reactions of monophenols were positive. Among the latter the coupling reaction with diazonium salts, in alkaline medium, the Folin–Ciocalteu reaction, the Millon reaction, the Gerngros–Voss–Herfeld reaction and the Gibbs reaction may be mentioned.

Another important step forward was made possible through the study of the shades of colour shown, on paper, by the spots of numerous pure synthetic monohydroxyphenylamines, when using as developing agents the diazonium salts of sulphanilic acid or *p*-nitroaniline or the Gibbs reagent. The colour tones of spots obtained with hydroxyphenylalkylamine derivatives (tyramine, hordenine, paredrine, paredrinol) were clearly different from those of spots obtained with hydroxyphenylalkanolamine derivatives (synephrine, *m*-synephrine, *nor*synephrine, *m-nor*synephrine, *p*-hydroxyephedrine, *m*-hydroxyephedrine, *m*-hydroxy*nor*ephedrine).

In this connexion, the behaviour of octopamine was always exactly the same as that of hydroxyphenylalkanolamines.

On the basis of these results, special attention was naturally given to hydroxyphenylamines having an alcoholic hydroxy group in the α-position of the lateral chain. That octopamine was identical with *p*-hydroxyphenylethanolamine and different from all other hydroxyphenylalkanolamines examined was clear after the first chromatographic runs.

Up to the present, more than twenty different solvents and mixtures of solvents have been used. For all of them the R_F values of octopamine (concentrated eluates of octopamine spots) agreed perfectly with the R_F values of *dl-p*-hydroxyphenylethanolamine (*nor*synephrine), and in 'mixed' chromatograms, uni- and bi-dimensional, the octopamine spots were always exactly superposed on those of *nor*synephrine, thus constantly giving strictly unique spots.

Having identified octopamine as *nor*synephrine, it was obvious to expect that hydroxyoctopamine could be identified as hydroxy*nor*synephrine, namely, as *nor*adrenaline. This assumption was confirmed experimentally.

Eluates of octopamine spots from numerous unidimensional chromatograms were irradiated with ultra-violet light in the presence of air and then, after concentration, re-chromatographed. Besides the usual solvents and developing agents, solvents and reagents especially suitable for chromatographic separation and development of catechol derivatives were also used (phenol saturated with water, butanol + acetic acid; potassium ferricyanide, iodine, Wood's light). Comparison chromatograms were run with epinine, *nor*adrenaline and adrenaline.

In this way it was possible to establish that, parallel with the fading of the octopamine spot, a clear catecholic spot appeared and became intensified on the chromatograms of irradiated octopamine eluates. Owing to its R_F value, its behaviour on 'mixed' chromatograms, and its colour and fluorescence reactions, this spot was identified as *nor*adrenaline.

Octopamine eluates caused pharmacodynamic effects on the blood-pressure and on the nictitating membrane of the spinal cat, which were qualitatively the same as those due to *nor*synephrine. Quantitatively, they appeared to be twice as active as *dl-nor*synephrine solutions, giving a Pauly colour reaction of the same intensity. This leads to the assumption that octopamine represents the lævorotatory stereoisomer of *nor*synephrine.

Irradiated octopamine eluates showed, in their turn, pharmacological actions which were qualitatively the same as those of irradiated *nor*synephrine solutions, and very similar to those of *nor*adrenaline solutions.

Equipressor doses of irradiated octopamine eluates and of irradiated *nor*synephrine solutions proved equally active on the nictitating membrane of the cat, before and after cocaine, on the dicestrus uterus and the colon of the rat, as well as on the small intestine of the rabbit. Similar results were obtained with equipressor doses of irradiated octopamine eluates and of untreated *nor*adrenaline solutions. In this connexion, however, one must bear in mind that not only hydroxyoctopamine, that is, *nor*adrenaline, is present in irradiated octopamine eluates, but also unaltered octopamine. It has always been easy to distinguish hydroxyoctopamine from adrenaline also by pharmacological tests.

The probable origin of octopamine and its significance in the biosynthesis of *nor*adrenaline[4] will be discussed when the complete account of this work is published.

V. Erspamer

Pharmacological Institute,
University of Bari.
Sept. 15.

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Atmospheric Pollution and Plant Growth

A recent review of the literature relating to gas damage to plants[1] refers to many works on the effects of sulphur dioxide and other gases. Few of these works deal with the direct effect of gaseous atmospheric pollution on plant growth, although most authors claim that the results are relevant to this question.

Although sulphur dioxide is the commonest and usually the most abundant polluting agent, experiments with this gas have shown[2] that, under the conditions employed, there is no effect on yield unless the concentration is high enough to cause leaf injury. With concentrations below this level, there is no detectable deleterious effect on the growth of plants even with a period of twenty-five days treatment (*l.c.*).

Investigations are in progress in this Department to determine the effect of atmospheric pollution on plant growth, and particularly on certain pasture species. Two experimental greenhouses have been constructed at the Experimental Grounds of the Botany Department at Fallowfield, Manchester. One receives the polluted air existing at this site; the other receives similar air after it has passed through a filter and water scrubber. The main experimental material has been the strain of ryegrass (*Lolium perenne* L.) known as 'Aberystwyth *S*23', although other species have been used.

In Table 1 are set out the results obtained with *S*23 ryegrass grown in beds in the greenhouses. Two soil fertility levels, designated 'high' and 'low', were used in this series of experiments. Treatment with purified air gave, with one exception, a dry weight considerably higher than treatment with polluted air.

These results cannot be attributed either to differences in temperature and humidity, or to the position of the greenhouses.

