females, pregnant, and postpartum hamsters were studied (Table 1). In addition, 7 males were killed 3 days after injection of 1–2 ml of minced dead fetal tissue in saline to determine if the presence of partly resorbed fetuses (estimated to have been dead about 3 days) might have caused the increase in mast cells in 2 of the pregnant hamsters. The thymi were fixed in sublimate-alcohol, embedded in wax, sectioned at 6 μ, and stained with aqueous toluidine blue. This method clearly demonstrated the mast cells in all sections of the thymus of each group of hamsters.

In order to determine the relation of decrease in size of the thymus to the number of tissue mast cells (*4*) present, camera lucida tracings were made of cross sections of lobes, and the number of mast cells per section was determined by actual count. Leucocyte counts and smears were made of blood from the jugular vein after cervical fracture and before the heart ceased beating.

Mast cells ranged from 18 to 65/cross section of a thymic lobe of control, pregnant, or postpartum hamsters, with the exception of 2 females that had partly resorbed fetuses (Table 1). Resorption of fetal tissue did not appear to be the causative factor, for the number of mast cells was not increased in the 7 adults injected with minced dead fetal tissue (Table 1). No variation due to age differences of 38–387 days was found in the number of mast cells, although the thymi of older hamsters were considerably smaller. Slight depletion of the thymus by 1–3 injections of ACE, and extreme depletion by cortisone or starvation, did not increase the mast cells per cross section, although the thymi of these groups were reduced to ¼–⅛ normal size and had marked condensation of the stroma.

A significant increase of mast cells occurred in all 20 of the 34 irradiated hamsters which had thymi in the inversion (shift of lymphocytes from cortex to medulla) stage of involution. Fifteen of the 20 had over 100 mast cells/cross section, more than twice the number that occurred in sections of the thymus of all other groups except 2 of the pregnant hamsters (Table 1).

In the irradiated group, thymi of the 10 animals in the extreme depletion stage were as small as those in the inversion stage—or smaller (¼–1/10 normal size); they had fewer lymphocytes and more condensed stroma, but no increase in the number of mast cells like those thymi in the inversion stage.

Macroscopic gastroenteric hemorrhage occurred in 11 of 20 hamsters in the inversion stage of thymic depletion and in 6 of 10 with extreme depletion of the thymus. Since mast cells are considered to be a source of heparin, their increase during involution may augment the effects of the thrombocytopenia that occurred in all the irradiated hamsters (Table 2).

References

1. MURRAY, R. G. In William Bloom (Ed.), *Histopathology of Irradiation from External and Internal Sources.* New York: McGraw-Hill (1948).
2. JORPES, J. E. *Heparin: Its Chemistry, Physiology and Applications in Medicine.* London: Oxford Univ. Press (1939).
3. WILANDER, O. *Skand. Arch. Physiol.*, **81** (Suppl. 15), 89 (1938).
4. MICHELS, N. A. In Hal Downey (Ed.), *The Mast Cells,* Vol. I, Sec. IV, *Handbook of Hematology.* New York: Hoeber (1938).

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Tetrahydropyrimidine Derivatives as Potential Foliage Fungicides

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In the course of a study of the fungitoxicity of some organic chemicals, a group of derivatives of tetrahydropyrimidine was found to constitute a new class of compounds possessing high fungistatic value. Various materials in this class have been prepared and evaluated in the laboratory and greenhouse; results are summarized in this paper.

The 2-alkyl or 2-aryl tetrahydropyrimidines listed in Table 1 were prepared (usually in good yield) by reaction of 2,4-diamino-2-methyl-pentane or 1,3-diaminopropane with the appropriate acid or its methyl or ethyl ester. A side product in the reaction of acid with diamine was the salt of the tetrahydropyrimidine with the starting acid; production of this side product was minimized by heating the reaction mixture above 250° C. 2-Mercapto-4,4,6-trimethyltetrahydropyrimidine was obtained through the reaction of 2,4-diamino-2-methylpentane with carbon bisulfide.

The slide-germination method (*1*) was used for the determination of the fungistatic LD_{50} values. This method consists essentially of placing a given concen-

TABLE 1

FUNGISTATIC LD_{50} VALUES OF TETRAHYDROPYRIMIDINES

	LD_{50} values (ppm)	
	A. circinans	*M. fructicola*
2-Heptyl-4,4,6-trimethyltetrahydropyrimidine	180.0	36.0
2-Undecyl-4,4,6-trimethyltetrahydropyrimidine	2.5	5.0
2-Pentadecyl-4,4,6-trimethyltetrahydropyrimidine	0.54	0.13
2-Heptadecyl-4,4,6-trimethyltetrahydropyrimidine	0.29	0.13
2-(8′-Heptadecenyl)-4,4,6-trimethyltetrahydropyrimidine	1.90	0.78
2-Heneicosyl-4,4,6-trimethyltetrahydropyrimidine	25.0	9.0
2-β-Pyridyl-4,4,6-trimethyltetrahydropyrimidine	800.0	36.0
2-p-Tolyl-4,4,6-trimethyltetrahydropyrimidine	360.0	180.0
2-p-Octylphenyl-4,4,6-trimethyltetrahydropyrimidine	16.0	18.0
2-Phenoxymethyl-4,4,6-trimethyltetrahydropyrimidine	180.0	180.0
2-Mercapto-4,4,6-trimethyltetrahydropyrimidine	2000.0	2000.0
2-Heptadecyltetrahydropyrimidine	5.0	2.5

tration of chemical, and recording percentage germination after incubation for 24 hr at 21° C. The test fungi used were *Monilinia fructicola* (Wint.) Honey and *Alternaria circinans* (Berk. and Curt.) Bolle.

