ridges on one side of the float with a standard deviation of 2; and the floats covered an average of 0.526 of the total length of the egg with standard deviation of 0.029. The measurement of breadth was made including the floats.

It was not found possible to get any specimens of *A. stephensi* from Bombay, so the form of this species occurring in Bombay is not yet determined. Of the cities from which *A. stephensi* type was secured, only in Mysore and Bangalore cities did we find no specimens of the variety of this species.

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TABLE I.
Average measurements of A. stephensi type ova.

	LENGTH (MICRONS).		BREADTH INCLUDING FLOATS (MICRONS).		LENGTH OF FLOAT (MICRONS).		NUMBER OF RIDGES ON ONE SIDE OF FLOAT.		PROPORTION OF LENGTH COVERED BY THE FLOATS.	
	Mean.	Standard deviation.	Mean.	Standard deviation.	Mean.	Standard deviation.	Mean.	Standard deviation.	Mean.	Standard deviation.
Mysore and Bangalore cities— 40 females 1,828 ova	553.62 ± 0.40	25.15 ± 0.25	200.09 ± 0.19	11.89 ± 0.13	286.73 ± 0.36	22.58 ± 0.25	17.92 ± 0.03	1.74 ± 0.02	0.516 ± 0.0004	0.028 ± 0.0006
Poona— 1 female 45 ova	585.33 ± 1.12	11.10 ± 0.79	205.33 ± 0.66	6.57 ± 0.47	293.56 ± 1.07	10.60 ± 0.75	17.24 ± 0.10	0.97 ± 0.07	0.503 ± 0.001	0.011 ± 0.001
Calcutta— 6 females 220 ova	544.59 ± 0.99	21.78 ± 0.70	205.95 ± 0.32	6.96 ± 0.22	291.27 ± 0.80	17.58 ± 0.57	17.90 ± 0.05	1.08 ± 0.03	0.536 ± 0.001	0.028 ± 0.0006
Delhi— 36 females 1,580 ova	553.63 ± 0.39	22.76 ± 0.27	208.18 ± 0.17	10.22 ± 0.12	296.68 ± 0.38	22.10 ± 0.27	17.91 ± 0.02	1.41 ± 0.02	0.535 ± 0.0005	0.029 ± 0.0006
Lucknow— 22 females 1,034 ova	530.71 ± 0.59	28.07 ± 0.42	196.71 ± 0.26	12.20 ± 0.18	282.84 ± 0.43	20.38 ± 0.30	17.53 ± 0.03	1.44 ± 0.02	0.532 ± 0.0005	0.023 ± 0.0006
Total— 105 females 4,707 ova	548.06 ± 0.26	26.59 ± 0.18	200.26 ± 0.12	12.33 ± 0.09	289.65 ± 0.22	22.25 ± 0.15	17.82 ± 0.02	1.55 ± 0.01	0.526 ± 0.0003	0.029 ± 0.0006

MEASUREMENTS OF OVA OF *A. STEPHENSI* VAR. *MYSORENSIS*.

Table II gives the average measurements of 6,916 ova from 147 *A. stephensi* var. *mysorensis* females obtained from six parts of India. In Table II are included measurements of ova from Delhi and Lucknow *A. stephensi* which have not been reported before. Out of 23 *A. stephensi* received from Lucknow, 22 were classed as the type form and one was distinctly of the *mysorensis* variety. We are indebted to Rao Bahadur Dr. A. K. Banerjea for sending these specimens, and to Dr. I. M. Puri for the specimens sent from Delhi.

The average length of *A. stephensi* var. *mysorensis* ova was 477 microns, with a standard deviation of 24 microns; average breadth including floats was 161, standard deviation 13 microns; average length of float 218 microns, standard deviation 20.44; there was an average of 13½ ridges on one side of the float, standard deviation 1¼, and the floats covered an average of 0.457 of the total length with a standard deviation of 0.032.

TABLE II.

Average measurements of ova of *A. stephensi* var. *mysorensis*.

