TWO NEW SPECIES OF GENUS CURVULARIA

Curvularia Siddiqui Sp. novo and Curvularia Ellisi Sp. novo

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During the work on atmospheric fungi in Karachi, two species of the genus *curvularia* were collected and were confirmed as new species by Dr. Ellis of the Commonwealth Mycological Institute.

Few species of the genus *curvularia* have been described from the sub-continent of Pakistan and India, and those described have been isolated either from the soil or seeds. The present species have been isolated from air and seem to differ from the known species of the genus described from this country and elsewhere, [1-4] and hence are described as new species.

1. Curvularia Siddiqui sp. novo

Colony when grown on Czapek's agar pH 6 grows fast and is buff-coloured in the beginning, changing to olive in the absence of conidial formation and finally dark grey or black when conidia are formed. Older colonies are covered with greyish mycelium which spreads on the surface.

Mycelium.—With profuse branching, the branches closely interwoven and twisted, forming a tough leathery layer on the surface of the medium. Hyphal diameter 3.44-7 μ, chlamydospores frequently seen in cultures, stromata not seen.

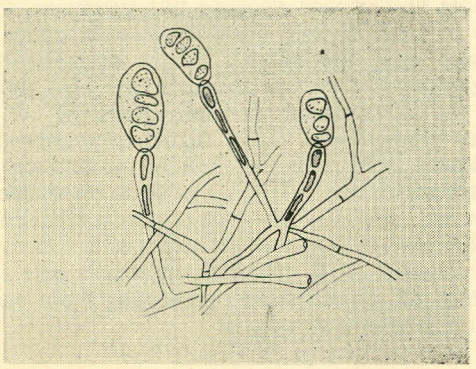

Fig. 1.—Camera lucida drawing of short, unbranched conidiophores of *Curvularia Siddiqui* bearing solitary conidium.

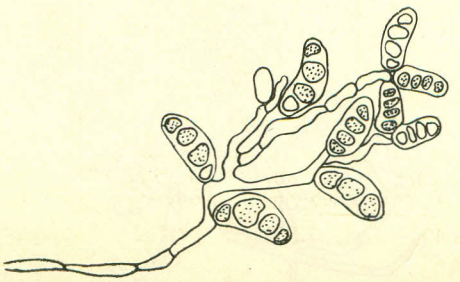

Fig. 2.—Camera lucida drawing of ong, dichotomously branched conidiolphore of *Curvularia Siddiqui* with many conidia.

Conidiophores.—Multiseptate and of two types; one, short and unbranched 34-172μ, the cell at the tip wider and club-shaped, 5.6-6.88μ in diameter, bearing a solitary conidium (Fig. 1), the other type of conidiophore is long and dichotomously branched with short alternate bends bearing a conidium at each bend; the tip of the cell bearing conidium is club-shaped, the length of the conidiophore is very variable, 206-413μ or more, the width is 5.160-7.74μ (Fig. 2).

Conidia.—Four-celled, slightly curved, second and third cell larger and darker than others. The size of the conidium is 20-38×10.5-17.2μ.

The shape and structure of the conidiophores differentiate this species from other related species.

We have great pleasure in dedicating this species to Dr. Salimuzzaman Siddiqui to whom we are greatly indebted for guiding us throughout the progress of this work.

2. Curvularia Ellisi sp. novo

Colony, when grown on Czapek's agar pH 6, velvety, fast growing, light green in the beginning, darkening with age and finally turning black. Older colonies covered with a whitish fluffy mycelium restricted to patches on the surface of the colony.

Mycelium septate, irregularly branched, terminal cells of the branches elongated; hyphal diameter 3.44-6.88μ. Chlamydospores frequently seen in cultures; stromata not seen.

Conidiophores multiseptate, usually short and erect or reclining, geniculate at the tip, usually 35-258 μ in length, some times much longer, 5.1-8.6μ in diameter at the tip (Fig. 3); spores forming clusters at the tip and also borne along the length of the condiophore. Diameter of the basal cell of the conidiophore 2.5-6 μ.

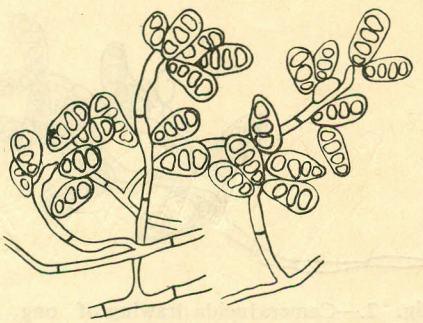

Fig. 3.—Camera lucida drawing of conidiophores of *Curvularia Ellisi*.