Table 1. *S*23 RYEGRASS: COMPARISON OF TREATMENTS WITH PURIFIED AND POLLUTED AIR

Expt.	Initial condition of *S*23	Date of commencement	Duration in days	Soil fertility level	No. of plots per greenhouse	Scrubbed air: mean dry wt. per plant (mgm.)	Polluted air: mean dry wt. per plant (mgm.)	Difference favouring scrubbed air	Difference between means significant at the $P = 0.05$ level
1	Seed	Aug. 10, 1950	46	High	8	341 ± 15*	280 ± 13	+ 61	41
2	3rd leaf stage	Oct. 6, 1950	75	High	6	99 ± 10	72 ± 7	+ 27	28
				Low	6	73 ± 4	59 ± 2	+ 14	9
3	Sec. growth of Expt. 2	Dec. 20, 1950	81	High	6	57 ± 2	33 ± 3	+ 24	14
				Low	6	35 ± 3	22 ± 1	+ 13	7
4	3rd leaf stage	March 16, 1951	77	High	6	817 ± 74	825 ± 11	− 8	168
				Low	6	542 ± 45	345 ± 34	+ 197	125
5	Seed	June 5, 1951	63	High	6	1,084 ± 55	673 ± 112	+ 411	280
				Low	6	728 ± 35	287 ± 46	+ 441	130

* ± Standard error of mean.

No sign of leaf damage could be detected in the greenhouse with polluted air. This fact, and other evidence, would seem to indicate that pollution decreases the growth-rate, even in the absence of visible leaf injury. Earlier workers inferred that unless leaf injury was manifest there were no other deleterious effects.

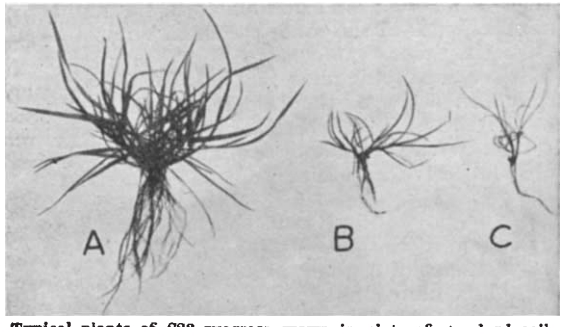
Table 2. DAILY MEAN CONCENTRATIONS OF SULPHUR DIOXIDE (PARTS PER MILLION)

Expt.	Total No. of days observed	No. of days at below 0·01 p.p.m.	No. of days at 0·01–0·03 p.p.m.	No. of days at 0·04–0·06 p.p.m.	No. of days at 0·07–0·09 p.p.m.	No. of days at 0·1–0·2 p.p.m.
3	52	Nil	24	24	4	Nil
4	77	Nil	20	44	11	2
5	63	4	26	20	10	3

The pollution factor causing this effect on growth-rate is not known. Records of the daily mean concentration of sulphur dioxide at the experimental site have been kept since January 10, 1951, and are summarized in Table 2. Sulphur dioxide was present in the 'normal' air throughout the periods of the experiments, usually in concentrations between 0·01 and 0·06 p.p.m. The daily mean concentrations were always well below the values reported to cause visible leaf damage.

Some field-experiments were also carried out. Plants grown in plots of standard soil in localities receiving different levels of pollution have been reported to give striking results[3]. Similar results have been obtained in standard soil plots at various localities around Manchester, and these plots are being used to study the effect of atmospheric pollution on the winter hardiness of different species of plants (see photograph).

This work is being continued and a fuller account is being prepared for publication.



Typical plants of *S*23 ryegrass grown in plots of standard soil in localities receiving different levels of atmospheric pollution. Planted November 1, 1950; photographed April 19, 1951. *A*, from pure air; *B*, from suburban air; *C*, from Manchester air (near centre)

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J. K. A. BLEASDALE

Department of Botany,
University of Manchester.
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Discovery of *Cryptolæmus montrouzieri* Mulsant (Coccinellidæ, Coleoptera, Insecta) in Bangalore, South India

Cryptolæmus montrouzieri Mulsant (Coccinellidæ, Coleoptera), which was imported in 1892 by Albert Koebele[1] into California from Australia to attack the citrus mealybugs, is a well-known predator on different mealybugs and is second in importance only to *Rodolia cardinalis* Mulsant. A considerable literature has accumulated on its importation into and colonization later in various countries such as France, Italy, Egypt, Philippines, Hawaii, etc., for dealing with various mealybug pests, particularly *Pseudococcus* spp. attacking different plants.

In July 1951, the appearance of this predator in large numbers in its late larval and pupal stages on the trunks of *Araucaria* pines around Bangalore was noted. In this connexion it is interesting to note the occurrence of this predator in Australia, its native home: "Froggatt ('Australian Insects', 211; 1907) speaks of this insect as frequently swarming in 'thousands upon the trunks of scale-infested *Araucaria* pines, pupating in such numbers that they form large white patches over the tree trunks'"[2]. What was observed in Bangalore on the *Araucaria* pines was no less spectacular.

Observation showed that this predator was common wherever mealybugs (*Pulvinaria* spp. and *Pseudococcus* spp.) were found, and was particularly abundant on *Pulvinaria psidii* Maskell, attacking guava and mango; in fact, it was scarcely possible to obtain this mealybug free from *Cryptolæmus* from the guava and mango gardens around Bangalore. Collections in the Mysore State Entomology Division showed them as having been taken in 1940 on mealybugs in Bangalore.

So far as we can find, there is no published evidence of the importation of *Cryptolæmus* into or its occurrence in India. Dr. A. P. Kapur, a specialist on Coccinellidæ in India (with whom we have had correspondence), says, "I have failed to find any reference about its [*Cryptolæmus*] importation into