	LENGTH (MICRONS).		BREADTH INCLUDING FLOATS (MICRONS).		LENGTH OF FLOAT (MICRONS).		NUMBER OF RIDGES ON FLOAT.		PROPORTION: LENGTH OF FLOAT OVER LENGTH.	
	Mean.	Standard deviation.	Mean.	Standard deviation.	Mean.	Standard deviation.	Mean.	Standard deviation.	Mean.	Standard deviation.
Mysore State— 112 females 5258 ova	469.96 ± 0.18	19.58 ± 0.13	157.17 ± 0.09	10.15 ± 0.07	213.80 ± 0.17	18.34 ± 0.12	13.40 ± 0.01	1.28 ± 0.008	0.454 ± 0.0003	0.033 ± 0.0002
Sukkur, Sind— 11 females 535 ova	504.92 ± 0.57	19.39 ± 0.40	177.36 ± 0.29	10.00 ± 0.21	242.79 ± 0.41	14.19 ± 0.29	13.81 ± 0.03	0.99 ± 0.02	0.479 ± 0.0006	0.020 ± 0.0004
Hyderabad, Sind— 7 females 303 ova	489.44 ± 0.67	17.26 ± 0.47	159.04 ± 0.42	10.76 ± 0.29	229.27 ± 0.51	13.19 ± 0.36	13.95 ± 0.04	0.90 ± 0.02	0.467 ± 0.0007	0.017 ± 0.0005
Poona— 12 females 570 ova	499.77 ± 0.78	27.46 ± 0.55	168.63 ± 0.35	12.24 ± 0.24	229.91 ± 0.54	18.96 ± 0.38	13.55 ± 0.03	1.19 ± 0.02	0.458 ± 0.0008	0.028 ± 0.0006
Delhi— 4 females 200 ova	512.90 ± 0.82	17.27 ± 0.58	185.75 ± 0.30	6.33 ± 0.21	241.80 ± 0.46	9.72 ± 0.33	14.37 ± 0.05	1.07 ± 0.04	0.469 ± 0.0008	0.016 ± 0.0005
Lucknow— 1 female 50 ova	456.00 ± 0.71	7.46 ± 0.50	165.20 ± 0.72	7.53 ± 0.51	209.20 ± 0.56	5.92 ± 0.40	13.50 ± 0.07	0.78 ± 0.05	0.457 ± 0.001	0.015 ± 0.001
Total— 147 females 6,916 ova	477.12 ± 0.19	23.87 ± 0.14	160.65 ± 0.10	12.63 ± 0.07	218.08 ± 0.17	20.44 ± 0.12	13.50 ± 0.01	1.25 ± 0.007	0.457 ± 0.0003	0.032 ± 0.0002

In Mysore State, outside of Mysore and Bangalore cities, we got only specimens of the *mysorensis* variety of *A. stephensi*, as was the case with 11 females from Sukkur and seven females from Hyderabad in Sind; from Poona we received 12 variety *mysorensis* females and one type form. Of 40 females from Delhi, 36 were classed as type form and four as variety *mysorensis*, although in both average length and average breadth the eggs of these four specimens were larger than these average measurements of the Mysore specimens, plus twice their standard deviation; it should also be noted that the average lengths of the eggs of the four and the 36 Delhi specimens were not significantly different, but that the other averages of the other *mysorensis* females were significantly lower; in spite of some confusion in average length, and possibly in average breadth, it was necessary to put these four females in the variety

mysorensis due to their other measurements, and all of their average measurements are well within the limits of the variety total averages. It seems probable that a study of the eggs of a larger number of Delhi *A. stephensi* would clear up the situation.

EGG MEASUREMENTS OF SPECIMENS REARED FROM LARVÆ.

Since it is sometimes difficult to catch adult specimens of *A. stephensi* type in nature, and since control work is being done in many cities in which this form might be found, we tried dipping for larvæ in Bangalore and rearing these larvæ to adults, mating them, and measuring the eggs subsequently laid by the females. Of 19 females which laid 915 viable ova, the average length of the eggs was 581 microns, average breadth 211 microns, average length of float 297 microns, average number of ridges on the float 18, and the floats covered 0.512 of the total length. These averages were well within those for all Mysore specimens of type form and for all specimens of this form given in Table I, so from our experience it is possible to classify specimens accurately by means of ova laid by females of *A. stephensi* type reared from larvæ. Our experience would lead us to state that this would be difficult with specimens of *A. stephensi var. mysorensis*, since this variety mates and lays eggs in captivity only with great reluctance.

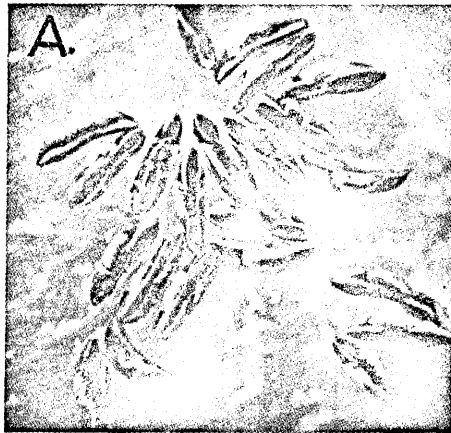
COLONY REARING OF *A. STEPHENSI*.

As was mentioned in a previous article (Sweet and Rao, 1937) there is a distinct difference between the two forms of *A. stephensi* in their reaction to life in captivity. In spite of repeated attempts we have not found it possible to get more than 17 females of an F_1 generation of *A. stephensi var. mysorensis* to lay ova and none of any F_2 females have laid, under conditions in which the type form of *A. stephensi* went on to more than 12 generations in captivity. Obviously it is either impossible to rear the variety in colonies or else special conditions of temperature, humidity, food, and the like are necessary. Measurements of 772 ova of 17 F_1 female variety *mysorensis* are given in Table III to show that this species breeds true for one generation at least.

