

developmental mortality in *C. lusitanica* was the same as that in *J. barbadensis* (90%); however, the mortality of 1.3% due to parasitoids was much lower than the 9.6% noted in *J. barbadensis*.

Members of the genus *Phloeosinus* in Europe and North America have been recorded almost exclusively from the Taxodiaceae and the Cupressaceae; some species of beetles attack one or more members of a particular genus while others attack several species from both families (Wood 1982). *P. serratus* has been recorded only from *Juniperus* spp., *J. deppeana* Stendel, *J. monosperma* (Engelmann), *J. occidentalis* (Hooker), *J. osterosperma* (Torrey), *J. scopulorum* Saragat, and *J. barbadensis* (Wood 1982, Garraway & Freeman 1981), but never before from any species of *Cupressus*. This beetle has never been recorded from *C. lusitanica* in Jamaica in spite of the abundance of this host relative to *J. barbadensis*. This attack on *C. lusitanica* was characterized by high fecundity and a developmental mortality similar to that in its primary food plant.

I thank Susan Iremonger for identifying the host plant, Stephen L. Wood for identifying the beetle and supplying useful information, W. R. Mason for identifying the parasitoids and Audette J. A. Bailey for reviewing the manuscript.

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#### SURFING ANTS

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Ants are frequently associated with aquatic habitats. *Acromyrmex heyeri*, for example, inhabits swamps in Parana, Brasil (Goncalves 1961), and *Acromyrmex diasi* is adapted to live in swamps where it builds elevated corridors and bridges with grasses to walk and live over the water (Goncalves 1982). *Solenopsis geminata* and other ant species form knotted balls of workers clinging to a piece of floating wood when their nests are flooded during the rainy season in the Brazilian Pantanal and the Colombian and Venezuelan Llanos (personal observation). Similarly, nests of *Lasius* and *Myrmica* species build plant covered nests of sand in tidal meadows of Denmark (Nielsen 1986). Species of *Brachymyrmex* and *Forelius* are reported to build their nests in the sand in the intertidal areas of beaches in Mexico (Yensen et al 1980); and *Iridomyrmex purpureus* has been observed feeding on polychaete worms and other strand line invertebrates in Australia (Buckley 1980).

Here I report two observations of ant-water interactions in intertidal areas of sandy

beaches. The first is of nests of *Paratrechina longicornis* (Formicidae: Formicinae) in the intertidal zone of sandy beaches in Bombay, India, and the other is of foraging in the intertidal zone and surfing on small waves by a *Conomyrma* species, a *Solenopsis* species, *Paratrechina longicornis* and *Mycetophylax conformis* in La Blanquilla island, Venezuela.

At low tide on the beaches of Bombay, hundreds of meters of new coast are exposed, filled with marine debris and human detritus. In this area, some 100 m from the high tide line, I found colonies of *Paratrechina longicornis* nesting in the sand foraging on the debris around their nest up to 25 m away. Nest density was very high (estimated in over 1 nest/ m<sup>2</sup>), although colonies are known to be polydomic and thus all nests could have been from a single colony. These ants have to hide in their nests at high tide, which probably are protected from flooding thanks to trapped air in their galleries.

At La Blanquilla island, tidal changes of the sea level are very small. The exposed sand surface at low tide is increased by no more than a couple of meters. Normally, the sea is calm and very soft waves reach the beach, rolling gently over the sand. As waves are of variable intensity, the dry sand surface varies continuously. Each wave carries oceanic debris which is left on the sand. Workers of *Paratrechina longicornis*, a *Conomyrma* species, a *Solenopsis* species, and *Mycetophylax conformis* forage on this material. *M. conformis* built its nests in the dry sand of the beaches and foraged exclusively along the edges of the water. Only 8% of *Conomyrma* workers from a nest located near a beach carried material which could be identified as from oceanic origin (64 randomly chosen workers were observed after exiting the nest and during foraging; ants lost by the observer were not counted). One percent carried seeds and the rest foraged on dead animals (mainly lizards).

The behavioral adaptation which allowed workers of all of the species observed to forage in the intertidal zone was most interesting. As soon as a worker was touched by water, it assumed a "nymphal" posture, contracting its legs and bending the abdomen to the ventral part of the thorax. In this position, workers were able to float over the foam of the wave, surfing in front of the rolling wave over the beach, until the water was absorbed into the sand. As soon as the ant dried, it extended its legs and immediately continued to forage (over 50 workers from all 4 species, including only one *Solenopsis* worker, were observed surfing and none of them drowned). No avoidance behavior toward the water was observed, nor did workers avoid foraging in the direction of the ocean. Workers from all these species, when dropped on calm sea water, eventually drowned.

All these species are known to also inhabit areas outside the intertidal zone. Thus, the adaptations described could be expected to be present in other ant species. It would be interesting to have data on swimming and surfing behavior of other ant species before drawing evolutionary and ecological conclusions of these observations.

I thank Stefano Turillazzi for assistance and help in observations in Bombay.

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