Conidia curved, four celled, second and third cells from the base darker and wider than others, conidia measuring 18.92-26.3×9.6-13.43 μ.

The species differs from the related species of *Curvularia lunatum* in having branched conidiophores, and in the size of the conidia and conidiophores.

We have great pleasure in dedicating this species to Dr. Ellis of Commonwealth Mycological Institute to whom we are greatly indebted for confirming it as a new species and for going through the manuscript of this paper.

Locality.—Karachi, Pakistan, from air at a height of 10 feet on 10th December, 1956.

Collected by :— S. Iftikhar Ahmad.

Type specimen at these Laboratories and Commonwealth Mycological Institute, Surrey.

Acknowledgement.—We are much obliged to Dr. J. C. F. Hopkins, Director, Commonwealth Mycological Institute, for his help in indentification of fungi. Special thanks are due to Dr. Ellis of the same institute for his confirmation of the above species as new and for valuable suggestions, The authors also thank Dr. Siddiqui for his encouragement.

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RESTING HABITS OF ANOPHELES SPECIES IN MYMENSINGH DISTRICT, EAST PAKISTAN

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Study of the resting habits of vector species is essential before large scale indoor spraying operations with residual insecticides are carried out for the control of Malaria in a given area. The WHO Malaria Control Demonstration team[1] to Pakistan, therefore, studied the resting habits of local anopheles species in Ishwarganj Thana in Mymensingh District before starting spraying operations. The present paper is based on the work done during this period.

In papers previously published it was stated that the vector, *A. philippinensis* was found in somewhat unusual situations. "It does not rest in situations where other anophelines are normally to be found, such as the ceiling, thatch, cobwebs, etc. It generally rests on the wall very close to the floor of the room, within a foot or a foot and a half from floor level, being only very rarely found at higher levels"—Iyengar.[2]

The author did not find this peculiar behaviour on the part of *A. philippinensis* in the area but on the other hand noted that all of the commoner species of anopheles show a preference to rest on the lower half of walls in bedrooms and that, with the exception of *A. annularis*, they exhibit the same habit in cowsheds.

Regular collections were made in bed rooms and cattle sheds in the area: an arbitrary limit of five feet was chosen because this height in a majority of cases divided the walls into an upper and a lower half, the normal height of a bedroom being about 10 feet. A careful study also showed that the distribution of individuals of all the species studied was fairly regularly scattered on the lower half, and no special preference was thus shown for any particular location up to a height of five feet, nor was any such preference noticeable in individuals resting above a height of five feet, with the exception of *A. annularis*, in which case some tendency to rest on straws projecting from ceiling was noticeable in cowsheds.

The present paper is a statistical analysis of the data obtained. The results from bedrooms and cowsheds have been summarized in Tables 1 and 2,

respectively. Other entomological observations have been reported in the Final Comprehensive Report Pakistan, East Bengal Malaria Control Demonstration Team Mymensingh District.

Mosquitoes in Bedrooms

The values of P in the table range from 0.18 to 0.40 with $\bar{P}=0.3006$, thus indicating a definite preference of the mosquitos to rest below 5 feet. Assuming that all the species rest independently of height, i.e. the proportion resting above 5 feet and below 5 feet is the same, we may apply the x^2 test, viz.

$$x^2=\frac{1}{\bar{p}\,\bar{q}}[\Sigma(ap)-n\bar{p}]$$

with (6—1,) (2—1) degrees of freedom where $n=1568$, $\bar{p}=1568/3649 = .3006$, $\bar{q}=1-\bar{p}=0.6994$, we get with five degrees of freedom,

$$x^2=\frac{1}{.3006\times .6994}(492.806-471.2715)=102.441.$$

This is almost ten times the value of x^2 with 5 d. f. 11.070 (Fisher's table), thus showing that in the above data variations from species to species are statistically significant.

The habits of individual species can now be analysed in the light of the data obtained. The normal test is applied, since the sample is considered to be large enough to conform to the normal distributions, and we calculate

$$\sigma=\sqrt{npq}$$

where n= total number, $p=q=\frac{1}{2}$.

For *A. philippinensis* we have n=994, number captured above 5 ft.=269, number captured below 5 ft.=725, and deviation=456, yielding

$$\sigma=\sqrt{994\times\tfrac{1}{2}\times\tfrac{1}{2}}=\quad 15.8.$$

The observed deviation being more than 14 times the calculated value of σ, the result is significant, establishing that *A. philippinensis* has a tendency to rest below 5 ft. in bedrooms.

Similarly for *A. aconitus* we have

$$\sigma=\sqrt{1138\times\tfrac{1}{2}\times\tfrac{1}{2}}=16.867$$

while the value of observed deviation is 366 i.e. about 22 times the calculated value of σ this establishes that *A. aconitus* has a tendency to rest below 5 ft. in bedrooms.

