Comments and Communications

What Is the Pollinating Agent for *Hevea brasiliensis?*

Despite the fact that breeding experiments with *Hevea brasiliensis* Mull. Arg. (H.B.K.) have been carried on over a considerable number of years, the natural pollinating agent or agents are still unknown.

The writer spent almost 5 years working on the Firestone Plantations in Liberia, West Africa, and during that period carried on a number of studies to determine whether the trees are wind- or insect-pollinated.

The arrangement of the inflorescence in *Hevea,* in which, although the female flowers hang below the male flowers, the blossom is inverted and the short stigma is shielded by the sepals, indicates that the flowers are not wind-pollinated. Vaselined slides placed to one side and below the inflorescences failed to collect any pollen. The sparse production of pollen is a factor mitigating against successful wind-pollination; compared to many Temperate Zone plants, e.g., apples, cherries, etc., *Hevea* produces pollen in almost infinitesimal quantities. Also, the pollen grains are too large and heavy to float easily in ordinary air currents. If young inflorescences are bagged before the flowers are open, no fruit is produced, even in clones which are not entirely self-sterile. This eliminates the possibility that self-fertilization or apogamy is involved.

On the other hand, during months spent in hand-pollinating rubber trees, practically no insects were ever seen. Since the odor of the flowers seems stronger at night, especially around 8: 30 P.M., indicating a possible increased attraction to insects at such hours, the possibility that night-flying insects might do the pollinating was investigated. However, no insects were found, except a few lonely red ants, and these, although they could be found at all times of the day or night, carried no pollen.

The wide distribution of *Hevea brasiliensis* Mull. Arg. (H.B.K.) throughout tropical regions in Asia, Africa, South America, etc. indicates that the insect vector or vectors, if any, are probably different in each of these widely separated regions; yet, it is true that in none of these regions has any insect been shown to be the pollinating agent. It is a notable fact that certain *Hevea* clones, such as Tjirandji 1, always bear seeds profusely, regardless of the region in which they are planted, while other clones which are poor seed bearers seem always to be poor seed producers wherever they are grown.

In plantings grown from seed, some trees almost always bear fruit each year, while neighboring trees may be alternate bearers, occasional bearers, or completely barren. This is also true to a lesser degree of the clones of *Hevea,* some of which, such as Tjirandji 1, Tandjong Kemala 12, etc., bear fruit very freely as a rule, whereas others, such as Bodjong Datar 5, Bodjong Datar 10, etc., are very poor seed producers and seem to be almost completely self-sterile. Even within a clone, there is considerable variation in bearing. Full sunlight, good drainage, and a dry period during flowering stimulate seed bearing. Unhealthy or injured trees produce seed more heavily than healthy trees. The presence of a seedling tree in the midst of a clonal planting will cause the neighboring clonal trees to bear fruit in direct ratio to the distance from the seedling tree. Seed bearing along the boundary line between two clones is more prolific than within the clone.

The difficulties in pollinating *Hevea* by hand are, of course, well known. A final success of 5% is usually considered a satisfactory result, even though early fruit set may be as high as 90%. The loss of fruit occurs entirely during the first 6 weeks after pollination. For the next 8 weeks no loss normally occurs, except in cases of wind damage, etc. Girdling the fruiting branches or dipping a tongue of bark in hormone solution seems to be of no avail. However, spraying the young fruits with hormone solution has given promising results, in so far as retention of the fruits is concerned. Spraying inflorescences did not increase fruit set.

The present status of the problem would seem, from the foregoing experiments and observations, to be somewhat unsettled. We are inclined to assume that either wind or insects are concerned in the pollination of most tree flowers, and it is difficult to conceive of any other agencies being effective. The structure and arrangement of the inflorescence indicate strongly that wind is not the agent; yet, if an insect does the pollinating, why has it never been identified?

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Plasma Reduction of Methylene Blue

Stadie, in a report of a study of the reducing power of serum from subjects with malignant disease (*Science,* August 27, p. 211), indicated that the reduction of methylene blue by serum was due solely to the presence of newly formed S^{--}. His measurements of such S^{--} ion concentrations by means of methylene blue reducing time and iodometric titration failed to reveal any significant difference between serum samples from individuals with or without malignant disease. He indicated that these data lead to conclusions contrary to the independent reports of Savignac and myself (Savignac, *et al.* In *AAAS Research Conference on Cancer.* Washington, D.C.: AAAS, 1945. Pp. 241–252; Black. *Cancer Res.,* 1947, **7,** 321–325).

