between the sulphuric acid and the anode is broken. This is restored when further oxygen is consumed. The volume of hydrogen simultaneously generated at the cathode is equal to twice the volume of oxygen consumed. Oxygen consumption and carbon dioxide output are usually about equal; but any unbalance is readily shown by respiratory quotient determinations.

With the soil samples so far tested in this apparatus organic matter decomposition followed a first-order reaction, that is, the rate of decomposition decreased with time and was proportional to the amount of decomposable material present. The decrease was shown not to be due to fall in *p*H, the accumulation of toxic products or the adverse effect of the respirometer environment on microbial activity.

Among the results so far obtained the following are of particular interest. When a soil was air-dried and rewetted an appreciable flush of decomposition resulted. Further successive dryings and rewettings produced effects similar in magnitude, rate of decomposition, and kind of organic material decomposed. The effect lasted for about five days. Oven-drying had a similar effect but of greater magnitude. The drying effect was shown not to be related to microbial stimulation, destruction of toxic compounds, the release of nitrogen, phosphorus and potassium or microbial death with subsequent decomposition of the remains. All the evidence available indicates that the drying effect is one of liberation from the clay of rapidly decomposable material which, under steady moist conditions, is protected by the clay from microbial attack. The magnitude of the effect is related to the degree of drying (influencing both the amount of material liberated and the rate at which it is re-absorbed and reprotected from microbial attack on rewetting), the kind and amount of clay and the amount of organic material associated with it. More exact relationships have yet to be worked out. A single air drying of a forest soil (5·4 per cent carbon) liberated rapidly decomposable organic material equivalent to 0·011 gm. carbon per 100 gm. soil (or 220 lb./acre-6 in. assuming this weighs 2×10^6 lb.). Replacement of this material, assuming it to be of a humic nature, would involve the decomposition of about 1,700 lb. of dry plant material on the basis that this contains 50 per cent carbon and loses 75 per cent of the carbon as carbon dioxide during decomposition to humus.

Similar behaviour was observed with sand–pure clay mixtures to which gelatine was added. Not only did montmorillonite have a much greater protective effect on gelatine decomposition than kaolinite, but also the protected gelatine could afterwards be partly released on successive drying and rewetting, thus paralleling the behaviour of the soil. With kaolinite the drying effect was much less marked. No doubt clays intermediate between these two extreme types would show intermediate effects.

It further appears that the organic material liberated on drying may also be liberated through displacement by other organic compounds. Thus, when gelatine was added to two moist soils, slowly respiring, the respiratory quotient (1·29) for the active decomposition period following the addition was almost identical with that following oven-drying and rewetting and considerably above the theoretical value (0·8) which was obtained during gelatine decomposition in sand–pure clay mixtures. Presumably a rapid exchange took place between the gelatine and the protected organic material, some of the former then being protected and the latter exposed to microbial attack.

These results indicate that part, at least, of the humus fraction under moist conditions is protected from, but not inert to, microbial attack. When it is released either by drying or displacement, it is rapidly decomposed. Further, since decomposition generally parallels ammonia accumulation there should be a quick release, through mineralization, of nitrate and other nutrients. Such behaviour has an obvious bearing on (*a*) the seasonal pattern of humus decomposition, (*b*) the nitrate flush which, as reported by Griffith[2], occurs at the start of the rains and is related to the degree of soil drying, and (*c*) the beneficial effects, so often reported, of burning. It is also possible that the so-called priming action of fresh organic matter on the breakdown of soil humus, generally ascribed to increased microbial activity, is in fact a displacement effect caused by an exchange between the organic matter decomposition products and those already associated with, and protected by, the clay.

There are several references in the literature both to the protective effect of soils and clays against the decomposition of organic compounds, and to the effect of drying on increasing soil fertility. The evidence described above, for the liberation of the protected material on drying, provides a link between these two observations. It also indicates a possible use for the respirometer in soil fertility studies.

H. F. Birch
M. T. Friend

East African Agriculture and Forestry
Research Organization,
P.O. Box 21,
Kikuyu, Kenya.
April 19.

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Transmission of Beet Mosaic Virus from *Stellaria media* and *Capsella bursa-pastoris* by *Myzus ascalonicus* Doncaster

During the winter of 1955–56, *Myzus ascalonicus* Doncaster was observed hibernating on chickweed (*Stellaria media*) in the field at Gembloux, next to a place where fodder beet had been cultivated in 1955 and harvested in October of the same year. With the view of testing if any of the aphids were bearers of beet viruses, adults and larvæ of the spring generation were put on fodder beet seedlings var. 'Jaune de Vauriac' for 48 hr. (5–10 aphids a plant), between April 5 and May 2, 1956. After 20–30 days, three of the eighteen tested beets showed chlorotic and yellow translucid circular or irregular little spots on the young leaves. The symptoms were attenuated on the older leaves; these last became narrow and showed interveinal yellowing. The plants were stunted. Later, one of the infected beets showed a regular vein yellowing on the young leaves.

The sap of one of the infected beets, mixed with 'Carborundum', was inoculated to healthy 'Jaune de Vauriac'; a general mosaic appeared on the young leaves of the five test plants within seven days, suggesting that the virus transmitted was *Beta* virus 2. Using the same source, a transmission was made to beet seedlings by *Myzus persicae* Sulzer

(1–2 min. on the source after 2 hr. fasting, 24 hr. on test plants, 10 aphids a plant). Mosaic was obtained on young leaves within 10–20 days.

