Letter to the Editor

Lipids in Dissected Wheat and Other Cereal Grains

Sir:

Zeringue and Feuge published analyses of lipids in dissected triticale, wheat and rye (*JAOCS* 57:373 [1980]) at about the same time as we published similar analyses of lipids in dissected wheat grains (K.D. Hargin and W.R. Morrison, *J. Sci. Food Agric.* 31:877 [1980]; K.D. Hargin, W.R. Morrison and R.G. Fulcher, *Cereal Chem.* 57:320 [1980]). It is clear that they did not appreciate all the problems involved, and as a result they failed to extract all of the grain lipids, the lipids which were extracted suffered extensive lipolysis, and some phospholipids were incorrectly identified. Consequently, their data differ from ours to such an extent that we feel it is necessary to point out where they went wrong.

Zeringue and Feuge soaked their kernels in cold water to soften them prior to dissection. This was undoubtedly the cause of most of the lipolysis (high free fatty acid [FFA] figures). We found it was necessary to use boiling water for 8-10 min to inactivate lipolytic enzymes completely. Omission of similar precautions when analyzing their milled whole kernels would also have caused lipolysis and formation of artifacts (W.R. Morrison, S.L. Tan and K.D. Hargin, *J. Sci. Food Agric.* 31:329 [1980]; S.L. Tan and W.R. Morrison, *JAOCS* 56:531, [1979]).

We cannot identify the fault in their dissection technique, but if their bran fraction contained aleurone (confirmed by the high triglyceride content) then there should have been much more than 4.0-4.6% bran. We found 6.8-8.6% pericarp and 4.0-10.0% aleurone which, added together, gave 12.6-18.5% bran—this is in much better agreement with values in the literature (see review by W.R. Morrison in *Adv. Cereal Sci. Technol.* Vol. 2, edited by Y. Pomeranz, 1978, pp. 221-348).

It is always difficult to assess the completeness of extraction of lipids from cereal tissues, but we think that their results for bran (including aleurone) are far too low because of failure to disrupt the aleurone cells; their results for endosperm evidently do not include the starch lipids. Starch lysophospholipids, which comprise 39-71% of the whole grain phospholipids, can only be extracted with hot, aqueous alcohol mixtures such as water/sat. *n*-butanol at 100 C.

The results given by Zeringue and Feuge in Tables II and IV show evidence of considerable lipolysis (e.g., high FFA, monoglycerides)—we found very little FFA and partial glycerides in sound wheat and maize. Their analyses of phospholipids also seem to be wrong, apart from the omission of starch lysophospholipids. Nobody else has reported phosphatidylethanolamine as the principal phospholipid in these cereals. Since it would be the fastest migrating phospholipid on TLC plates, we believe that most of this material was N-acylphosphatidylethanolamine and its lyso form (the principal nonstarch lipids in endosperm) and variable quantities of phosphatidylbutanol, a well known type of artifact formed in enzyme-active plant tissues during extraction with cold alcoholic solvents. The absence of phospholipids in bran can only be explained as the failure to extract aleurone lipids properly. We found that aleurone and germ lipids in wheat are very similar, and both contain 14-17% phospholipids; similar lipids are found in barley aleurone (R.D. Firne and H. Kende, *Plant Physiol.* 54:911 [1974]).

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ERRATUM

In the article "HPLC Separation of Natural Oil Triglycerides into Fractions with the Same Carbon Number and Numbers of Double Bonds" appearing in the November issue of *JAOCS* (Petersson, Podlaha and Töregård 58: 1005 [1981]) three errors were printed: 1. p. 1006, left column, second paragraph: the amount of the oil samples injected is 2,000 μg, not 200 μg. 2. Table IIIB, under the heading "Main TG type:" The third TG type "M-D-L" should read "M-O-L." 3. Fig. 1, last chromatogram: the TG type notations over the second and third peaks should read, respectively, LLLn and OLnLn instead of OLnLn and OLLn.