absorbed by the fruit for two to three days only. At the end of the third day no uptake occurred. The factor involved is still unknown.

In other experiments, different metabolic inhibitors known to affect respiration were supplied to detached fruits by the same procedure mentioned above. Immediately after application, a rise in the respiration rate started. When cyanide and chloral hydrate were supplied, the fruit softened entirely. When azide and arsenate were used, the basal half of the fruit did not soften. Malonate, a specific inhibitor for the tricarboxylic acid cycle, had no effect.

High CO_2

Since the solution in which the bacteria were grown anaerobically was high in carbon dioxide, the effect of potassium bicarbonate was checked by supplying $KHCO_3$ at 0.3 molar to the fruit. Fruit supplied with bicarbonate ripened three to five days earlier than controls. To check the effect of the pH of the solutions as a possible explanation of the results, hydrochloric acid and sodium hydroxide (0.1 normal) were supplied to the fruit. Fruits supplied with HCl ripened three to four days earlier than the controls, while fruits with NaOH ripened two to three days earlier than the controls which were supplied with water. The bicarbonate effect, therefore, could be due to the high pH. The treatments did not appear to alter the flavor of the fruits.

Sugar content

The sugar content of avocado fruits decreases with age. This may account for the fact that fruit picked early in the season requires longer to reach the climacteric than fruit picked late in the season. These experiments suggest that avocado fruits are dependent on a constant supply of substrates from the leaves. A reduction in the flow of the materials, below a critical level, results in initiation of the ripening processes. Picking of fruit results in the same effect. The characteristics of the substance or substances involved are not known, but sugar may be involved. Ability to control the processes involved in avocado fruit softening requires still further research.

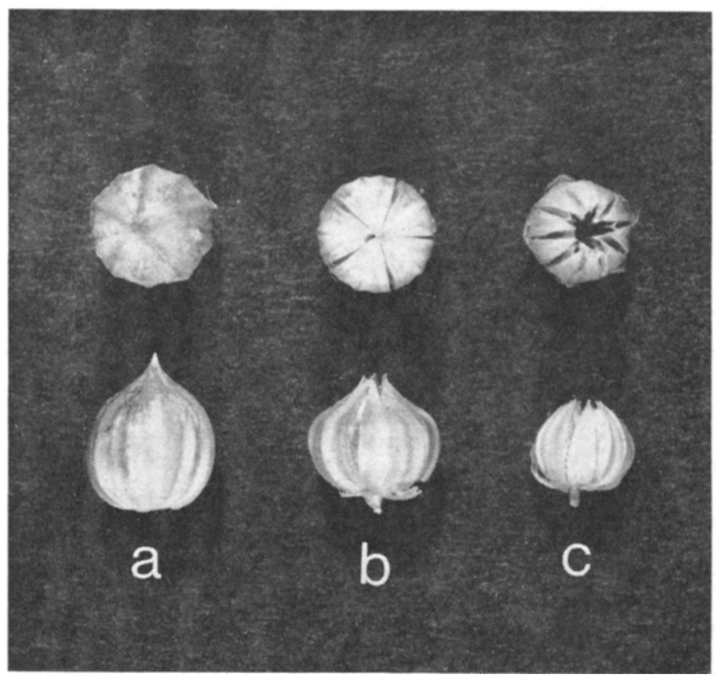
E. Bogin is Research Assistant, and A. Wallace is Professor of Plant Nutrition, Department of Agricultural Sciences, University of California, Los Angeles.

D. M. YERMANOS · S. C. HEMSTREET

Germplasm available for NEW FLAX *. . . with different types*

LINSEED OIL is still preferred by paint manufacturers in spite of keen competition from other seed oils and synthetic materials. For this reason, breeding efforts have always been directed toward flax varieties with high linolenic acid content contributing quick-drying qualities to the oil. To develop different types of linseed suitable not only for paint and varnish, but other industrial uses, U.C. researchers at Riverside began collecting and screening a large number of flax strains to make available germplasm with great variability.

Over 1,500 lines of cultivated flax from the United States and abroad were grown at the Experiment Station at Riverside. Analyses of 350 of these lines which appeared to have above average adaptation to California conditions showed the following percentage ranges in fatty acid composition: palmitic, 4 to 7; stearic, 2 to 4; oleic, 14 to 33; linoleic, 7 to 18; and linolenic 45 to 66%. Iodine values ranged from 162 to 196. Most of these seed collections are genetically heterogeneous. Single plant selections with widely varying oil compositions could probably be made. Striking examples of this possibility are apparent in other oil crops. In rapeseed, samples from single plants of the variety "Liho" had a range of 6 to 50% in erucic acid content. In safflower, mutant types have been found with 75% oleic and 15% linoleic acid in contrast to 20% oleic and 70% linoleic acid, respectively, as found in the commercial varieties grown in California. Thus, when

