

## BRIEF NOTE

# Cactus Growth Changes as an Effect of Wind in Baja California Sur, México<sup>1</sup>

ALFREDO ORTEGA-RUBIO, HEIDI ROMERO-SCHMIDT, AND FERNANDO VEGA-VILLASANTE, Centro de Investigaciones Biológicas del Noroeste, A.P. 128, La Paz 23000, Baja California Sur, México

**ABSTRACT.** At Natividad Island, Baja California Sur, México, we sampled a *Ferocactus fordii* var. *grandiflorus* population. All 50 individuals recorded in the northeast part of the island exhibited different degrees of prostration, directly related to their size and the direction of prevailing winds. Prostration was always oriented away from the direction of the dominant winds blowing over the island. There are essentially no previous publications of the effects of wind on the cactus growth form.

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## INTRODUCTION

*Ferocactus fordii* (Orc.) Britt. & Rose var. *grandiflorus* Lindsay is an endemic variety from the Vizcaíno Desert of the Baja California Peninsula, México (Lindsay 1956) (Fig. 1). Because of its endemic status there have been no previous studies concerning ecological aspects of this variety. There exist only references to taxonomic aspects (Wiggins 1980, Innes and Glass 1991).

The effect of wind on vegetation and plants is a well documented phenomenon (Greene et al. 1992, Nemoto and Lu 1992, Schneidt and Weberling 1993), but there are essentially no previous published works dealing with such effects on cactus populations.

Wind dominance, persistence, and velocity can affect vegetation growth (Bayfield 1984, Robertus et al. 1991), even of aquatic plants (Carter et al. 1991, Yen and Myerscough 1989), and can alter the landscape. For example, the life forms and abilities of species to persist in habitats of varying exposure to the wind are selected (Williams and Williams 1984) and wind is an important selection force of the physical environment driving evolution in Arctic and alpine zones (Sonesson and Callaghan 1991).

Wind effects on vegetation can be produced, also, indirectly through the increase of soil desiccation (Isard 1986), soil erosion (Doering and Reider 1992), and the modification of substrate topography (Nakanishi and Fukumoto 1991).

## MATERIALS AND METHODS

Individual measurements were made at Natividad Island, a low flat island about 1.2 km westward of Punta Eugenia across Dewey Channel, which is located at 27°53' N latitude and 115°10' W longitude (Secretaría de Gobernación 1987) (Fig. 2). Natividad Island is 7.2 km long in the northwest-southeast direction, and from 0.8 km to 1.6 km wide, is barren and hilly, rising near the middle to an elevation of 163 m (Lewis and Ebeling 1971).

The mean annual temperature at the island is 16.48° C, and the total annual precipitation is 80.0 mm (Hernández et al. 1991). Winds from the northwest persistently blow over the island throughout the year at an average velocity of 1.32 m/sec (4.75 km/hr) (Hernández et al. 1991).

The shores of the island are mostly steep and rocky,

fringed by detached rocks and kelp; several reefs extend off the NW side of the island (Lewis and Ebeling 1971).

The island vegetation is sarcophilous desert, mainly composed of annual herbs (*Ambrosia* sp., *Atriplex* sp.), small shrubs (*Acacia* sp.), and some cacti like "Cardón" (*Pachycereus pringlei*), "Chollas" (*Opuntia* spp.), and "Viejitos" (*Mammillaria* spp.).

*Ferocactus fordii* (Orc.) Britt. & Rose var. *grandiflorus* Lindsay is a medium sized, globular cactus, grayish-green, up to 100 cm high, prominently ribbed with approximately 21 ribs, with gray woolly areoles set at 2 cm intervals (Bravo-Hollis and Sánchez-Mejorada 1991). Each areole bears about 4 central spines, one up to 4 cm long and hooked. The flowers of this cactus are red or orange and 6 cm long (Wiggins 1980).

During two days of August 1994 we traversed Natividad Island, searching for individuals of *F. fordii* var. *grandiflorus*. At the NE slope of the island we found a population of this cactus covering a total of 1,500 m<sup>2</sup>. For each individual of this population data recorded were: growth orientation, average diameter, height of the plant from the soil to the point of bending, and total length.

Growth orientation of each plant was taken with a compass, and we estimated the proportion of prostration as the difference between the total length and the bend length portion.