Data obtained in this way are presented in Table 1. It may be seen that in the case of the 2-substituted-4,4,6-trimethyltetrahydropyrimidines the fungistatic effectiveness was strongly dependent upon the nature of the substituent in the 2-position. When this substituent was an *n*-alkyl group, a maximum toxicity to fungus spores was reached at an alkyl chain length of approximately 17 carbon atoms, beyond which fungitoxicity decreased. In this respect these homologs resemble the glyoxalidines (*2*). It may also be seen that those compounds tested having other substituents in the 2-position were less fungitoxic than the *n*-alkyl homologs. The three methyl groups on the ring enhanced the effectiveness of these compounds, as shown by the fact that 2-heptadecyl-4,4,6-trimethyltetrahydropyrimidine was markedly more fungitoxic than 2-heptadecyltetrahydropyrimidine.

Greenhouse tests with these 2-alkyl-4,4,6-trimethyltetrahydropyrimidine homologs have shown that phytotoxicity is at a minimum with the compound containing the 2-heptadecyl group. Late blight of tomatoes [*Phytophthora infestans* (Mont.) deBy.] was controlled in the greenhouse with a spray containing approximately 1.5 oz of this compound/100 gal spray/acre, and phytotoxicity was noted at approximately 6 oz/100 gal spray/acre. Late blight of celery (*Septoria apii-graveolentis* Dorog.) was controlled at 6 oz/100 gal spray, and no injury was noted. No control was obtained on powdery mildew of beans (*Erysiphe polygoni* D. C.), and only moderate control of rust on beans [*Uromyces appendiculatus* (Pers.) Lev.].

Only preliminary field assessment of the efficacy of these compounds has been made. However, successive sprayings in field plots on tomatoes and potatoes have shown that with some formulations there can be an accumulative effect of the tetrahydropyrimidines with injury appearing after 4–6 applications. Phytotoxic response is noted in the form of bronzing and necrosis of the leaves or, in mild cases on potatoes, a rugosity of the foliage.

On the basis of preliminary laboratory and greenhouse tests, it would appear that the alkyltetrahydropyrimidines possess high fungistatic value and merit further testing as foliage fungicides.

References

1. AMERICAN PHYTOPATHOLOGICAL SOCIETY, COMMITTEE ON THE STANDARDIZATION OF FUNGICIDAL TESTS. *Phytopathology*, **33**, 627 (1943).
2. WELLMAN, R. H., and MCCALLAN, S. E. A. *Contribs. Boyce Thompson Inst.*, **14**, 151 (1946).

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Comments and Communications

Preparing Lantern Slides

THE filing system used by Ciba Pharmaceutical Products, Inc. (SCIENCE, **114**, 308 [1951]), is almost identical with that used for filing lantern slides by the Illinois Geological Survey in its handling of geological subjects. When a slide is turned in for filing, it is given a serial number. Several 4″ × 6″ cards are made for each slide for cross-reference purposes. On the left side of each of the cards is mounted a photographic print of the slide, made from the slide negative. The title is typed at the side of the print. Each card receives a subject classification, which is typed across the top of the card; the cards are then filed alphabetically according to the subject classification.

On cards in a separate part of the subject index we have recorded numbers of slides used by staff members to illustrate papers or addresses they have given. These contain title of the paper, date and place of presentation, and numbers of the slides used. One copy is filed with the manuscript.

Several years ago, before converting to the system now in use, we often found it difficult to locate promptly a particular slide because it may have been filed in any one of several major subject classifications. For instance, a slide of a geologic map of Illinois, which also showed locations of coal mines and principal shipping routes, might have been found under "Coal," "Geologic Maps," or "Economics." This situation is not serious in a small collection, when it takes only a few minutes to pick up all the slides filed in several categories and look at them individually. When, however, it means looking at several hundred slides, it is another matter.

An additional advantage of the system now in use is that our 3400 slides and index occupy only 3 sq ft of floor space, much less than was previously needed when viewing racks were used.

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THE preparation of lantern slides is often an arduous and expensive task. For many purposes where clarity alone is essential, it is satisfactory to present the data directly on a glass slide without the use of a photographic procedure. This requires a prior treatment of the glass surface with a bonding material that can be easily marked with pen and ink. A solution of gum damar in xylene has been found quite effective as a bonding material. Glass lantern slide plates are first cleaned and dried thoroughly. A 0.5% solution of gum damar in xylene is either sprayed on the slide by a