

TOXICITY OF MUSTARD OIL  
SAMPLES PREPARED FROM MUSTARD  
SEEDS AND CAKES UNDERGOING  
MICROBIAL DECOMPOSITION

IN a recent communication the present author<sup>1</sup> reported that it was possible to prepare mustard oil samples from argemone-free mustard seeds and cakes undergoing microbial decomposition, resembling in physical and chemical properties samples of mustard oil reputed to have produced symptoms of epidemic dropsy in man. He<sup>2</sup> has also shown that three proved potent samples of mustard oil obtained from Lal did not contain argemone oil—the causative factor suggested by Lal, Chopra and others—even in a concentration of 0.75 per cent.

However, if the microbial decomposition theory be correct then the oil samples prepared from decomposed mustard seeds and cakes should, in the first instance, prove toxic to animals. With this end in view some feeding experiments were carried out and a summary of the effects observed is given here.

Twelve growing albino rats were used, nine in the experimental series and three in the control group. The experimental rats were given a daily dose of mustard oil both expressed and extracted from fungus-decomposed mustard seeds and cakes whereas the control ones received equal amounts of pure 'ghani' mustard oil. The animals in the experimental group showed very soon a sickly appearance with considerable loss of fur and subsequent loss in body weight. Of the nine animals, six died and three killed at intervals to study the progressive changes in tissues, if any. The control animals behaved in a more or less normal manner and there was a gradual increase in body weight. One control rat while maintaining a good growth suddenly developed peritonitis with intestinal obstruction and died on the fiftieth day. The other control rats were killed at intervals to serve as standards for comparison.

The heavy mortality in the experimental group coupled with definite histological changes in some tissues of these animals reported by Sen (elsewhere in this issue) indicates that

mustard oil samples prepared from decomposed mustard seeds and cakes are fairly toxic. In this connection some findings of Lal appear to be very significant. While experimenting with rats he and his co-workers<sup>3</sup> observed that 'a supply of mustard oil, which had been incriminated on epidemiological grounds, proved toxic to rats in as much as it caused reduction in weight and early death'. In the case of cats they<sup>4</sup> observed that in 5 per cent. argemone oil group none died whereas there was heavy mortality in the Rangpur oil group (dropsy-positive mustard oil) and five out of six cats died. Full details of the present investigation will be published elsewhere.

My best thanks are due to Dr. T. N. Sen, M.B., for kindly carrying out the post-mortem and histological examinations. I am also grateful to Prof. S. N. Bose, F.N.I., and Prof. J. K. Chowdhury, F.N.I., for their kind interest.

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<sup>1</sup> Sarkar, *Ann. Biochem. Exp. Med.*, 1941, 1, 325.

<sup>2</sup> —, *Ibid.*, 1941, 1, 271.

<sup>3</sup> Lal, et al., *Ind. Jour. Med. Res.*, 1941, 29, 168.

<sup>4</sup> —, *Ibid.*, 1941, 29, 183.

POST-MORTEM AND HISTOLOGICAL  
CHANGES IN SOME TISSUES OF  
RATS FED ON MUSTARD OIL  
SAMPLES PREPARED FROM MUSTARD  
SEEDS AND CAKES UNDERGOING  
MICROBIAL DECOMPOSITION

ON the suggestion of Dr. S. N. Sarkar, post-mortem and histological examinations of various tissues of animals subjected to his mustard oil tests were carried out by me and the important changes noticed are summarised below.

*Morbid Anatomy.*—The liver showed marked congestion in all the experimental animals and in a few cases, some hæmorrhagic spots or patches were noticed. In the control series very slight congestion of liver was observed.

Congestion of lungs in varying degree was present in all the experimental rats. In one

case a solidified patch, whitish in colour, was observed at the lower pole of the lower lobe of each lung. While sectioning through these solidified patches a thick whitish gelatinous matter came out. Very little congestion was noticed in the control series.

In the heart of the experimental animals, the ventricles were all empty and the auricles (specially the right), the superior vena cava and the inferior vena cava were distended with accumulation of dark blood. In some, the coronary blood vessels were somewhat engorged. In one case there were also some sub-pericardial hæmorrhages. The control series, however, showed no appreciable change.

In the experimental series no noticeable change in kidney in earlier stages could be seen but in later stages it showed some congestion. In the control series there was practically no change.

In the spleen of the experimental animals slight congestion could be noticed in later stages whereas in the control group no such change could be noticed.

The skin in some of the experimental animals was studied and the blood vessels of the ear appeared to be a bit more prominent than those in the control series. In the abdominal skin the cutaneous blood vessels could not properly be examined due to the part being thickly covered with hair.

One control rat which unexpectedly died showed much congestion of the intestines with some unstained peritoneal fluid and intestinal obstruction in the lower part of the ileum. The intestinal coils above the site of obstruction showed undue distension of the gut. As this rat died of some intercurrent disease so the changes in different organs were not taken into consideration.

*Morbid Histology.*—The liver in all the experimental animals showed considerable dilatation and engorgement of the sinusoids, central intralobular vein and branches of portal vein. In some cases the liver showed degenerative changes also. In the control series, the liver, in some cases, showed slight congestion but it was practically negligible in comparison with

that of the experimental series. The extravasation of blood was not noticed in any case and the hæmorrhagic areas in the morbid anatomical examination were due to extreme vascular dilatation.