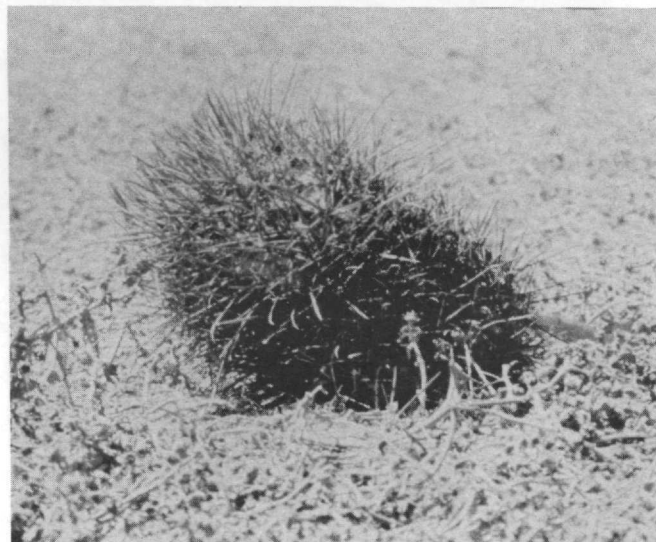


FIGURE 1. *F. fordii* var. *grandiflorus* showing wind prostration.

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## RESULTS AND DISCUSSION

A total of 50 individuals were measured at the study site on Natividad Island. All individuals showed a consistent growth orientation to the southeast, away from the direction of the dominant winds. That is, all the *Ferocactus* individuals observed lean to the southeast, as a result of the intensity and persistence of the winds blowing from the northwest to the southeast.

The degree of prostration is significantly correlated ( $r = 0.45$ ;  $p < 0.001$ ) with the size of the individuals (Table 1). Certainly, since the prostration degree is derived from the height of plants, both variables are mutually dependent, but both must be highly correlated only if the effect on the growth form is produced by a persistent phenomenon acting for the entire life of the plant. Such is the case of the blowing wind at Natividad Island.

Reported wind effects on other plant species include the considerable modification of the normal contour of shrubs and trees under their influence (Schneidt and Weberling 1993), the determination of the location and extent of forest regeneration (Greene et al. 1992), and the determination of the successful establishment of plants (Brothers and Spingarn 1992).

There have been no previous studies related to the size and structure of individuals of any population of *F. fordii* var. *grandiflorus* with which to compare our results. Concerning the wind effects on such populations at Natividad Island, we can conclude that there is a determinant effect on *F. fordii* var. *grandiflorus* individuals; they became prostrate because of the persistence, intensity, and direction of the dominant wind blowing over the island.

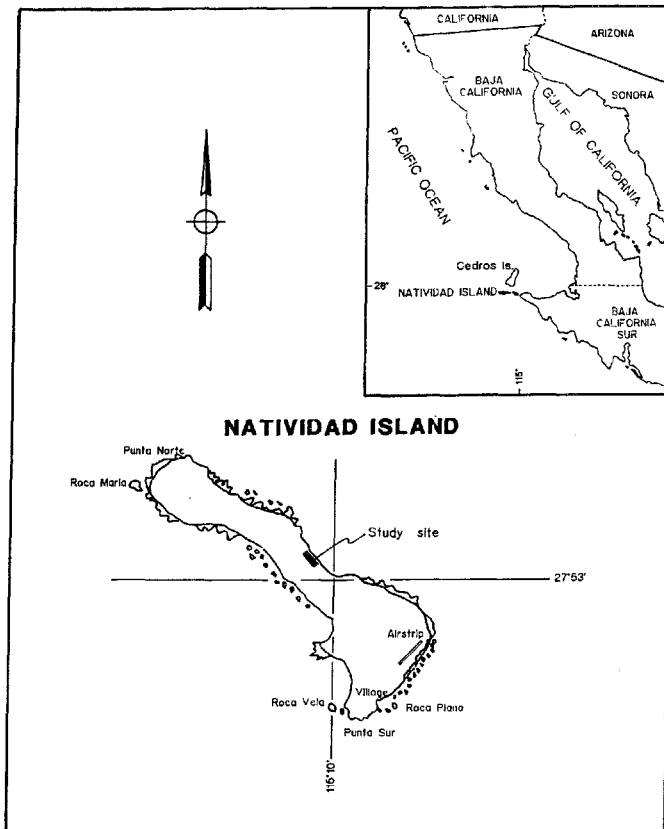


FIGURE 2. Location of Natividad Island and study site.

TABLE 1

*Degree of prostration and direction of growth of Ferocactus fordii* var. *grandiflorus* individuals at Natividad Island, B.C.S.

Total Length (cm)	Average Diameter (cm)	Average Percent Prostration	Standard Deviation	Growth Orientation
10 - 20	9.35	29.72	28.32	SE
21 - 30	11.41	51.23	9.43	SE
31 - 50	13.85	64.22	6.09	SE

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