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A Peculiar Linearly Cover Variant of Amensalsim in Mathematical Ecology with Restricted Resources: Case(IV)

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Abstract

The structure of this model is made up of two nonlinear differential equations of the first order. They are both standing in for the Amensal and the Enemy Species. The effects of decline rate of enemy species due to natural restrictions *on the formed model are analysed and discussed in this paper. The Amensal Species has restricted resources and a cover defence that varies linearly, providing them with some measure of safety from the assaults of enemy species. When further investigation is carried out, the necessary graphs have been illustrated with it so that the nature of the relationship with interactions between the two species can be observed more closely.*

1.Introduction:

K.V.L.N.Acharyulu and N.Ch.Pattabhi Ramacharyulu explored the local and global stabilities of an Ammensal-enemy ecological model by forming quasi-linear basic equations [2-9]. In past research, An Ammensal-enemy eco-system with varied resources was analysed for stability under various situations.Some scholars, such as, pioneered new eras[1,10-18] by establishing efficient ways for resolving a number of obstacles when investigating species interactions. This study's main goal is to examine how the two species interact owing to enemy species' natural decrease rate.

2.Basic Equations of the Considered Model:

A strange linearly cover variant of Amensalsim with Limited Resources in Mathematical Ecology are considered as

dX/dt = aX- bX^2-c (X-(d+eX))Y

dY/dt =fY-gY^2

Here x and y stand for Amensal and Enemy growth rates respectively. The natural growth rates of Amensal and enemy species are referred as a and f. c is the Amensal coefficient**.**

b and g are the two species' decline rates due to natural resource restrictions. d+ex is the Ammensal population, which protected from the attacks of enemy species by maintaining constant values for d and e.

3.Case(i): The influence of g on Ammensal-Enemy Model

For investigating the interaction between Ammensal and Enemy Species, the following values of concerned parameters are considered.

Table(1)

a	b	c	d	e	f	g	X_0	Y_0
1.1100	0.889	2.515	0.875	0.67	0.859	changes	0.134	0.366

The impact of changing the parameter g on the model in view of possible Dominance time instincts .

Table(2)

S.NO	g	t_1^*	t_2^*
1	0.0590	0.375	2
2	0.1720	0.37	2.75
3	0.2190	0.365	2.60
4	0.3750	0.36	3.85

