

Evaluation of density thresholds of Desert locust gregarization in Mauritania

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Introduction

The preventive control strategy adopted by FAO and locust affected countries is focused on early warning and early reaction system which is assumed as a way to decrease the frequency of plagues by monitoring and controlling population's size in seasonal breeding areas. The present work aimed to better define the Desert locust density threshold for gregarization in natural environments.

Indeed, the density threshold of gregarization remains a major tool in determining intervention criteria for minimizing the locust invasion risks. The influence of environmental factors on the gregarization phenomenon has never been tested in the field.

Adult group in egg-laying site in Mauritania



Hopper band in Mauritania

Materials and methods

The study was conducted in two parts:

- The first part involved a statistical analysis of historical database of Desert locust survey operations of National Center for Locust Control in Mauritania. The information recorded in this database was used to examine the influence of the locust **adult's** density and vegetation on the probability of observing gregarious populations.
- The second part performed vegetation measurements, **hoppers** densities and phase determination during two successive rainy seasons allowing field sampling in seasonal breeding areas of Mauritania. These samplings permitted an assessment of Desert locust hoppers density thresholds of gregarization in field conditions.

Results

- For the **adult** Desert locusts, our results showed the change in the threshold of gregarization of according to the cover and status of the vegetation (table 1). Low cover and dry vegetation led to a low density threshold of gregarization due to high probability of individuals to touch each other. Dense and green vegetation favored a high threshold of gregarization due to a dispersion of the individuals and a low probability of individual encounters.
- For **hoppers**, the field sampling provided a critical density value around 2.45 hoppers/m² above which gregarious hoppers were expected to be seen more frequently in nature (figure 1). Hopper density was confirmed as the main factor explaining the presence of gregarious individuals. Vegetation parameters were not helping in explaining the observation of gregarious hoppers compared with hopper density.

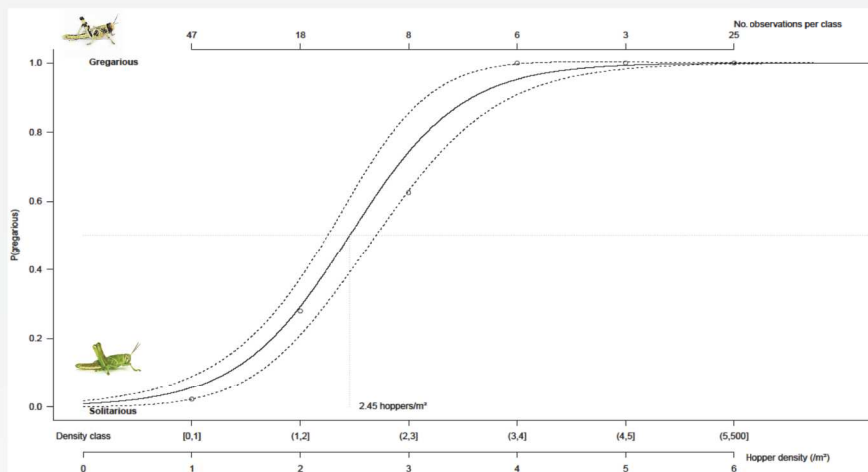


Figure 1. – Relationship between the probabilities to observe gregarious hoppers in the field vs locust hopper density. The x axes show the density and density classes of hoppers, the y axis the probability to observe gregarious hoppers in the field, and the top axis the number of observations per density class. The dots indicate the proportions of gregarious observation in sampling sites per density class, the lines correspond to the predictions (\pm SE) of the logistic regression model for the probability to observe gregarious hoppers depending on hopper densities.

Table 1. – Variation of **adult** Desert locust gregarization threshold (defined as when $P(\text{gregarious}) = 0.5$) depending on vegetation status and coverage based on the prediction of the regression model.

Vegetation status	Vegetation coverage	No. observations in selected data	Gregarization threshold (min-max) ¹
Drying	Dense	1050	744 (704-788)
	Low	765	326 (307-348)
	Medium	4352	650 (633-667)
Greening	Dense	36	776 (700-856)
	Low	62	340 (306-376)
	Medium	287	678 (619-736)
Shooting	Dense	77	1525 (1388-1670)
	Low	66	669 (607-735)
	Medium	328	1332 (1228-1437)
Dry	Dense	14	474 (386-565)
	Low	49	208 (169-248)
	Medium	78	414 (339-489)
Green	Dense	1440	779 (738-824)
	Low	863	342 (321-364)
	Medium	6152	680 (663-698)

¹The minimum and maximum values are based on the adjustment errors of the statistical model.

Conclusions

These findings should help the management of locusts and decision making during control operations. Indeed, field workers could assess easily the gregarization risks depending on the numerical values of density (and vegetation situation for adults). Using these, the field workers would control with pesticide only when it is necessary.