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**A Novel Lipid Pathway is Responsible for the Massive Quantity of Surface Wax on Bayberry Fruit**

Understanding lipid synthesis may inform efforts to engineer plants for secretion of high value lipids

**The Science**

To gain insight into how Bayberry fruits produce the highest amount of surface lipid known in nature, the authors examined the chemical and morphological development of the Bayberry wax layer, monitored its biosynthesis through radiolabeling studies, and identified transcripts for enzymes and proteins expressed during Bayberry surface wax production. The biochemical and expression data together indicate that Bayberry surface glycerolipids are synthesized by a pathway for triacylglycerol synthesis that is related to cutin biosynthesis, rather than conventional triacylglycerol assembly.

**The Impact**

This study discovered a novel pathway that produces large quantities of extracellular lipids. The Bayberry fruit’s combination of a unique surface wax and massive accumulation may aid understanding of how plants produce and secrete non-membrane glycerolipids and also how to engineer alternate pathways for high value lipid production in biomass crops.

**Summary**

The objective of this study was to discover how Bayberry fruits achieve massive accumulation of a unique surface wax with a structure similar to triacylglycerol seed oils. Research on plants that produce such large amounts of surface lipids may provide insights into the molecular features and biochemical pathways for plant lipid secretion and may help develop strategies to engineer lipid production in non-seed tissues. This work began by examining changes in fruit anatomy, details of the chemical structures secreted by Bayberry fruits, and quantifying the accumulation of wax through fruit development. Biochemical pathway analysis by [14C]-labeling and transcript analysis by RNA-seq revealed features of Bayberry wax accumulation that are distinctly different from conventional triacylglycerol production. Together, these results indicate that the extracellular glycerolipids in Bayberry wax are synthesized by a novel pathway that differs from previously defined triacylglycerol biosynthesis pathways. An increased understanding of this process may prove useful in engineering plants for secretion of high energy and high value lipids, particularly those that have toxic or negative consequences when accumulated inside cells.

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**Publications**

J.P. Simpson and J.B. Ohlrogge, “A Novel Pathway for Triacylglycerol Biosynthesis Is Responsible for the Accumulation of Massive Quantities of Glycerolipids in the Surface Wax of Bayberry (*Myrica pensylvanica*) Fruit**.”** *The Plant Cell*, **28, 248** (2016) [DOI: 10.1105/tpc.15.00900]

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