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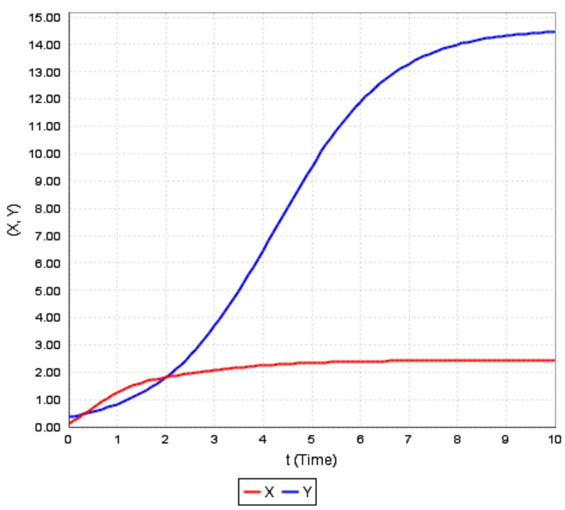
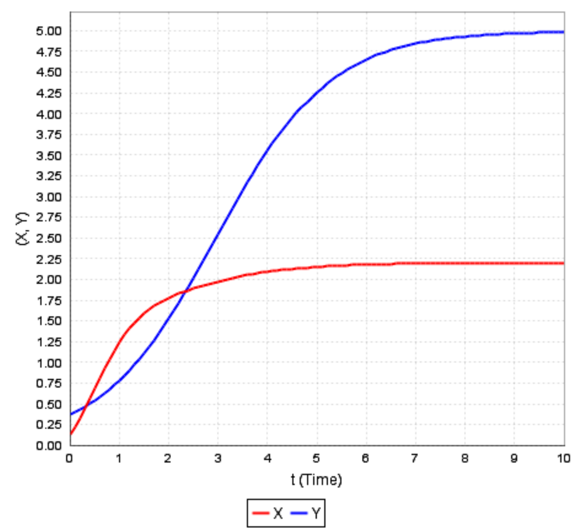
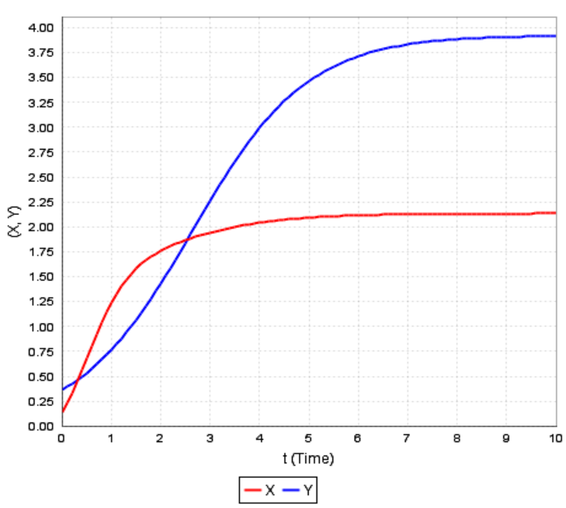
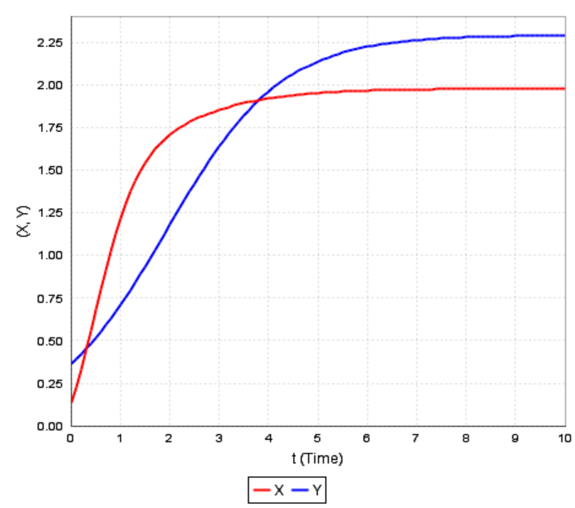
5	0.4910	0.32	*
6	0.5910	0.3	*
7	0.7310	0.295	*
8	0.8160	0.29	*
9	0.9560	0.28	*

Fig(1) to Fig(10): when a=1.1100,b=0.889,c=2.515, d=0.875,e=0.67,f=0.859,,X_0=0.134,Y_0=0.366 Vs change in g









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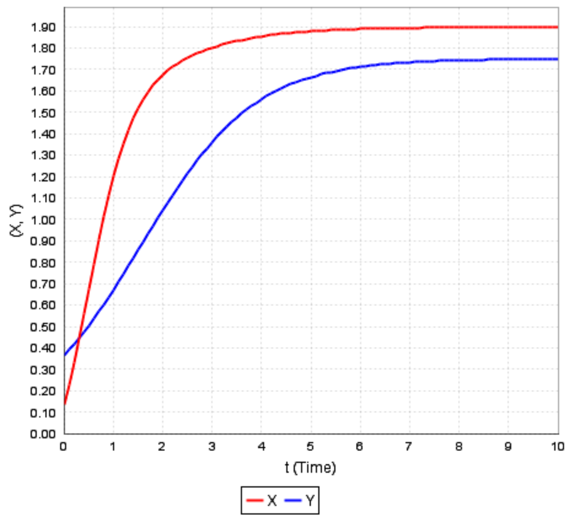

