Plastids are usually uni-parentally inherited and genetic recombination between these organelles is seldom observed. The genus *Pseudo-nitzschia*, a globally relevant marine diatom, features bi-parental plastid inheritance in the course of sexual reproduction. This observation inspired the recombination detection we pursued in this paper over a ~1,400-nucleotide-long region of the plastidial *rbcL*, a marker used in both molecular taxonomy and phylogenetic studies in diatoms. Among all the *rbcL*-sequences available in web-databases for *Pseudo-nitzschia*, 42 haplotypes were identified and grouped in five clusters by Bayesian phylogeny. Signs of hybridization were evident in four of five clusters, at both intra- and interspecific levels, suggesting that, in diatoms, (i) plastidial recombination is not absent and (ii) hybridization can play a role in speciation of *Pseudo-nitzschia* spp.