had a grain of sand or clayey material forming the central core, with faecal cement coated around this core to shape it into a sphere. Measurements were made of these pellets with the aid of a binocular microscope fitted with a linear grid. The mean maximum diameter was found to be 2.062 mm (S.D.±0.179) for 100 pellets measured. The diameters of the foramina of the interconnecting tunnels were also measured, and were found to be slightly smaller in diameter than the pellets, but with much smaller variation (fig. 3). Hence, it was not surprising that when the pellets were placed into the holes they were found to fit snugly into place. The goodness of fit was also due to the round, concave depression in the cell wall leading to the tunnel foramen. This concavity therefore allowed for the variation in size of the pellets and yet served to hold them in place.

These observations provide a plausible explanation for the presence of the spherical pellets in the nest of *Prohamitermes mirabilis*. I suggest that the termites have deliberately constructed these pellets to be used as plugs for entry points when nests are damaged. Admittedly, there are as yet no actual observations of the process, but the fact that a number of holes were sealed with the aid of the pellets, coupled with the number of pellets observed in each cell and their size, which provided a remarkably good fit to the interconnecting openings in the cell walls, does provide evidence to support this suggestion. The way these pellets were constructed, with a core of non-faecal material, would further suggest that they were not artifacts from nest building.

By having such ready-made 'boulders' within the cells, the efficiency of the sealing-off behavioral response as a defense strategy is greatly enhanced, and shows a selective evolutionary advance over the time-consuming and laborious method of faecal deposition and masonry work by a chain of workers. Instead, these termites now need only to roll a 'boulder' into place and cement it in. The suggestion that the construction of these pellets is deliberate would imply that the termites have added an accessory feature to their nest which serves no function until, and unless, the nest is damaged. This anticipatory constructional activity incorporated into the social behavior has not been reported in any other termite species nor in other groups of social insects.

I thank Adrian G. Marshall for commenting on the manuscript.

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Y. P. Tho

Forest Research Institute
Department of Forestry, Peninsular Malaysia
Kepong, Selangor
Malaysia

Reduction in Euglossine Bee Species Richness on Isla del Caño, a Costa Rican Offshore Island

Insect species richness is conspicuously lower on small tropical islands than in similar mainland habitats (e.g., Janzen 1973). Here I compare the array of orchid bees (Apidae: Euglossini) that arrives at chemical baits on Isla del Caño with those that arrive at identical baits on the adjacent mainland, in Corcovado National Park on the ocean-side coast of the Osa Peninsula, Puntarenas Province, southeastern Costa Rica. Isla del

Caño lies 17 km offshore and is 320 ha in its triangular area. It is a rocky plateau 50 to 150 m in height, and is about 70 percent clothed in 20-50 m tall evergreen rain forest (Holdridge 1951). Above the island's rocky beaches, the forest on the steep sides of the plateau is an impoverished version of the forest in the same habitat on the mainland. The intact parts of the forest on the top of the plateau are a nearly pure stand of the large tree *Brosimum utile* (Moraceae), with *Hymenaea courbaril* (Leguminosae) and *Calophyllum macrophyllum* (Guttiferae) in small patches. The island is clearly visible to humans on the mainland, and was a major pre-Columbian Indian burial ground (Finch and Honetschlager 1979).

After many censuses of euglossine bees with five chemical baits (cineole, eugenol, methyl salicylate, methyl cinnamate, benzyl acetate) on the Corcovado mainland (Janzen *et al.* 1981), it became evident that on a sunny morning any rain-forest-understory, chemical-bait census site would usually attract 100-300 bees of 12-20 species. In November 1978 (peak rainy season), I did a preliminary census on Isla del Caño in the *Brosimum* forest understory and was mobbed by what seemed to be thousands of bees of just two species of *Euglossa.*

To examine the apparent island-mainland difference, on 18 March 1979 (peak dry season), I conducted a control census in the rain-forest understory on the mainland across from the island and about 4 km south (in the primary forest along the trail to San Pedrillo, north of La Llorona, 500 m inland from the sea, 100 m elevation). The 494 bees belonging to 22 species that arrived in 3 hrs are listed in table 1. There are no surprises in species or proportions in this list; all the species have been taken before at these chemicals in Corcovado National Park (Janzen *et al.* 1981). Two days later, on 20 March 1979, I censused a site on Isla del Caño in exactly the same manner. The site lies approximately in the center of the island (about 500 m from the sea and 100 m elevation) in the shade of an intact canopy of *Brosimum utile* about 40 m high. The 1281 bees of three species captured in 1.5 hours are listed in table 1. Additionally, one suspected *Eulaema meriana* was observed but not captured (*E. meriana* is chosen rather than the in-flight indistinguishable *Eulaema bombiformis* because the latter bee never comes to cineole on the mainland). I stopped the census after 1.5 hours because there was no evidence that further collecting would change the information content of the sample. On the mainland, I captured at least 98 percent of the bees that came to the chemical baits, but on the island at least 25 percent of the bees escaped during the 1.5 hours of collecting. This result was not because they were especially alert, and therefore potentially different species, but rather because they arrived in such numbers that despite frantic collecting I was unable to keep up with them. As many as 40 bees could be taken with one swing of the net if they were allowed to accumulate at the bait for 10 minutes. The two rare bees were obvious in flight when they arrived, as would have been most of the other species that arrived at the baits on the mainland.