I should like to call attention to several features of this apparent discrepancy:

(1) I am in agreement with Stadie, and I believe Savignac is also, in regard to the importance of S^{--} ions in the reduction of methylene blue in the techniques employed. Experimental data on the sulfhydryl reduction of methylene blue with reference to alterations in malignant neoplastic disease were reported by me in *Cancer Research,* 1947, **7,** 592. In this study I indicated that the increased reducing time observed by my technique

was not indicative of a change in the total protein or A/G ratio or the total –SH bonds potentially present. The technique employed appeared to measure the reactivity or the rate of appearance of such groups wherein a decided difference was found in plasma from patients with and without malignancies.

(2) The use of the technique which I have described previously has now been applied to almost 2,000 control individuals, 1,000 diverse cases of nonneoplastic diseases, and 1,000 cases of diverse forms of cancer. In 75–80% of the cancer cases distinctive prolongations of the methylene blue reducing times have been noted. No such findings are encountered in the nonneoplastic diseases with the exceptions of cases of pregnancy, tuberculosis, rheumatic fever, and cirrhosis. Further, the elevated reducing times in cancer cases are readily reversible after adequate therapeutic procedures via surgical resection or radiation. These results have been corroborated by various investigators whose combined series total more than 500 cases (personal communication; also discussion by Dr. W. Morris at American College of Chest Physicians, Chicago, 1948).

(3) The following experimental data would indicate that while there is no significant difference in the total reducing groups in the presence or absence of malignancy, there is a decided difference in the time of appearance of these groups under the experimental conditions employed. It is this latter phenomenon which is measured by my technique and which undergoes alteration with malignant disease.

One cc of plasma or serum is mixed with 0.2 of a 0.15% methylene blue solution in a Wasserman tube. The tube is immersed in a boiling water bath and the time noted for complete decolorization of the dye. This is the usual technique employed by me and referred to as the methylene blue reducing time. On removing the tube, cooling, and agitating, the blue color returns. The tube is then replaced in the boiling water bath, and again the time is noted for complete decolorization of the dye. The second decolorization is found to require less time than the first. This process is repeated until the time for decolorization appears to be constant:

Case	MBT_1*	MBT_2	MBT_3	MBT_4	MBT_5	*Diagnosis*
G.C.	15	9.0	5.0	4.0	4.0	Ca. esophagus
J.F.	13.5	4.0	4.0	..	..	Hodgkin's disease
A.C.	7.5	4.5	4.0	4.0	..	Cholecystitis
J.M.	11.0	7.0	5.0	3.5	3.5	Ca. tongue

* Methylene blue reducing time in minutes.

These findings indicate that (1) there is no significant difference in the total reducing groups potentially present in the serum of patients with and without malignant disease, as shown by similarity of the final reducing time obtained after multiple heatings; and that (2) this in no way is contradictory to the observation that the initial reducing time in the technique employed is increased in 75–80% of cases of malignant neoplastic disease.

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The Varieties, Quantities, and Purities of Stable Isotopes Which Have Been Concentrated Electromagnetically[1]

The electromagnetic process for the separation of isotopes at Oak Ridge has been successfully applied to concentrating stable isotopes of the following elements:

Lithium	Copper	Indium
Magnesium	Zinc	Tin
Silicon	Germanium	Antimony
Chlorine	Selenium	Tellurium
Potassium	Bromine	Cerium
Calcium	Strontium	Tungsten
Titanium	Zirconium	Rhenium
Chromium	Molybdenum	Mercury
Iron	Silver	Thallium
Nickel	Cadmium	Lead

Additional elements are being added to this list from time to time.

From several hundred isotope collections approximations can be made as to the expected enriched concentration of an isotope, based on its natural abundance and the probable amount of an isotope which will be available. These expected concentrations and amounts are approximate because the natural abundance of an isotope is not the only factor which influences its enriched concentration after it has been processed in the mass spectrograph (calutron), and because the amount available for shipment will, of course, depend on the time given to collecting the particular isotope.

The following table summarizes the likely amounts of stable isotopes of the above elements available, together with their probable range of enriched concentrations:

If the natural abundance is:	The probable amount available for shipment is:	The expected enriched concentration is in the range:
(%)	(mg)	(%)
0.01 – 0.1	1	0.1 – 1
0.1 – 2	10	0.5 – 60
2 – 5	50	25 – 70
5 – 10	100	45 – 85
10 – 25	250	70 – 90
25 – 90	500	85 – 99
90 – 100	1,000	95 – 100

More specific information can be obtained from the Catalog of Stable Isotopes which is available from the Isotopes Division, Atomic Energy Commission, Oak Ridge, Tennessee.

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