spores, the manner in which ascospores become labeled, and the isolation and identification of exometabolites produced by labeled strains of the fungus.

References and Notes

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3. J. E. Kuntz, C. H. Beckman, and A. J. Riker, *ibid.* **42**, 13 (1952).
4. C. H. Beckman *et al.*, *ibid.* **42**, 2 (1952).
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6. We are indebted to R. F. Nystrom, University of Illinois Radiocarbon Laboratory, for supplying the labeled sucrose and for technical advice.
7. Per liter: KH_2PO_4, 0.5 g; $MgSO_4 \cdot 7H_2O$, 0.25 g; asparagine, 1.0 g; yeast extract, 1.0 g; sucrose, 20.0 g; distilled water, q.s.
8. Dried drops of the last wash water failed to show evidence of radioactivity in autoradiographs after 30 days or more of exposure.
9. Robert A. Reitz, of the University of Illinois Betatron Laboratory, supplied the emulsions and developed certain autoradiographs.
10. The average differences above background of the counts obtained with ascospore masses indicated odds of 9:1 that the difference was not due to chance alone.
11. The oak wilt fungus was reisolated from seedlings inoculated with labeled ascospores and conidia; but, probably because of attenuation of the labeling, no significant radioactivity readings were obtained from the isolations.
12. Gross determinations of C^{14} activity were made with a G-M monitor having sensitivity of 10^{-2} to 10^{-3} μc. Where specified, they are given as counts per minute above background and are considered significant.

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Waxy Constituents of the Saw Palmetto, *Serenoa repens* (Bartr.) Small

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Serenoa repens (Bartr.) Small (*1*), commonly called the saw palmetto and often incorrectly called the scrub palmetto, is the most abundant palm in the United States. It occurs in wide distribution in the southeastern and southern states, ranging from South Carolina to the Florida Keys and along the Gulf Coast to Louisiana (Fig. 1).

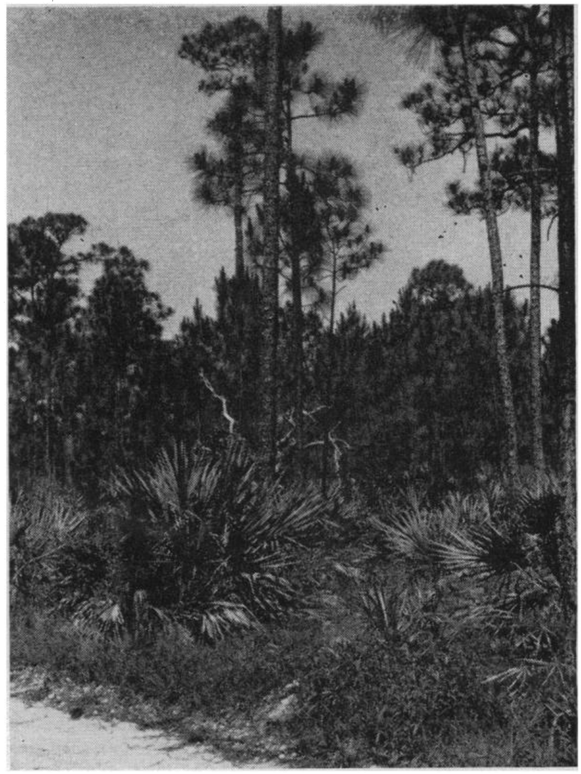

Fig. 1. Saw palmetto undergrowth in a slash pine (*Pinus caribaea* Morelet) woods. This is a common ecological pattern.

Although considered somewhat of a weed because it is so ubiquitous, it was found useful in industrial application during World War II when it yielded an accepted cork substitute that could be processed from the soft tissue of the stem (*2*). Other potential uses include tannin source (*3*), fibers, wallboard, and paper.

Because the world market can always appreciate a new hard vegetable wax to supplement existing commercial waxes, such as carnauba (*Copernicia cerifera*), candelilla (*Euphorbia antisyphilitica*), ouricuri (*Syagrus coronata*), sugar-cane wax (*Saccharum officinarum*), and others, recent attention was given to the saw palmetto as a source of wax. In previous field observations, we had noted the waxy bloom.

