Source of Oxygen Liberated during Photosynthesis

PROF. HUGH NICOL'S note, "Photosynthesis, Philosophy and Priestley", in *Nature* of August 10, p. 200, mentions G. Bredig (1914) as the first to suggest that the photosynthetic oxygen comes from water. It may be of interest to know that J. Liebig (*Ann. Chem. Pharm.*, **46**, 58; 1843) gave the following picture of the carbon dioxide assimilation of plants:

$$2CO_2 + H_2 = \begin{matrix} COOH \\ | \\ COOH \end{matrix},$$

involving the formation of hydrogen and oxygen from water. More recently, I considered (*Camera-Luzern*, **4**, No. 6; 1925) a reaction in line with Willstätter's assimilatory coefficient $CO_2/O_2 = 1$ and with von Bayer's (1870) formaldehyde theory, and I formulated the following scheme:

$$H_2CO_3 + 2H + 2OH = HC\begin{matrix} O \\ \diagup\!\!\!\diagdown \\ H \end{matrix} + H_2O_2 + H_2O_2 \text{ and}$$

$$2H_2O_2 + \text{catalase} = 2H_2O + O_2.$$

Both the reducing hydrogen and the hydroxyl radicals were supposed to be photolytic products of water. According to these formulæ three-quarters of the oxygen liberated comes from water; one molecule being involved in the reaction

$$CO_2 + H_2O = H_2CO_3$$

and two mols in

$$2H_2O + \text{activated chlorophyll} = 2H \text{ (active)} + 2OH.$$

K. Shibata and Yakushi (*Naturwiss.*, **21**, 267; 1933) give a similar representation. Four mols of water are involved to give first

$$4H_2O = 4H + 4OH, \text{ and then } 4H + CO_2 = HCOOH + H_2O.$$

Finally,

$$4OH = 2H_2O_2 \text{ and } 2H_2O_2 + \text{catalase} = 2H_2O + O_2.$$

According to this concept, all the liberated oxygen comes from water and none from carbon dioxide.

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A New Genus of Cucurbitaceæ

AN interesting plant was discovered in Assam in 1883 by the late Gustav Mann. Later, Mr. I. H. Burkill found it in Abor Hill during his expedition in 1911 and 1912 (Burkill, No. 37363 and 37742). After a lapse of twenty-two years, Dr. N. L. Bor again found the plant in April 1933 at a place called Painjuli, Aka Hills. Mann's sheets were examined at Kew by the late C. B. Clarke, who thought this to be a new species of *Zanonia*.

In 1939, while trying to name a few of Dr. Bor's Aka Hill collection at the Calcutta Herbarium, I came across this plant. Soon Mann's and Burkill's sheets were found and an examination was made of the floral parts. From the data obtained it was not possible to fit this new plant within *Zanonia* as suspected by Clarke. It proved to be a new genus under the tribe *Fevilleæ* of Cogniaux and is closely allied to *Thladiantha* Bunge. The description was drawn up and sent to Kew in 1940, but owing to the War the publication was delayed for a few years. The main characters of this genus are given below for the benefit of other workers in different parts of the world.

Indofevillea Chatterjee Gen. nov. Affinis *Thladiantha* Bunge sed sepalis petala longe superantibus squamis floribus nullis, antheris liberis subsessilibus, reniformibus hirsutis, pistillodio nullo fructuque multo majore satis discrepat. Species unica Assamica (*Indofevillea khasiana*).

A full account will appear in *Kew Bulletin*.

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Size of Sampling Unit in Yield Surveys

IN a previous communication[1] I directed attention to the risk of obtaining biased estimates of crop yields with sampling units of small size. Further results confirming these findings are now available. Of particular interest are the results of the investigations on paddy (rice) in the Gaya district in Bihar and the Kistna district in Madras. The Gaya district has a geographical area of 4,766 sq. miles, of which approximately 35 per cent is under paddy. It is divided into four sub-divisions. The plan of sampling consisted in selecting at random 108 villages, 36 from the Gaya division and 24 from each of the other sub-divisions. In each selected village two paddy-growing fields were selected at random, and in each selected field the following five sampling units were marked: (*a*) one rectangle of size 33 ft. × 16½ ft., area 544·5 sq. ft.; (*b*) two equilateral triangles of side 15 links, area 42·4 sq. ft.; and (*c*) two isosceles right-angled triangles with the equal sides equal to 5 ft. area 12·5 sq. ft.

