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Physiological and morphological attributes of shortleaf × loblolly pine F1 hybrid seedlings: is there an advantage to being a hybrid?

Curtis J. Lilly, Rodney E. Will, and Charles G. Tauer

Abstract: Fire suppression and other anthropogenic activities have the potential to eliminate ecological barriers that previously kept related, sympatric species from interbreeding. We compared artificial F1 shortleaf pine (*Pinus echinata* Mill.) × loblolly pine (*Pinus taeda* L.) hybrids with their parents to determine potential traits that have allowed hybrid seedlings to dramatically increase in abundance since 1950s. Six open-pollinated families each of loblolly and shortleaf pine as well as 12 controlled crosses were compared over 2 years in Oklahoma, USA. Loblolly and hybrid seedlings had higher establishment and growth rates than shortleaf pine. The hybrid seedlings had similar numbers of sprouts following top-clipping as shortleaf, which were higher than those of loblolly pine. Formation of a strong basal crook, an adaptation to protect dormant buds from fire, was greatest in shortleaf and lower in hybrid and loblolly pine. Instantaneous water use efficiency indicated that hybrid pine had similar high water use efficiency as shortleaf pine compared with loblolly pine. In the absence of fire, the hybrid seedlings perform at least as well as the parent species, which points out the importance of fire to eliminate hybrids and maintain the genetic integrity of shortleaf pine native to fire-prone, xeric sites.

Résumé : La suppression du feu et d'autres activités anthropiques ont la capacité d'éliminer les barrières écologiques qui empêchaient autrefois les croisements entre les espèces sympatriques qui sont reliées. Nous avons comparé des hybrides artificiels F1 entre le pin à courtes feuilles (*Pinus echinata* Mill.) et le pin à encens (*Pinus taeda* L.) à leurs parents pour déterminer les traits potentiels qui ont permis aux semis des hybrides d'augmenter de façon dramatique en abondance depuis les années 1950. Six familles à pollinisation libre de pin à courtes feuilles et six autres de pin à encens ainsi que 12 croisements contrôlés ont été comparés sur une période de deux ans en Oklahoma, aux États-Unis. Les semis de pin à encens et des hybrides avaient des taux d'établissement et de croissance plus élevés que les semis de pin à courtes feuilles. À la suite d'un étêtage, les semis des hybrides avaient un nombre de rejets semblables à ceux du pin à courtes feuilles et plus grand que ceux du pin à encens. La formation d'un coude basal robuste, une adaptation qui protège les bourgeons dormants du feu, était plus importante chez le pin à courtes feuilles et moins importante chez le pin à encens et les hybrides. L'efficacité d'utilisation de l'eau instantanée indiquait que les pins hybrides avaient une efficacité d'utilisation de l'eau élevée, semblable à celle du pin à courtes feuilles, comparativement à celle du pin à encens. En l'absence de feu, les semis des pins hybrides performaient au moins aussi bien que les espèces parentales, ce qui fait ressortir l'importance du feu pour éliminer les hybrides et conserver l'intégrité génétique du pin à courtes feuilles qui est présent naturellement dans les stations xériques sujettes aux incendies.

[Traduit par la Rédaction]

Introduction

Rapid introgression, i.e., the flow of genes into a species through hybridization and backcrossing with another, implies human causation and can lead to extinction (Allendorf et al. 2001). Species introductions and subsequent interbreeding among related, but previously separated, taxa is a common cause of introgression. However, anthropogenic factors such as fire suppression and climate change might lead to increased hybridization among taxa that previously co-occurred but were ecologically isolated. For instance, fire suppression removes an important selection pressure against species that lack fire-adapted traits and climate change alters phenology and shifts species niches. Increased introgression imperils the genetic integrity of tree species and might lead to unintended and deleterious outcomes.

Loblolly pine (*Pinus taeda* L.) and shortleaf pine (*Pinus echinata* Mill.) co-occur across much of the southeastern United States (Little 1971). Historically, hybrids of these two species were occasionally identified and were more common west of the Mississippi River (Raja et al. 1997; Tauer et al. 2007). Between the 1950s and 2010, however, hybridization dramatically increased across the Southeast. When comparing

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C.J. Lilly[*], **R.E. Will, and C.G. Tauer.**[†] Department of Natural Resource Ecology and Management, 008C Agricultural Hall, Oklahoma State University, Stillwater, OK 74078, USA.

Corresponding author: Rodney Will (e-mail: rodney.will@okstate.edu).

[*]Present address: Campbell Group, 300 Champions Drive, Apt. 211, Lufkin, TX 75901, USA.
[†]Present address: 222 Silver Loop, Silverton, OR 97381, USA.