with the spectrum of the standard Ct C and relative intensities of the 10 most intense peaks were in good agreement, also, with m/e 43 being the base peak. While the overall spectrum of Eversweet cotyledon extract was similar to the spectrum of Ct C (base peak 43), the only peak found in the high mass region was m/e 499.

CONCLUSIONS

Thin-layer and mass spectral data confirmed the only Ct found in the fully expanded cotyledons of Palomar and PI to be Ct C. The amount of Ct C in PI was much less than in Palomar.

A compound from Eversweet cotyledons was shown to be similar but not identical in chromatographic and mass spectral data to Ct C. It was surprising to find a compound so similar to Ct C in the nonbitter cultivar Eversweet since all cucurbitacins impart a bitter taste to the plant. Further research may indicate that this compound is either a precursor or a derivative of a cucurbitacin.

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Condensed Tannins in Kernels of Thirty-one Pecan [*Carya illinoensis* (Wangenh) K. Koch] Cultivars

Thirty-one pecan cultivars or seedling nut meats were assayed for condensed tannin content. There was expected variation in total condensed tannin content of the different cultivars.

Tannins contain many phenolic hydroxyl groups that enable them to form stable cross-linkages with proteins and other macromolecules. Tannins characteristic of the pecan [*Carya illinoensis* (Wangenh) K. Koch] species are partly responsible for the kernel coloration; they are found in high quantities in the shuck and corky middle portion of the nut and to a lesser extent in the hull and kernel (Brison and Cain, 1957; Polles et al., 1979). Reports on the role of tannins or tannin-like compounds in the pecan are limited (Senter and Forbus, 1978).

Thirty-one cultivars or seedling nut meats were assayed for condensed tannin content to establish values that could be used in evaluating these pecan types in light of the aforementioned references.

MATERIALS AND METHODS

Fresh pecan meats of 31 types were extracted from the hull, separated from the packing material, and finely chopped. Pecan nut samples were collected from five trees for each variety in the summer of 1978. An aliquot meat sample was taken for each variety from a 227-g sample. Three 100-mg portions from each type of meat were weighed into separate 30-mL Corex centrifuge tubes, and 5 mL of 5% HCl in 1-butanol (Swain and Hillis, 1959) was added to each tube. The meats were then homogenized with a Polytron homogenizer for 30 s. After homogenization, the tubes were immersed in a boiling water bath for 1 h, removed, and centrifuged, and the contents were diluted 1:5 v/v with 1-butanol. The absorbance was read on a spectrophotometer at 550 nm, and the percent tannin was computed from a standard curve made from condensed tannin obtained from A. C. Waiss, Jr. The curve was linear in the range observed and had the equation mg of tannin = $0.0534A + 0.00187$. The variation among samples was determined by ANOV. Means of determinations were then separated by Duncan's multiple range ($p = 0.05$).

RESULTS AND DISCUSSION

Table I lists the percent condensed tannin found in 31

Table I. Percent Condensed Tannins of Pecan Meats

cultivar	% tannin[a]
Shoshoni	1.710 a
Forkert	1.526 b
Wichita	1.398 bc
Kernodle	1.276 cd
Apache	1.257 cd
Caddo	1.193 de
Lewis	1.117 def
Farley	1.110 def
Harris-Super	1.088 def
Seedling-3	1.040 efg
Mahan	1.039 efg
Mohawk	1.032 efg
Sumner	1.007 efgh
Shawnee	0.995 efghi
Joe-Wright	0.994 efghi
Hale	0.970 fghi
Cape-Fear	0.917 fghij
Barton	0.911 fghij
Stuart-Mahan	0.870 ghij
Success	0.852 ghij
Kiowa	0.845 ghij
Curtis	0.839 ghij
Dependable	0.828 ghij
Candy	0.826 ghij
Big-Z	0.809 hij
Schley	0.789 hij
Seedling-2	0.785 ij
Choctaw	0.779 ij
Desirable	0.742 j
Stuart	0.736 j
Jackson	0.699 j

[a] Means followed by the same letter are not significantly different at the 0.05 level of probability by Duncan's multiple range test.

types of pecan nut kernels. The range of condensed tannin, 0.699–1.710%, represents significant differences among cultivars.

Forbus and Smith (1971) showed that tannins can leach from the shell into the meats during the preconditioning soak before cracking the pecans in the shelling process. Knowledge of the quantities of condensed tannins already present in the meats coupled with that leached from the shell could indicate those pecan types more suitable for processing with minimum loss of quality.

Earlier works have alluded to the relationship of certain tannin constituents on nut meat color and flavor stability (Heaton et al., 1975; Senter and Forbus, 1978). The range of condensed tannin content found in the 31 types of pecan meats in this study could provide a basis for quantitative determination of the effects condensed tannins have on nut meat color and flavor stability. Condensed tannins are astrigent and, above a certain level, may reduce palatability (Bate-Smith, 1972). Possibly the level of condensed tannins in pecan kernels is related to their flavor and acceptability and could be used as a trait for testing the desirabiltiy of cultivars.

Tannins have also been implicated in plant resistance to pathogens and insects in various plants (Beck and Reese, 1974; Feeney, 1976). Perhaps the level of condensed tannins and other components found in various pecans is related to their insect and disease resistance.

In summary, we have presented, for the first time, data showing variation in the total condensed tannin content of 31 types of pecan meats. This should provide a basis from which to further research the role of condensed tannins in the pecan.

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