The sampling units (*a*) and (*b*) were marked with the help of pegs and tapes, but the sampling unit of 12·5 sq. ft. was marked with the apparatus devised and used by Mahalanobis in the Bihar rabi survey (1943–44)[2]. The experiments were carried out by the Circle officers posted in the district, each working within his own jurisdiction. Altogether seventeen officers were employed.

The results are presented in Table 1. It will be seen that the sampling unit of 12·5 sq. ft. results in a serious over-estimation of yield, the percentage over-estimation being 23. Even a sampling unit of 42·4 sq. ft. gives an over-estimate of nearly 9 per cent. An examination of the yield estimates for each sub-division showed that small-size sampling units gave biased yield estimates in all divisions.

TABLE 1. THE GAYA DISTRICT

Sampling unit	Area in sq. ft.	No. of sampling units harvested	Estimate of the average yield in lb. per acre	Percentage over-estimation
Rectangle, 33 ft. × 16½ ft.	544·5	206	991·54	
Equilateral triangle, side 15 links	42·4	412	1078·77	8·7
Right-angled isosceles triangle with equal sides 5 ft. each	12·5	412	1221·12	23·1

A proper test of bias is to compare yield estimates from sampling units of different size with those obtained from harvesting the whole field. This was not found feasible in the investigation carried out in the Gaye district. Another investigation was, therefore, carried out on paddy in the Kistna district of the Madras Province. The results are shown in Table 2. It will be seen that the yield estimate from sampling unit of 435·6 sq. ft. is in close agreement with that obtained from harvesting the whole field, but those from small-size sampling units are over-estimates. The differences are all found to be statistically significant. An examination of the results for each sub-division also showed a close agreement between the yield estimates from sampling units of 435·6 sq. ft. and those obtained by harvesting the whole field; but the yield estimates from small-size sampling units were considerably different from the latter. The bias observed was positive (over-estimate) in certain sub-divisions and negative (under-estimate) in others, but did not cancel out when the results were combined for the district, as one might expect when experiments are carried out by several investigators.

TABLE 2. THE KISTNA DISTRICT

Sampling unit	Area in sq. ft.	No. of sampling units harvested	Estimate of the average yield in lb. per acre	Percentage over-estimation
Whole field		108	1939·2	
Rectangular plot, 50 links × 20 links	435·60	108	1954·1	0·8
Circle of radius, 3 ft.	28·29	216	2025·9	4·5
Circle of radius, 2 ft.	12·57	216	2113·2	9·0
Equilateral triangle of side 5 ft.	11·12	216	2433·4	25·5

These results confirm the conclusions of the previous investigation on wheat, that sampling units of 12·5 sq. ft. used by Mahalanobis in India[2] and of the size used by workers in Britain and the United States result in biased yield estimates under Indian conditions.

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[1] Sukhatme, P. V., *Nature*, **157**, 630 (1946).
[2] Mahalanobis, P. C., *Sankhya*, **7**, 29 (1945).

John Ray's Tomb

RECENTLY, when making a tour of some of the Essex churches, I visited Black Notley, and was concerned to find that the monument to John Ray in the churchyard had been seriously damaged by a bomb which fell nearby, so the Rector informs me, on December 10, 1943. The monument has been figured by Gunther ("Further Correspondence of John Ray", 1928), and earlier by Lankester ("Memorials of John Ray", 1846). It consists of a rectangular base surmounted by a pyramid with a decorative plinth and finial. The base is protected by an iron railing. The latter is only slightly affected, but the base of the monument itself was broken and blown open so as to be exposed to the weather. The finial was also snapped off.

It is unthinkable that the tomb of so famous a naturalist should be allowed to remain in such a state, and we may hope that the public bodies more directly concerned, the Royal and Ray Societies and the Essex Field Club, will take the initiative in the task of restoration. Ray was born and died at Black Notley, and spent the last twenty-six years of his life there. His home in the village, which he built in 1655, was destroyed by fire in 1900, and hence the monument is all that is left to remind us of his association with the place. I may add that the Rector of the parish, the Rev. J. L. Head, is anxious to co-operate in any scheme for the repair of the tomb.

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