South American Locust

Schistocerca cancellata (Serville, 1839)

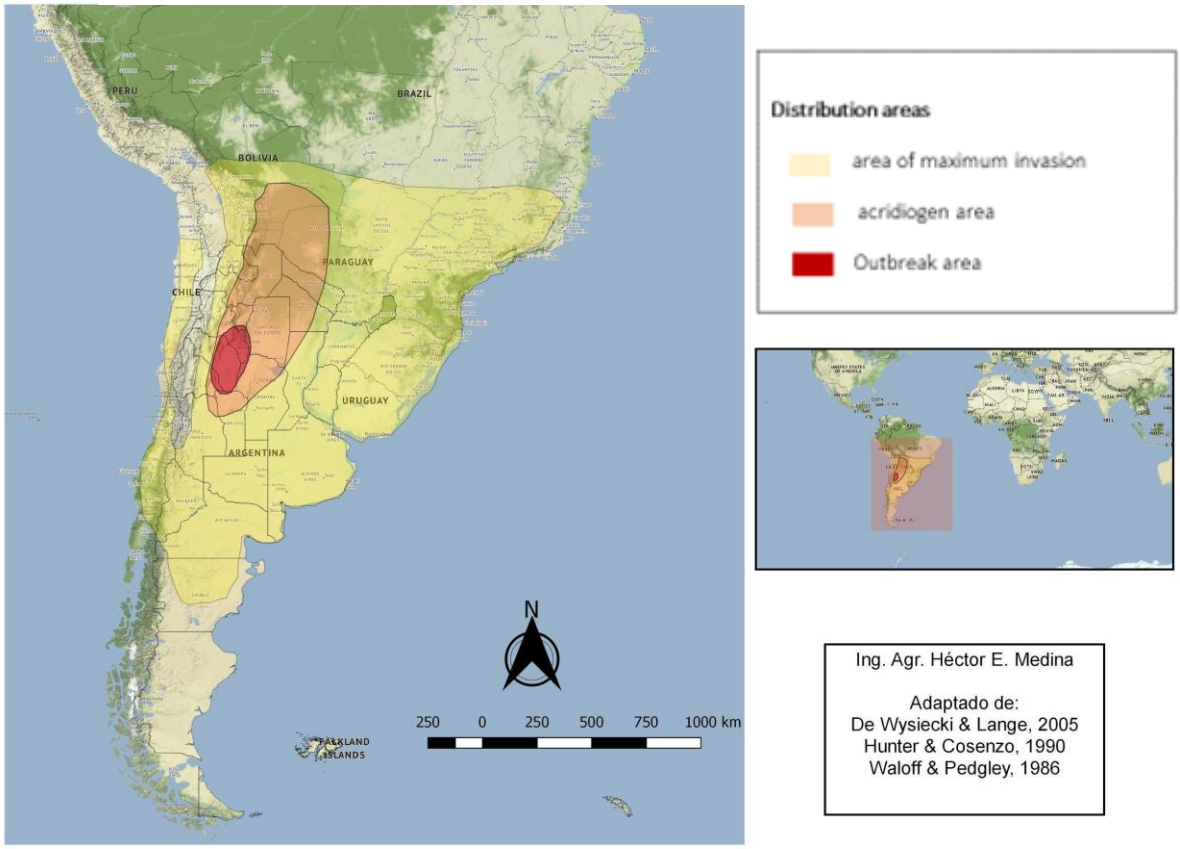
Female, solitarious phase. Source: Carbonell et. al 2006

Imago (sexually immature adult) in gregarious phase (left). Sexually mature female in gregarious stage (right) Source: Carbonell et. al 2006

Schistocerca cancellata nymphs in different phases. Source: Medina 2018.

Schistocerca cancellata is a locust as it features density-dependent phenotypic plasticity, which was demonstrated recently in laboratory studies by Pocco and collaborators (2019). The South American locust has historically been considered the worst agricultural pest in the southern part of South America (Kohler 1962, Gastón 1969, Medina 2017). *S. cancellata* has a wide geographic distribution that includes Argentina, Uruguay, Paraguay, southern Brazil, southeast Bolivia and the centre and north of Chile. With the exception of Chile (where *S. cancellata* remains in solitarious phase), this extensive distribution (almost 4 million km^2) matches the maximum historic invasion area. The area of recession, which corresponds to Barrera and Turk's (1983) acridiogenous area, covers a considerable territory of around 900,000 km^2, including Argentina, Bolivia and Paraguay. The outbreak area where, according to the bibliography, population explosions or outbreaks originate is much smaller: around 120,000km^2 in Argentina (Waloff and Pedgley 1986; Hunter and Cosenzo 1990; De Wysiecki and Lange 2005).

SOUTH AMERICAN LOCUST DISTRIBUTION



After six decades of limited *S. cancellata* activity -only three small outbreaks recorded in 1961, 1989 and 2010 (Barrientos Lozano, 2011. Medina, 2014)- a major population increase occurred starting in 2015 and continuing to the present day, when it has reached a plague level that threatens the agricultural production of several South American countries.

The main hypothesis for the recent population explosion that affects several countries in the region and which has put an end to a period of sixty years of recession suggests that the main biological driver is the influence of precipitation on certain demographic parameters and the duration of the winter reproductive diapause (Medina and Trumper, 2018). Mild winters with greater-than-average rainfall allowed this bivoltine species (two broods per year) to develop a third brood during the winter. The occurrence of a third brood is directly related to population explosions, according to a biological model developed by Hunter and Cosenzo (1990), who report that the plagues originate when there is a greater-than-average rainfall in winter, which allows for three annual broods to be born. Furthermore, the financial effect hypothesis is gaining in strength: periods of long recession negatively affect permanent surveillance actions in terms of the intensity and the surface monitored, thus impacting the detection of bands and swarms (Medina and Trumper, 2018). The management program established in Argentina between the 1950s and 60s failed only once in sixty years, leaving aside the years prior to 1950 when there was no preventive management (Gay et al, 2020). With no outbreaks for years, we can speculate that the infrastructure and the capital accumulated in the 1950s, be it human, social, financial or material, slowly decreased. Consequently, when the population increased in 2015, the combination of environmental changes and institutional weaknesses led to an area too large to

manage the plague with the resources available at the start of the outbreak (Medina et al 2017, Therville et al 2020).

Simplified table of the population dynamics of the **South American locust** (*S. cancellata*) for the outbreak area. The table corresponds to two annual broods. With favourable conditions three broods occur in one year, while unfavourable conditions can lead to one brood a year. The table may have variations as the development of the plague depends on environmental conditions.

BROOD	Months											
	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
FIRST BROOD	NYMPHS										NYMPHS	
	ADULTS											A
	MATING											
	EGG-LAYING											
	SWARMS											
SECOND BROOD		NYMPHS										
				ADULTS								
										MATING		
										EGG-LAYING		
					SWARMS							
				DIAPAUSE								

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