The virus was transmitted from infected beet to chickweed seedlings in the same conditions by *Myzus persicae*. It was then re-transmitted from supposed infected *Stellaria* to beet seedlings by *Myzus ascalonicus* Doncaster (1–2 min. on the source, after 2 hr. fasting; ten aphids a plant; 24 hr. on beet). Two of the five tested plants showed mosaic on young leaves after 15–20 days.

According to preliminary results, beet mosaic is also transmissible from infected *Capsella bursa-pastoris* to beet by *Myzus ascalonicus*.

Using beet as a source, *Myzus ascalonicus* was not considered previously as a vector of beet mosaic virus[1]. The results of our trials show that this aphid is able to transmit the virus from infected *Stellaria media* growing in the field, and from artificially infected *Stellaria* and *Capsella bursa-pastoris*. So far as we know, these two weeds seem to be new hosts of the virus.

Myzus ascalonicus is known from the literature as a vector of beet yellows (*Beta* virus 4 Roland and Quanjer), and *Stellaria media* as a host of this virus. Although the transmission of beet yellows from chickweed in the field by *Myzus ascalonicus* has not yet been found with certainty in our trials, the first results indicate that it is most probable.

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J. Semal

Phytovirology Laboratory,
Gembloux, Belgium.

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Effect of Herbicide 2,4-D on Bean Chocolate-Spot Disease

The herbicide 2,4-D (2,4 dichlorophenoxyacetic acid) has been recorded to affect fungal-host relationship. Ibrahim[1] demonstrated a reduction in the number of rust uredosori to one-fifth on treated oat plants compared with controls. Similarly, Crowdy and Wain[2] recorded a suppression in bean chocolate-spot disease treated with 2,4,6 trichlorophenoxyacetic acid. On the other hand, wheat plants treated with 2,4-D were found to be weakened, stunted and predisposed to a heavier infection with *Helminthosporium sativum*[3]. 2,4-D has been recorded to cause a depletion in the carbohydrate content of treated plants[4,5]; Weller and co-workers[6] observed a depletion of non-reducing sugars.

The present work aims at an evaluation of the possible role of 2,4-D in influencing the relationship between bean plants (*Vicia faba* L., Breed No. 34) and *Botrytis fabae* and the interpretation of such an effect in terms of: (*a*) pathological anatomy of infected treated and untreated plants; (*b*) fungal enzymic activity as influenced by host metabolism in absence or presence of 2,4-D; (*c*) host biochemical changes, in response to 2,4-D treatment, and their possible bearing on fungal development.

Leaflets of bean cut shoots, previously dipped for five days in pure water or in aqueous solution of 5 p.p.m. 2,4-D sodium salt, or freshly cut, were sprayed evenly with a spore suspension of *Botrytis fabae* to ensure a film of suspension on both leaflet surfaces; similarly, treated cut shoots were left uninoculated to serve as controls. For each treatment, three plants were used; they were kept constantly under humid conditions. The disease criteria were measured on leaves (Nos. 4, 5, 6 and 7), 48 hr. after spraying, by a method adopted by Crowdy and Wain[2]. The number of lesions, on both surfaces of the leaflet, was calculated and the mean diameter of a large number of lesions was determined. Since the lesions are more or less circular in outline, the mean area of the infected lesions could be calculated from the formula (πr^2). The total infected area was afterwards obtained by multiplying the mean area of the lesions on both surfaces of each experimental leaflet; percentage infection could be thus represented as percentage ratio between total infected area and total area of both leaflet surfaces; the latter was determined by planimeter. The results (Table 1) indicated a considerable reduction in percentage infection in cut shoots previously treated with 2,4-D in comparison with those dipped in water or previously freshly cut. In addition, carbohydrate analysis was made by Maskell's method modified by Gawadi[7].

Table 1. Percentage Leaf-Area Infection and Carbohydrate Analysis (gm. per 100 gm. dry weight) of Leaflets from Differently Treated Bean Cut Shoots

Criteria		Leaflet treatment		
		Fresh	Dipped in Water	Dipped in 2,4-D
Per cent infection		39%	36%	15%
Carbohydrate analysis	Hexose	2·995	2·306	1·957
	Sucrose	4·462	1·619	0
	Total sugars	7·457	3·925	1·957
	Poly-saccharides	3·727	3·932	2·170
	Total carbohydrates	11·184	7·857	4·127

No pathological differences could be detected in the anatomy of infected leaflets under varying treatments. The fungal enzymic activity, as influenced by the 2,4-D treatment of bean leaflets, was tested by Brown's disk method, as follows: juices were squeezed from differently treated cut shoots, cold sterilized by Menon's technique[8], inoculated heavily with *Botrytis* spores and incubated for three days at 25° C. The reaction times for *Botrytis* macerating enzymes, obtained from differently treated juices, were found to be close (that is, ranging between 18 and 20 hr.), denoting a feeble enzymic activity. On the other hand, the herbicidal treatment results in a depletion in the carbohydrate content of the leaf, especially sucrose, which completely disappears; such depletion may interfere with the normal development and pathogenic potentiality of *Botrytis*.

M. A. Mostafa
S. K. Gayed

Botany Department,
University of Cairo,
Giza.
July 8.

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