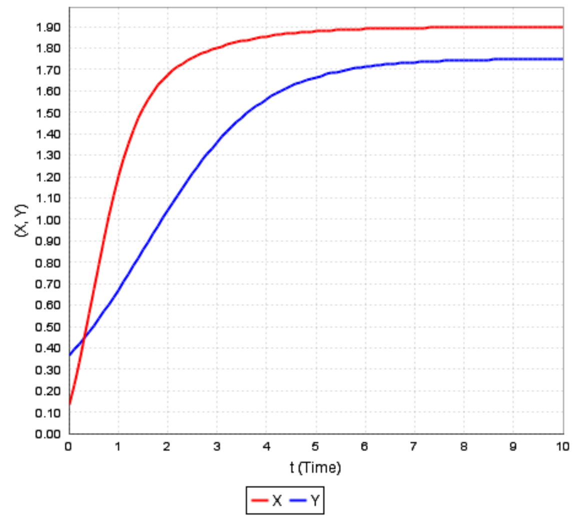

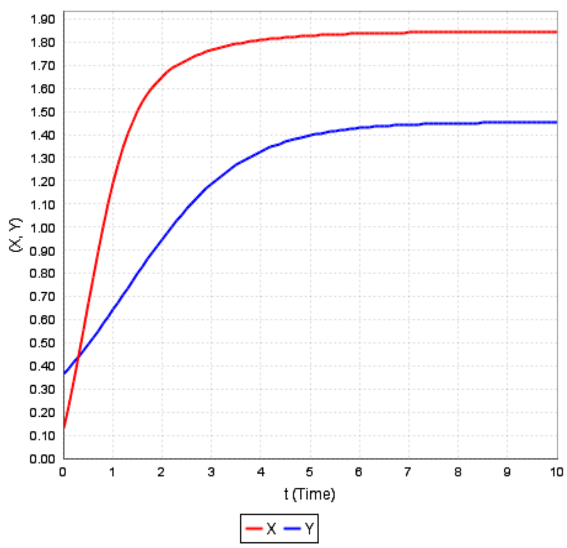

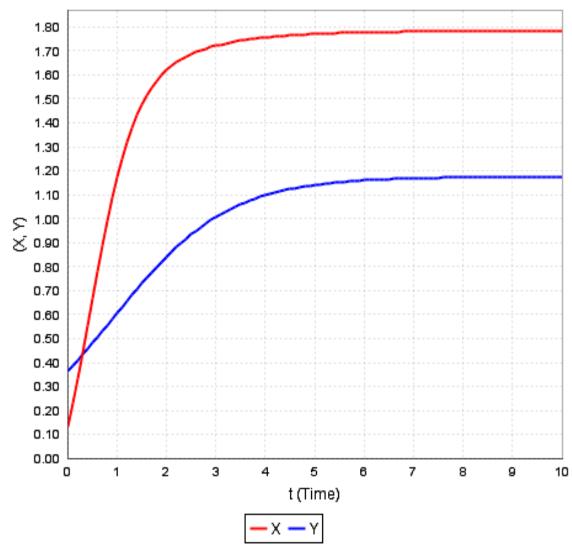

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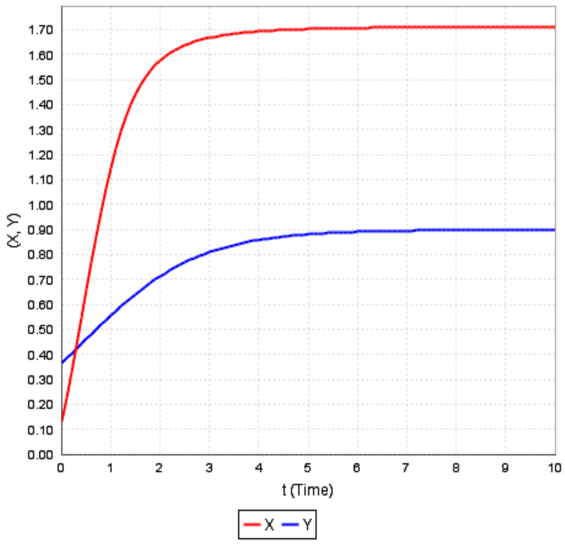

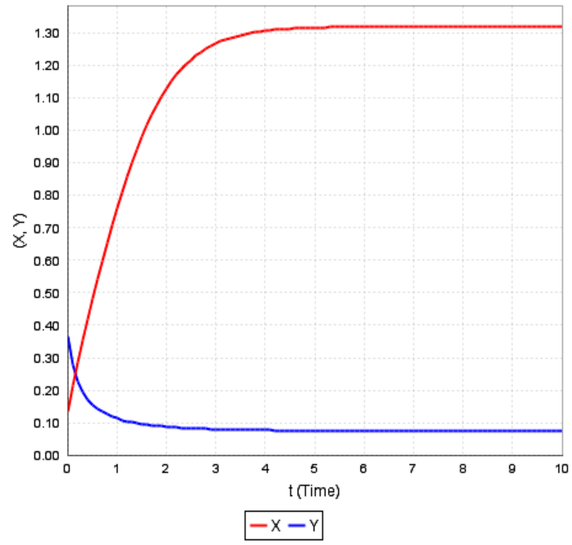

4.Conclusions: The change of Ammensal growth rate significantly influences on the Ammensal-Enemy Species. Initially Ammensal Species is dominated by Enemy Species, in a course time Ammensal dominates enemy species. Meanwhile dominance reversal time occurred two times at t_1^* andt_2^* . Here t_1^*gradually decreases and t_2^* Gradually increases.