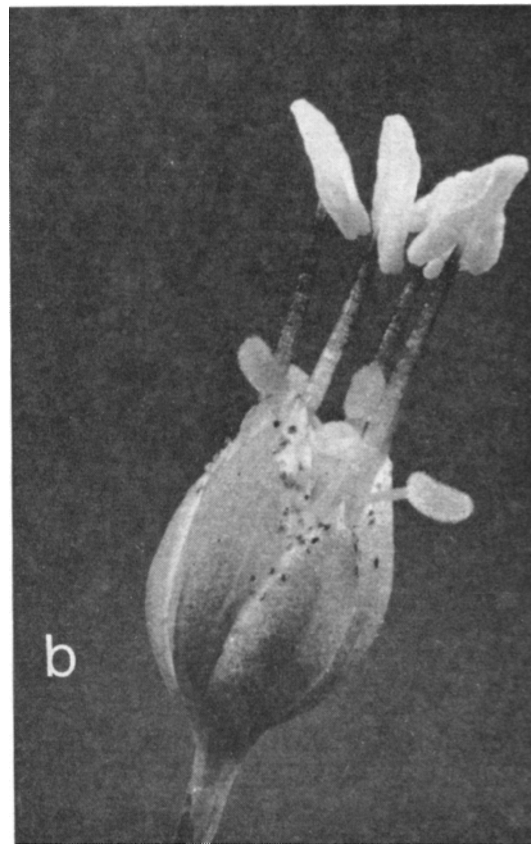


Indehiscent capsule of cultivated flax (a); two types of dehiscent capsules in wild species of flax (b) and (c). (Dehiscence is defined as the bursting open of a pod or capsule at maturity.)

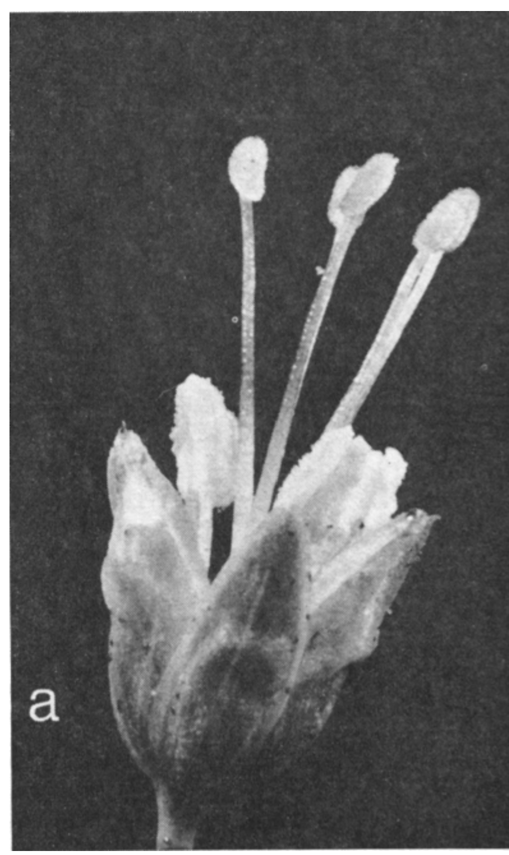
VARIETIES

of oil

Flax-breeding efforts in the past have been directed toward varieties with high linolenic acid content required by paint manufacturers to impart quick-drying qualities to linseed oil. To develop new varieties with oil suitable for other industrial uses and possible use in the human diet, over 1,500 cultivated flax strains and 35 wild species were collected, screened, and analyzed by the Department of Agronomy, University of California, Riverside.



Pin flower (a), of wild flax species with long style, short stamens; thrum flower (b), with short styles, long stamens. Pollen from pin flower will not fertilize the ovary of a pin flower.



single plants from the lines already studied are analyzed, the variability in fatty acid composition and the potential for selection of pure lines with divergent oil composition probably will be greater than these figures indicate.

Edible linseed oil

The high linolenic acid content of linseed oil has excluded it from the edible oil market because this acid is partly responsible for the appearance of undesirable off-flavors in refined oils after processing. The development of edible linseed oil with low or no linolenic acid would be of great significance because it would open a new market for linseed oil and a new source of edible oil for cold-climate countries. Most of the ordinary oil seeds which provide good quality vegetable oils either cannot be grown in countries like Sweden, or yields are too low to be economical. Little research has been directed toward the development of an edible linseed oil, and analyses of flax materials available thus far in the United States and abroad have failed to disclose any flax strains with low linolenic acid content.

Wild species

Recent oil analyses of some wild flax species have generated considerable interest. In general, wild species have the same major fatty acids as the cultivated varieties of flax. However, the relative proportions of these fatty acids had the following broad range of percentages in 35 wild species, as compared with the cultivated flax lines studied: palmitic, 3 to 11; stearic, 1 to 8; oleic, 8 to 33; linoleic, 11 to 69; and linolenic, 3 to 63. Most of the wild species had a high linolenic and low linoleic acid content, but two had less than 5% linolenic and over 65% linoleic acid. Thus, among the wild species valuable germplasm is available for parental material in flax breeding, if appropriate interspecific crosses can be made.

Until recently, only a few combinations of wild and cultivated species of flax were successful. Newer techniques in interspecific hybridization—induced polyploidy (multiplication of chromosome number), growth regulators, embryo culture, etc.—might be effective in bridging the interspecific gap in other cases. Incompatibility is caused primarily by the difference between chromosome number of the wild species and the cultivated species. Also, heterostyly prevents crosses among certain species. Heterostylic flowers (see photo) either have long styles and short stamens (pin type) or short styles and long stamens (thrum type). Pin × thrum or thrum × pin flower crosses are successful, while crosses among pin or among thrum flowers are sterile. Further difficulties are encountered when the seed capsules in most wild species of flax crack open at maturity and the seed shatters (dehiscence, see photo).

Efforts are currently being made to find new uses for linseed oil. In addition to its applications in the paint and varnish industry, linseed oil was shown to be a promising protective agent for concrete surfaces such as highways, dams, silos, garage floors and driveways, etc. Recent information indicates that linseed oil in the human diet could be useful in the prevention and treatment of thrombosis and myocardial infarctions. The flax germplasm now on hand which can lead to different types of linseed oil will increase its adaptability to present uses and to new ones that may develop.

D. M. Yermanos is Assistant Professor, and S. C. Hemstreet is Laboratory Technician II, Department of Agronomy, University of California, Riverside.