Cell cycle in the phytopathogenic fungus's dikaryotes.

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Introduction

A dikaryon is a cell in which the two nuclei—one from each parent cell—share a common cytoplasm for a while without going through nuclear fusion in a big group of fungus. A major group of fungi called the Basidiomycota, which includes mushrooms, bracket fungus, and numerous phytopathogenic fungi like the maize disease Ustilago maydis, is known for its regular life cycles that include the dikaryon stage. Yet, it is unclear how this route is engaged during the production of dikaryons and how its activation and deactivation are coordinated with the various cell cycle phases. To answer these questions, we offer and explore numerous hypotheses below. The virulence and sexual development of the phytopathogenic fungus Ustilago maydis are intimately linked. The mating of two compatible budding haploid cells results in the formation of an infective dikaryotic filament, which is necessary for the infectious stage to develop. The dikaryotic stage takes control of the time of growth that takes place during the infectious phase once the fungus has entered the plant tissue. Dikaryons are cells that share a common cytoplasm for a prolonged length of time without experiencing nuclear fusion. They have two nuclei, one from each parent cell. A complex cell cycle that depends on coordinated nuclear division and the growth of specialized projections is necessary for maintaining the dikaryotic state. Created not far from where the future septum would have formed. As a result, mitosis takes place in two different cell compartments: the developing clamp cell, where one nucleus enters and divides, and the main hypha, where the other nucleus divides. These mechanisms occur in the G2 phase, which must be appropriately expanded for this [1].

A heterodimeric homeodomain transcription factor called the b-complex, whose components (bW and bE) are given by each compatible mating partner, regulates the development and maintenance of dikaryotic growth. Although the specifics of these relationships remained mostly unknown, it was long assumed that the b heterodimer and cell cycle regulation were related. The production of a b-heterodimer activated two DNA damage checkpoint kinases, and this activation led to a brief stoppage of the G2 cell cycle, which most likely provided the window of opportunity for dikaryon cell division [2].

Nonconsensual creatures typically have two haploid genomes—one from each parent—joined in a single diploid zygote nucleus, which determines their fate throughout development. Basidiomycete fungi are an intriguing exception to this rule since they can still fertilise other monokaryons because the two haploid genomes of a dikaryon stay distinct. It is mainly unknown how the nuclear competition that results affects the equilibrium of selection within and between individuals. We examine the effects of the dikaryotic life cycle on aspects of fitness at the mycelium level and mate selection. We postulate a trade-off between the fitness of the fungus' mycelium and mating fitness at the level of the haploid nucleus. We demonstrate that dikaryons maintain their ability to fertilise, which results in a larger percentage of fertilised monokaryons, but that this intradikaryon selection for improved nuclear mating fitness reduces mycelium fitness in comparison to a diploid life cycle. In contrast to a fictitious life cycle in which dikaryons can also swap nuclei, this fitness loss is smaller. Hence, preventing dikaryon fusion lowers the level of nuclear parasitism. The number of loci that affect fitness is a key factor in determining how much the average mycelium's fitness is diminished. Importantly, a trade-off between nucleus and mycelium-level fitness determines the study's conclusions. We analyse the supporting data for this claim as well as the ramifications of a different hypothesis that there is a positive correlation between nucleus and mycelium-level fitness [3].

A dikaryon stage's potential advantages have been under consideration for some time. The existence of the dikaryotic stage highlights the intensity of selection on the individual nuclei, which is sometimes disregarded in talks of fungi's evolutionary history. The constant selection for mating success caused by the prolonged connection of unrelated haploid nuclei may be to the individual's harm. Our findings demonstrate the possible costs of selection at the nucleus level for mating for fitness components at the mycelium level and how those costs might be minimised. In contrast to entirely unrestricted exchange between dikaryons, confining dikaryon fertilisation to monokaryons lowers the degree of nuclear mating fitness and preserves greater mycelium-level fitness. Second, if the variation in mating fitness and the trade-off that goes along with it are limited a single locus, the costs to mycelial level fitness are reduced [4].

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