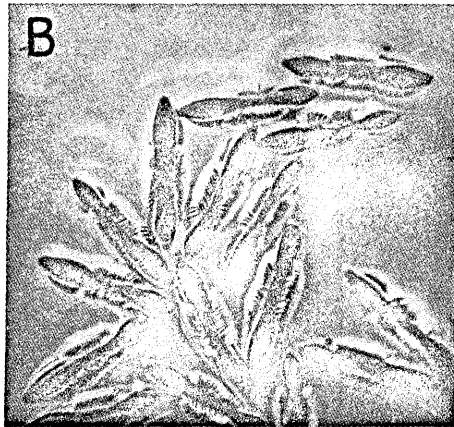
On the other hand no difficulty was experienced in starting a pure strain colony from the eggs of one female *A. stephensi* type form, and measurements have been made of ova from females of generations through F_{12} . The measurements of ova of colony females of *A. stephensi* type from the fifth through the ninth generations were given previously, and it was found that, with the exception of an apparent tendency to increase in the average measurements of length and breadth, the ova remained within the limits of the average measurements of ova of all the Mysore *A. stephensi* type. Table III gives measurements of ova of females of F_{10} and F_{12} from this type form colony.

The ova of the 7 females of the F_{10} generation of the *A. stephensi* type colony were significantly larger in their average measurements of length, breadth, and length of float than the total Mysore averages, thus continuing the tendency noticed from the F_8 generation onwards, but in the F_{12} generation these averages had gone down within the limits set by the standard deviations of the total Mysore averages.

PLATE XII.



Ova of *A. stephensi* var. *mysorensis*.



Ova of *A. stephensi* type.
Same magnification.

TABLE III.

Average measurements of ova of an F_1 generation of *A. stephensi* var. *mysorensis* and of F_{10} and F_{12} generations of *A. stephensi* type.

	LENGTH (MICRONS).		BREADTH INCLUDING FLOATS (MICRONS).		LENGTH OF FLOAT (MICRONS).		NUMBER OF RIDGES ON FLOAT.		PROPORTION: LENGTH OF FLOAT OVER LENGTH.	
	Mean.	Standard deviation.	Mean.	Standard deviation.	Mean.	Standard deviation.	Mean.	Standard deviation.	Mean.	Standard deviation.
Variety <i>mysorensis</i> F, 17 females 772 ova	499	28	171	15	224	24	13	1.5	0.44	0.03
<i>A. stephensi</i> type F_{10} 7 females 334 ova	636	26	235	12	338	20	20	1.3	0.53	0.02
<i>A. stephensi</i> type F_{12} 9 females 399 ova	595	33	222	18	305	23	18	1.2	0.51	0.02

The utility of *A. stephensi* type as a colony mosquito in India is worth noting. It takes readily to life in captivity, will feed on either man or small animals, mates and lays eggs readily in a small cage, and requires little attention. Our cages were 18 inches long, 12 inches broad, only 12 inches in height, and were made of cheap wood with a fine mesh copper gauze on top and a circular sleeved hole in front. One caution is necessary for places with temperatures equal to or lower than those of Bangalore. During the month of December 1937 our colony females gradually ceased laying and began to die off, although they continued to feed, so a few survivors were placed in an incubator and eggs were eventually obtained to continue the colony. During the winter of 1936 the colony was in a small room which was kept warm, but this was not possible in 1937, so apparently in the cooler parts of India it will be necessary to keep up the temperature in winter. Humidity in the cages can be maintained by means of small country earthen pipes filled with moistened sand, or some similar device.

SUMMARY.

Average measurements of eggs of *A. stephensi* type and *A. stephensi* var. *mysorensis* are given. The averages of 4,707 ova from 105 type females were 548 microns in length, 200 microns in breadth including floats, 290 microns in length of float, there were 18 ridges on one side of the float, and the floats covered 0.53 of the total length. Corresponding measurements of 6,916 ova of 147 variety *mysorensis* females were 477, 161 and 218 microns, 13.5 ridges on the float, and the floats covered 0.46 of the total length. Rearing *A. stephensi* type from larvæ and mating them in the laboratory was not found to alter the

average ova measurements but this will prove difficult in the case of variety *mysorensis*. *A. stephensi var. mysorensis* resisted all attempts at colonisation, and no generation beyond F₁ could be obtained, but *A. stephensi* type colonised easily in small cages and bred true in the main in its average egg measurements. The utility of *A. stephensi* type as a colony mosquito is noted.

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