Lungs in all the experimental animals showed dilatation and engorgement of alveolar capillaries with blood and cellular exudate and in one some granular exudate with a few cells in the alveolar spaces thus obliterating and filling up partially or completely some of them. In two cases lungs showed marked congestion with blood and leucocytes infiltration resulting in many of the alveoli being completely blocked with red blood corpuscles and white blood corpuscles. In the control series no such marked changes could be noticed.

In the experimental series the heart showed some engorgement of vessels in between the muscle fibres. In one case the section showed some engorged dilated vessels in sub-pericardial tissue. In the control series no pronounced change was noticeable.

The kidney in the experimental rats showed very little or no congestion of the glomerular capillaries at earlier stage of the experiment but in later stages it showed definite and marked congestion of glomerular and inter-tubular capillaries. In the control series, however, very slight glomerular congestion, if at all, could be noticed.

In the spleen of the experimental rats some degree of congestion was noticed at a later stage whereas in the control ones no such change was observed.

In the skin of some of the experimental animals there was some degree of vascularisation of the corium with young dilated capillaries and perivascular infiltration in some cases. In one where the abdominal skin was examined some engorged blood capillaries in the subcutaneous fatty tissue were observed. In the skin of the control series no marked vascularisation was present.

These findings together with the result of feeding experiments reported by Sarkar (elsewhere in this issue) suggest that mustard oil samples obtained from mustard seeds and

cakes undergoing microbial decomposition are definitely toxic. Full details will be presented elsewhere.

My best thanks are due to Dr. S. N. Sarkar for kindly supplying the materials used in this investigation. I am also grateful to Prof. S. N. Bose, F.N.I., and Prof. J. K. Chowdhuri, F.N.I., for their kind interest.

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### NON-HERITABLE POLYEMBRYONY IN *ANDROPOGON SORGHUM*

THE reported cases of polyembryony in crop plants fall into two groups, those in which the character is inherited as instanced in the case of citrus,<sup>1</sup> rice,<sup>2</sup> cotton,<sup>3</sup> etc., and others in which it is not hereditary.

The following is an example of the non-hereditary type of twinning observed in *Sorghum*. For the past seven years annually a few thousand seedlings of *Sorghum* of the *bilichigan* and other varieties have been raised individually in enamel dishes in connection with an investigation on *Striga* attack on *Sorghum*. On three occasions twin seedlings were obtained from individual seeds. In each of the three cases one of the two embryos developed into a seedling, which was bigger and more vigorous than the other seedling. The root systems of the two corresponded in vigour with their aerial parts; the roots of the weaker of the twins was slenderer and less branched (Fig. 1). Of the three twins one was accidentally destroyed, while in another the twin seedlings were planted separately and grew for some time and then both died. Both seedlings of the third grew to maturity and observations on this forms the subject of the present note. The twin seedlings shown in Fig. 1 were transferred without being separated, to a 12-inch earthen pot containing good garden soil mixed with farm-yard manure. The vigorous and weak plants were separately labelled and all through their life the difference in vigour was found maintained. Even the inflorescence of the less

vigorous plant was smaller though the seeds of both were of the same size. Selfed seeds

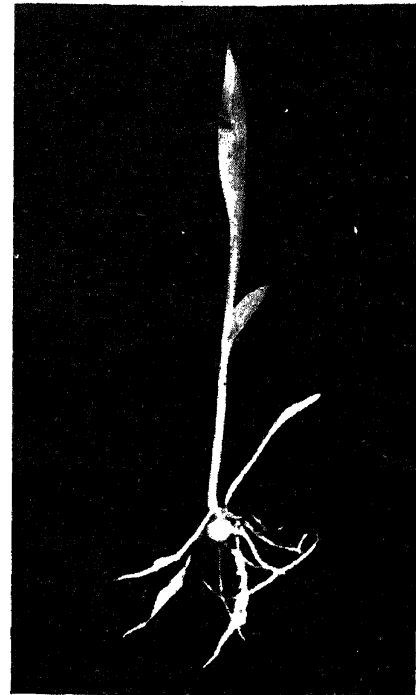


FIG. 1

of the two were collected separately. The following table gives the results of the progeny test in respect of the twinning habits:—

Character of plant	Total No. of seeds	Seeds germinated	Seeds that died	Single seedlings	Twin seedlings
Vigorous	532	495	37	495	0
Weak	131	69	62	69	0

Although the twins showed considerable difference in their size and vigour, they were presumably diploids, since both gave rise to normal progenies.

Reference to literature has shown that the occurrence of any type of twinning in *Sorghum* has not been reported previously. That only three such cases were observed in thousands of seeds shows that it is of very rare occurrence.

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<sup>1</sup> Frost, H. B., *Hilgardia*, 1926, 1, 365 (cited by Webber<sup>4</sup>).

<sup>2</sup> Ramiah, K., et al., *Ind. J. Agr. Sci.*, 1935, 5, 119.

<sup>3</sup> Webber, J. M., *J. Agr. Res.*, 1938, 57, 155.

<sup>4</sup> —, *Bot. Rev.*, 1940, 6, No. 11, 575.