5. Phase Plane Analysis:

Phase plane analysis has been carried out to analyze the model for establishing stability with equilibrium points which are associated with Eigen values.

When a=Changes,b=0.889,c=2.515,d=0.875,e=0.67,f=0.859,g=0.5

S.No	Values of Parameter(g)	Equilbrium Point	Jacobian matrix	Eigenvalues	eigenvectors
1	0.3750	(1.9775, 2.2907)	$\begin{bmatrix} -4.3071 & 0.5594 \\ 0 & -0.859 \end{bmatrix}$	$\lambda_{1=}$ -0.859 $\lambda_{2=}$ -4.3071	$E_{1=}(0.1601, 0.9870)^T$ $E_{2=}(0, 1)^T$
2	0.7310	(1.783, 1.1751)	$\begin{bmatrix} -3.0354 & 0.72083 \\ 0 & -0.859 \end{bmatrix}$	$\lambda_{1=}$ -0.859 $\lambda_{2=}$ -3.0354	$E_{1=}(0.3144, 0.9492)^T$ $E_{2=}(0, 1)^T$
3	0.9560	(1.710, 0.8985)	$\begin{bmatrix} -2.676 & 0.7811 \\ 0 & -0.859 \end{bmatrix}$	$\lambda_{1=}$ -0.859 $\lambda_{2=}$ -2.676	$E_{1=}(0.3948, 0.9187)^T$ $E_{2=}(0, 1)^T$

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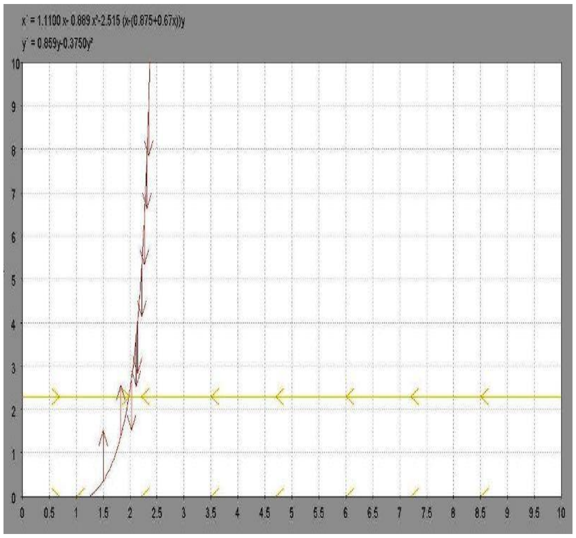
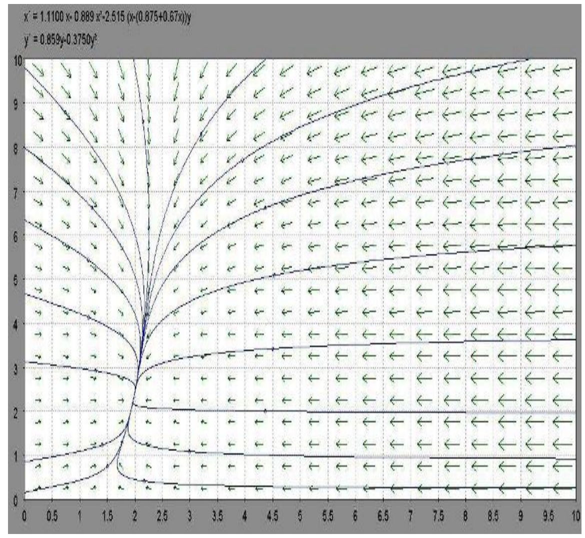
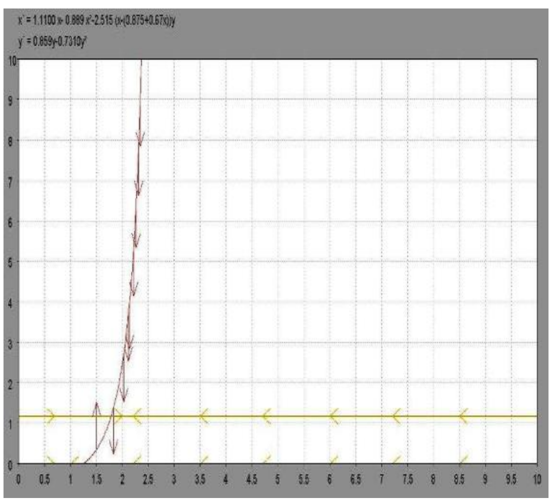