The leaves used in this study were collected in southern Florida. They were sun-dried, using the technique commonly practiced by harvesters of carnauba in Brazil. The wax was removed from the leaves by brushing off the free-flaking wax first and then by solvent, extracting the entire leaf with heptane to determine total extractables. The free-flaked wax was essentially the same in character as the solvent-extracted wax. The characteristics of the sample of wax examined are as follows:

Acid number	16.3
Saponification number	101.5
Melting point	81.2°C
Iodine number	9.8
Needle penetration, 100 g/5 sec	< 1

The wax is hard, brown in color, and somewhat resinous in appearance. Considering its qualities for possible use in naphtha-type polish products, it has a precipitation temperature of 98°C, which unfortunately is unusually low for a hard vegetable wax. A gel formation that occurs in naphtha containing 18 percent solids is firm, although it is grainy and has poor solvent retention. The wax contains about 13 percent of resinous material, of which 6.5 percent is soft and tacky and can be removed by leaching the powdered wax with cold (25°C) acetone, and 6.5 percent is hard resinous material that is insoluble in boiling isopropanol. Although this 13 percent of resinous material is lower than what one finds in candelilla wax (20 percent) the near absence of resinous material in carnauba is a better criterion of a good vegetable wax.

The leaf sizes, when compared with carnauba, were found to be relatively small, having a dry weight ranging from 35 to 58 g, which is considerably smaller than the 150-g average for the Brazilian palm. In a group of selected leaves, the free-flaking yields ranged from 1.44 to 2.7 g of wax based on 100 g of leaf. Solvent stripping of these leaves indicated an average total wax yield of 5.81 g/100 g of leaf. The average yield for all leaves on the basis of total solvent extractables was about 4.9 g/100 g of leaf, a surprisingly high yield, almost equivalent to carnauba. However, carnauba wax is nearly totally free-flaking, while the palmetto is only partly so. The only present commercial processes for harvesting wax from this type of palm leaf utilize mechanical methods requiring a free-flaking leaf. The yields by solvent stripping may be of little practical interest at present.

Although this wax could represent a new valuable raw material for some wax-consuming industries, the polish manufacturers would most likely find it of less value than the principal hard vegetable waxes now on the market.

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Relationship of Adrenalin to Tissue Sulfhydryl Compounds

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Such treatments as restraint (*1*), exposure to cold (*2*), and exposure to cold and restraint (*3*) have been shown to cause a lowering of the total nonprotein sulfhydryl concentration (TSH) of the liver. Since these several physiological stresses cause a drop in liver TSH, the possibility exists that the stresses elicit a general response which is the more immediate cause of the changes in the concentration of the sulfhydryl compounds. It is known that the sympatho-adrenal mechanism is activated by such stresses as these. To test the possibility of such a mechanism, rats were injected with adrenalin, and the effect on tissue TSH was compared with saline-injected controls (*4, 5*).

Healthy adult female Sprague-Dawley rats were used. The 60 animals were divided into two groups—30 control animals injected with isotonic saline and 30 animals injected with adrenalin. A 1 : 10,000 solution of adrenalin hydrochloride was injected subcutaneously—1.0 ml initially and 0.5 ml each half-hour over a period of 4½ hr. The control animals were similarly injected with isotonic saline. All the animals were stunned with a blow on the head; blood was obtained by cardiac puncture, and the tissues were excised immediately and frozen with dry ice. Ergothioneine (ESH) was determined by a modified method of Hunter (*6*), and TSH was determined by amperometric titration, using a modification of the method of Benesch and Benesch (*7*).

As is shown in Table 1, subcutaneous injections of adrenalin produced no significant change in the ESH of the blood or the liver or in the TSH of the blood or muscle. However, there was a significant drop in the TSH of the liver and the kidney. The fall in TSH in each of these organs were approximately 35 percent of the control value. It should be noted that, since there was no change in liver ESH, changes in glutathione (GSH) levels must largely account for the changes observed in TSH. These results add credibility to the hypothesis that sympathetic stimulation with adrenal medullary activation is the active agent in the lowering of the concentrations of these compounds in the afore-mentioned general physiological stresses.

The data showing no change in muscle TSH with adrenalin injection are in agreement with the work of Ilín (*8, 9*), who used cats and measured GSH rather than TSH. Zunz and Vesselousky (*10*) obtained an increase in blood GSH concentration after intravenous injections of adrenalin in cats. However, in the present study, no measurable change in erythro-

Table 1. The effect of injection of adrenalin on tissue nonprotein sulfhydryl compounds.

Organ	Sulfhydryl analyzed	Sulfhydryl (μM %)	
		Controls (saline injected)	Adrenalin injected
Whole blood*	TSH†	107 ± 4.4‡ (8)§	112 ± 4.4 (8)
	ESH‖	31 ± 1.6 (8)	34 ± 2.3 (7)
Liver	TSH	799 ± 10.3 (30)	506 ± 8.5 (30)
	ESH	63 ± 1.3 (10)	62 ± 2.1 (10)
Kidney	TSH	444 ± 19.7 (10)	280 ± 11.1 (10)
Muscle	TSH	106 ± 5.1 (10)	101 ± 3.1 (10)

* No significant difference in hematocrits; average, 43.9 percent.
† Total nonprotein sulfhydryl.
‡ Standard error of the mean.
§ The number in parentheses represents the number of animals in each group.
‖ Ergothioneine.