Many species of wind-dispersing microscopic animals, such as rotifers, nematodes, and tardigrades, have evolved from biparental ancestors to reproduce uniparentally. Uniparental reproduction is advantageous during dispersal because a lone individual can reproduce in a new environment without needing a mate. Uniparental reproduction has evolved independently several times in these taxa, with different mechanisms resulting in distinct allele inheritance patterns. Our research explores the evolutionary consequences of different mechanisms of uniparental reproduction in terms of colonization success. We contrasted mitotic parthenogenesis (production of clonal female offspring without fertilization) and hermaphroditism (individuals carry both male and female gametes, enabling self-fertilization). Using computational simulations, we tested the hypotheses that 1) parthenogens achieve higher colonization success when the new environment is similar to the ancestral environment because they do not experience inbreeding depression, and 2) hermaphrodites achieve higher colonization success when the new environment differs from the ancestral environment because they produce greater genetic variation which improves their adaptability. We simulated events in which an individual from a source biparental population disperses to a new environment after adopting either parthenogenesis or hermaphroditism, and subsequently either successfully colonizes or faces extinction. Our results confirm the expected costs and benefits of parthenogenesis and hermaphroditism during colonization and help discern probable evolutionary paths from biparental to uniparental reproduction.