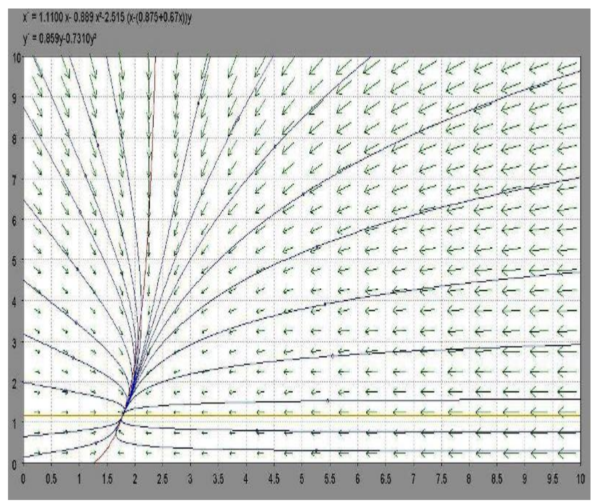
Phase Plane Figure(1)



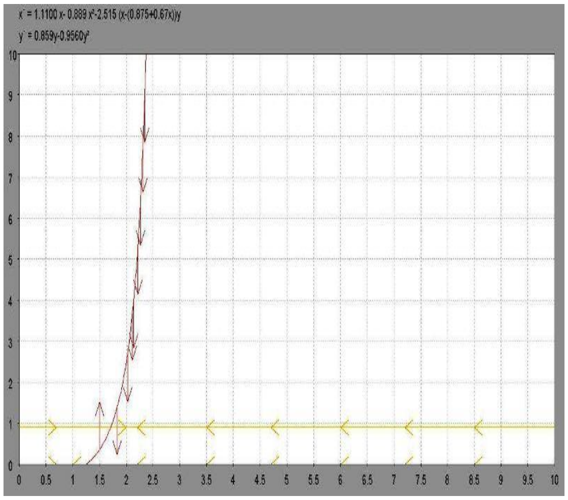
Phase Plane Figure(2)

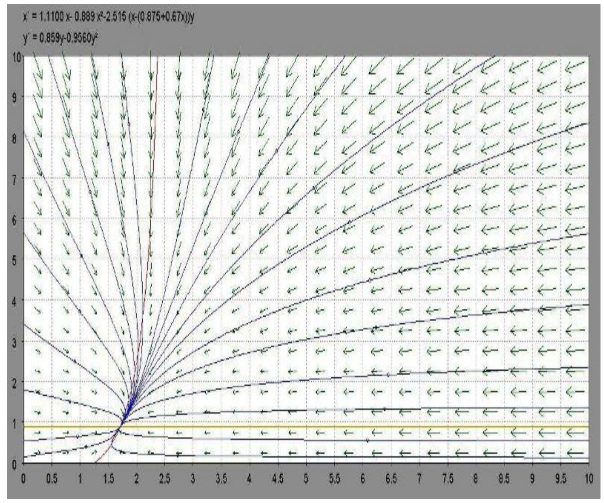


Phase Plane Figure(3)



Phase Plane Figure(4)





Phase Plane Figure(5) **Phase Plane Figure(6)**

6. Conclusions: The Ammensal–Enemy Species are greatly influenced by the change in the value of g. Initially, the Enemy Species will have the upper hand over the Ammenal Species throughout the course of some period of time. However, after some point in time, the Ammenal Species will have the upper hand. While this was going on, the dominance reversal time happened twice, once at t_1* and once at t_2*. In this part of the expression, t_1* goes down over time while t_2* goes up.

Overall Conclusions in a tabular form:

Change in the Parameter	Dominance Time	Nature
g increases	t_1^*decreases t_2^*increases	Nature of Dominance is reversed

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