Applying similar test to *A. annularis* we find the observed deviation of 124 is more than 7 times the calculated value of σ which is 16.031, and in the case of *A. vagus* we find the observed deviation of 301.5 to be more than 13 times the calculated value of σ, i.e. 22.071. In these two species also, the marked tendency for *A. vagus* to rest below a height of 5 feet in bedrooms is therefore established.

Mosquitoes in Cowsheds

The number of anopheline mosquitoes caught in cow sheds according to height have been shown in Table 2.

Here again on the assumption that all the species rest independently of height, i.e. the proportion resting above 5 feet and below 5 feet is the same, the x^2 test gives

TABLE 1.—THE NUMBER OF ANOPHELES SPP. CAUGHT ABOVE AND BELOW A HEIGHT OF FIVE FEET IN BEEDROOMS.

Anopheles species	Caught above 5 feet =a	Caught below 5 feet =a′	Total =a+a′	Proportion caught above 5 ft. $p=\frac{a}{a+a'}$	a.p.
Philippinensis:	269	725	4994	.2706	72.8
Aconitus	203	935	1138	.1784	36.2
Annularis	390	638	1028	.3794	148.0
Hyrcanus	20	50	70	.4000	8.0
Vagus	673	1276	1949	.3453	223.4
Rest(pooled)	13	25	38	.3421	4.4
	1,568	3,649	5,217 $\bar{p}=.3006$		492.8

TABLE 2.—THE NUMBER OF ANOPHELES SPECIES CAUGHT ABOVE AND BELOW A HEIGHT OF 5 FT. IN COWSHEDS.

Anopheles species	Caught above 5 feet a	Caught below 5 feet a′	Total	Proportion caught above 5 ft. $p=\frac{a}{a+a'}$	a.p.
Philippinensis	201	298	499	.4028	80.9
Aconitus	1179	2297	3476	.3392	399.8
Annularis	20296	14239	34535	.5877	11927.8
Vagus	2426	2844	5270	.4603	1116.7
Hyrcanus	812	1425	2237	.3630	294.7
Barbirostris	315	273	588	.5357	168.7
Rest	244	197	441	.5533	135.0
Total	25473	21573	47046		14123.9

$$x^2 = \frac{1}{.54145 \times .45855} (14123.9752 - 13792.222)$$
$$= 610{\cdot}7632 \text{ with 6 d.f.}$$

The value of x^2 with 6 d.f. from Fisher's table is 12.592. The assumption is, therefore, discredited and we find that species and the heights on which they rest are not independent, i.e. species have different proportions resting above and below 5 feet. As in the case of distribution in bedrooms, here also the samples are considered to be large enough to conform to the normal distribution and normal test is applied to individual species.

Applying the normal test to *A. aconitus* we have $\sigma = 29.5$, the observed deviation being 19 times the value of σ the result is highly significant showing a tendency for *A. aconitus* to rest *below* a height of 5 feet in cowsheds.

In the case of *A. annularis*, P is 0.5877, i.e. greater than $\frac{1}{2}$, and we get $\sigma = 92.9$, the observed deviation, 3028.5 being thus about 33 times the calculated deviation. This shows a marked tendency for *A. annularis* to rest *above* 5 feet in cowsheds. From similar calculations for *A. hyrcanus* and *A. vagus* the value of σ is calculated to be 23.6 and 36.3, respectively. The observed deviations in these cases are 306.5 and 209, respectively, or 13 and 6 times the calculated values of σ. Hence in both these cases there is a tendency to rest below 5 feet. This tendency, however, is more marked in the case of *A. hyrcanus* as compared with that of *A. vagus*.

A. philippinensis and *A. barbirostris* were not caught in sufficient numbers to justify the application of normal test, and numbers captured are, therefore, given without analysis. The data do not show any special tendency in *A. philippinensis* to rest near the floor, nor did *A. philippinensis* show any significant difference in its resting habit in bedrooms as compared with that of other anophelines.

The tendency to rest on lower half of the walls in bedrooms is found among all the anopheline species commonly found in the area. The proportion resting above a height of five feet is however not negligible but on the contrary is considerable. In cowsheds also all the common species, except *A. annularis*, show a tendency to rest below a height of five feet. However, the commonest species in cowsheds, *A. annularis*, rests predominantly on the upper half of the walls. *A. annularis* is thus the only species which shows different resting habits in bedrooms and cowsheds.

In the light of the data provided in this paper, it would appear necessary that in any spraying operations the entire inner structures including the ceiling have got to be sprayed to achieve satisfactory control.

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