Isla del Caño appears to have about 10 percent of the adjacent mainland orchid-bee fauna, but its two clearly resident species are enormously more abundant on the island than they are on the mainland. I hypothesize that the single specimens of *Euglossa dodsoni* and *Eulaema meriana* were transients (wanderers) from the mainland. It is striking that on the adjacent mainland, *Euglossa erythrochlora* was attracted only to cineole as well as to eugenol and methyl salicylate, while on the island it was collected at three chemicals, none of which was cineole and one of which was methyl cinnamate. Likewise, on the island *Euglossa tridentata* came, albeit in small numbers, to two chemicals that it did not visit on the mainland. Furthermore, its apparent relative preference on the mainland for eugenol over cineole is reversed on the island. Also, on 24 April 1975, 15 *E. tridentata* were attracted to cineole (the only bait used) on the island (C. L. Hogue, pers. comm.).

Pentagonia gymnopoda (Rubiaceae) is an extremely common understory shrub on the island, and on the mainland (where it is extremely rare) it is a heavily visited nectar source for *Euglossa.* I assume that this is one of the major nectar sources for the very high density of island euglossine bees. Despite careful search with binoculars on the island, I was unable to locate any orchid plants of species that are known to be visited by male euglossine bees. However, 21 (4.0%) of the *Euglossa tridentata* were carrying *Gongora* pollinaria (11 on bees to cineole, 10 on bees to eugenol) as was one of the *Euglossa erythrochlora* (0.13%). *Gongora* probably occurs somewhere on the island. Of the 494 bees taken in the mainland sample, seven (1.4%) were carrying orchid pollinaria of various species.

The high density of just two species of *Euglossa* on this island is probably due to a combination of a low

TABLE 1. *Percent of male euglossine bees collected at five chemical baits in three hours (mainland, Corcovado National Park) and 1.5 hours (Isla del Caño, Corcovado National Park).*

	Eugenol	Cineole	Methyl salicylate	Methyl cinnamate	Benzyl acetate	Number chemicals	Total bees
CORCOVADO MAINLAND							
Euglossa allosticta		100				1	4
Euglossa asarophora		100				1	3
Euglossa bursigera		100					5
Euglossa championi		36.0	64.0			2	25
Euglossa congata			97.4	2.6		2	38
Euglossa cyanaspis		80.0		20.0		2	5
Euglossa cybelia		100				1	1
Euglossa dodsoni		8.6		68.9	22.9	3	35
Euglossa erythrochlora	45.7	8.6	45.7			3	35
Euglossa flammea	16.7	83.3				2	6
Euglossa gorgonensis		100				1	27
Euglossa imperialis		70.1	29.9			2	177
Euglossa mixta			100			1	6
Euglossa purpurea		100				1	32
Euglossa sapphirina		22.6	67.7	6.5	3.2	4	31
Euglossa tridentata	57.1	10.5				2	14
Euglossa townsendi	83.3	16.7				2	18
Euglossa villosiventris			100			1	3
Eulaema bombiformis			100			1	4
Eulaema cingulata	90.0				10.0	2	10
Eulaema meriana		20.0	30.0	10.0	40.0	4	10
Exaerete frontalis		100				1	5
Total species	5	16	9	5	4		
Total individuals	49	243	159	29	14		494
ISLA DEL CAÑO							
Euglossa dodsoni					100	1	1
Euglossa erythrochlora	17.2		67.0	15.8		3	755
Euglossa tridentata	29.9	69.3		0.19	0.57	4	525
Eulaema meriana		100				1	1
Total species	2	2	1	2	2		
Total individuals	287	365	506	120	4		1282

species richness of chemical sources (orchids, aroids, fungi) for male euglossines, little or no competition for floral resources (there appear to be only about five other species of bee on the island, including one *Trigona, T. fulviventris*), high density of nectar resource (*Pentagonia*), and low density of nest parasites and predators. While no females have been collected at flowers on the island, the walnut-sized oval wax nests of *Euglossa* spp. are commonly encountered in the foliage.

This study was supported by NSF DEB 77-04889. L. S. Kimsey and R. L. Dressler identified the bees, and G. Vega and W. Hallwachs aided in their processing. The manuscript was constructively criticized by W. Hallwachs, L. S. Kimsey, N. H. Williams, R. L. Dressler, and J. D. Ackerman.

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Daniel H. Janzen

Department of Biology
University of Pennsylvania
Philadelphia, Pennsylvania 19104, U.S.A.