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## The spreading from

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This paper is concerned with a free boundary problem describing the spreading of a species in a reaction-diffusion model. The local existence and the asymptotic behavior of the free boundaries are studied. It is proved that two free boundaries tend to infinity as time goes to infinity, and the free boundary problem has a unique solution. If the intra-specific competitions are weak, there exists a unique solution.

**Keywords:** Free boundary; reaction-diffusion; asymptotic behavior.

**Mathematics Subject Classification:** 35R85, 35K57, 35K59, 35K65, 35K67, 35K70, 35K75, 35K80, 35K85, 35K90, 35K95, 35L05, 35L10, 35L15, 35L20, 35L25, 35L30, 35L35, 35L40, 35L45, 35L50, 35L55, 35L60, 35L65, 35L70, 35L75, 35L80, 35L85, 35L90, 35L95, 35M01, 35M02, 35M03, 35M04, 35M05, 35M06, 35M07, 35M08, 35M09, 35M10, 35M11, 35M12, 35M13, 35M14, 35M15, 35M16, 35M17, 35M18, 35M19, 35M20, 35M21, 35M22, 35M23, 35M24, 35M25, 35M26, 35M27, 35M28, 35M29, 35M30, 35M31, 35M32, 35M33, 35M34, 35M35, 35M36, 35M37, 35M38, 35M39, 35M40, 35M41, 35M42, 35M43, 35M44, 35M45, 35M46, 35M47, 35M48, 35M49, 35M50, 35M51, 35M52, 35M53, 35M54, 35M55, 35M56, 35M57, 35M58, 35M59, 35M60, 35M61, 35M62, 35M63, 35M64, 35M65, 35M66, 35M67, 35M68, 35M69, 35M70, 35M71, 35M72, 35M73, 35M74, 35M75, 35M76, 35M77, 35M78, 35M79, 35M80, 35M81, 35M82, 35M83, 35M84, 35M85, 35M86, 35M87, 35M88, 35M89, 35M90, 35M91, 35M92, 35M93, 35M94, 35M95, 35M96, 35M97, 35M98, 35M99, 35N01, 35N02, 35N03, 35N04, 35N05, 35N06, 35N07, 35N08, 35N09, 35N10, 35N11, 35N12, 35N13, 35N14, 35N15, 35N16, 35N17, 35N18, 35N19, 35N20, 35N21, 35N22, 35N23, 35N24, 35N25, 35N26, 35N27, 35N28, 35N29, 35N30, 35N31, 35N32, 35N33, 35N34, 35N35, 35N36, 35N37, 35N38, 35N39, 35N40, 35N41, 35N42, 35N43, 35N44, 35N45, 35N46, 35N47, 35N48, 35N49, 35N50, 35N51, 35N52, 35N53, 35N54, 35N55, 35N56, 35N57, 35N58, 35N59, 35N60, 35N61, 35N62, 35N63, 35N64, 35N65, 35N66, 35N67, 35N68, 35N69, 35N70, 35N71, 35N72, 35N73, 35N74, 35N75, 35N76, 35N77, 35N78, 35N79, 35N80, 35N81, 35N82, 35N83, 35N84, 35N85, 35N86, 35N87, 35N88, 35N89, 35N90, 35N91, 35N92, 35N93, 35N94, 35N95, 35N96, 35N97, 35N98, 35N99.

## 1. Introduction

In this paper, we consider the following free boundary problem:

$$\begin{cases} u_t - d_1 u_{xx} = u(a_1 - b_1 u + c_1 v), \\ v_t - d_2 v_{xx} = v(a_2 + b_2 u(t - \tau) - c_2 v), \\ u(t, x) = 0, \\ u = 0, \quad h'(t) = -\mu \frac{\partial u}{\partial x}, \\ u = 0, \quad g'(t) = -\mu \frac{\partial u}{\partial x}, \\ -g(0) = h(0) = b \quad (0 < b < \infty), \\ u(t, x) = u_0(x) \geq 0, \\ v(t, x) = v_0(x) \geq 0, \end{cases}$$