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TUNNEL ARCHITECTURES OF THREE SPECIES OF MOLE CRICKETS (ORTHOPTERA: GRYLLOTALPIDAE)

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The southern mole cricket, *Scapteriscus vicinus* Giglio-Tos, and the tawny mole cricket, *S. borellii* Scudder, damage turfgrass in southeastern United States. The two species are univoltine in most of their range. They also have similar life cycles and morphology. However, southern mole cricket is primarily carnivorous, whereas tawny mole cricket is herbivorous (Taylor 1979, Ulagaraj 1975, Matheny 1981). The African mole cricket, *Gryllotalpa africana* Palisot de Beauvois, is a world-wide pest (Sithole 1986). It damages plants including wheat, maize, rice, sorghum, millet, barley, oats, potatoes, cassava, groundnuts, strawberries, turnips, tobacco, and vegetables in Africa, Asia, and Europe. It also causes severe damage to turfgrass on golf courses in South Africa and Asia (Brandenburg, unpubl. data). Tsedeke (1979) reported that surface tunneling behavior, which is partly determined by feeding preference, is different between the two species in the U.S. We therefore speculate that tunnel architectures of three species are also different judging from the differences in their feeding behavior and damage. This study used fiberglass resins to compare tunnel architecture of three species of mole crickets in two locations

Tawny and southern mole cricket tunnel castings were made on the driving range of Oyster Bay Golf Course, Brunswick County, NC, during 1998 to 2000. The turfgrass on the driving range was hybrid bermudagrass, *Cynodon dactylon* (L.) Pers. in sandy loam soil. African mole cricket tunnel castings were made in typical heavy clay soil at Silver Lakes Golf and Country Club, Pretoria, South Africa. The turfgrass on the fairway was Kikuyu grass, *Pennisetum clandestinum* Hochst. ex Chiov.

We located mole cricket tunnel entrances by hand, and cleaned foreign matter, debris, and soil from the area around the entrance. We then used a soapy water flush (Short & Koehler 1979) as an irritant to flush the mole cricket from the tunnel for species identification. The soapy water flushing also helped to find other entrances to the tunnel and make the soil around the entrance firm. Areas without turf were avoided because the tunnels are often blocked by loose soil during the flushing.

We have previously reported that fiberglass resin is the best material for mole cricket tunnel casting (Brandenburg et al. 2001). Bondo® fiberglass resin and hardener (Dynatron/Bondo Corp., Atlanta, GA), was used in the U.S. study and a similar product used in South Africa. This and other similar products are widely available at local hardware and automobile repair stores. Approximately of the recommended amount of hardener was added to the fiberglass resin (about 1 ml hardener/100 ml resin). The fiberglass resin hardens quickly after adding hardener, therefore, the whole procedure must be done quickly. The fiberglass resin container was covered and shaken after adding hardener. The contents were then poured immediately into the tunnel entrance in a steady stream. The excavation of the castings started 1-2 h after pouring. The fiberglass resin in one can (1 l) usually filled two to three mole cricket tunnels. We used a large screwdriver to clear away the grass roots surrounding the tunnel entrance and to determine the direction of the casting before starting to dig the cast. Finding other entrance(s) of the tunnel helps to judge direction the tunnel casting. There are at least two entrances for tawny and African mole cricket tunnels. The soil on tunnel casts was washed away with water following excavation.

We made over 100 castings and excavations during 3 years. Tunnels of tawny mole crickets were almost always (90%) in the shape of "Y" with two entrances for each tunnel (Fig. 1A, B, C). Variations were occasionally observed in the tunnel architecture. There might be two parallel "Y"s linking together to form a tunnel, or, two entrances observed at each end of a tunnel. The length of most tawny mole cricket tunnels ranged from 50 to 70 cm. Tunnels of African mole crickets also typically showed "Y" shape (Fig. 1G, H, I). The length of African mole cricket tunnels ranged from 10 cm to 23 cm. This was much shorter than that observed in tawny mole crickets. The tunnels of southern mole crickets were more likely in a reversed "Y" shape with only one surface entrance (Fig. 1D, E, F). The tunnels often branched within 10 cm deep of the soil surface. The tunnels were usually much shorter than those of tawny mole cricket.

The difference in tunnel architecture probably relates to the behavioral difference of the three species. Southern mole crickets are carnivorous. They seek prey throughout the soil. Our observations and research by Tsedeke (1979) suggested that southern mole crickets were much more active in tunneling than tawny and African mole crickets. This may be why southern mole cricket tunnels were almost always branched down into the soil rather than near the soil surface. In con-

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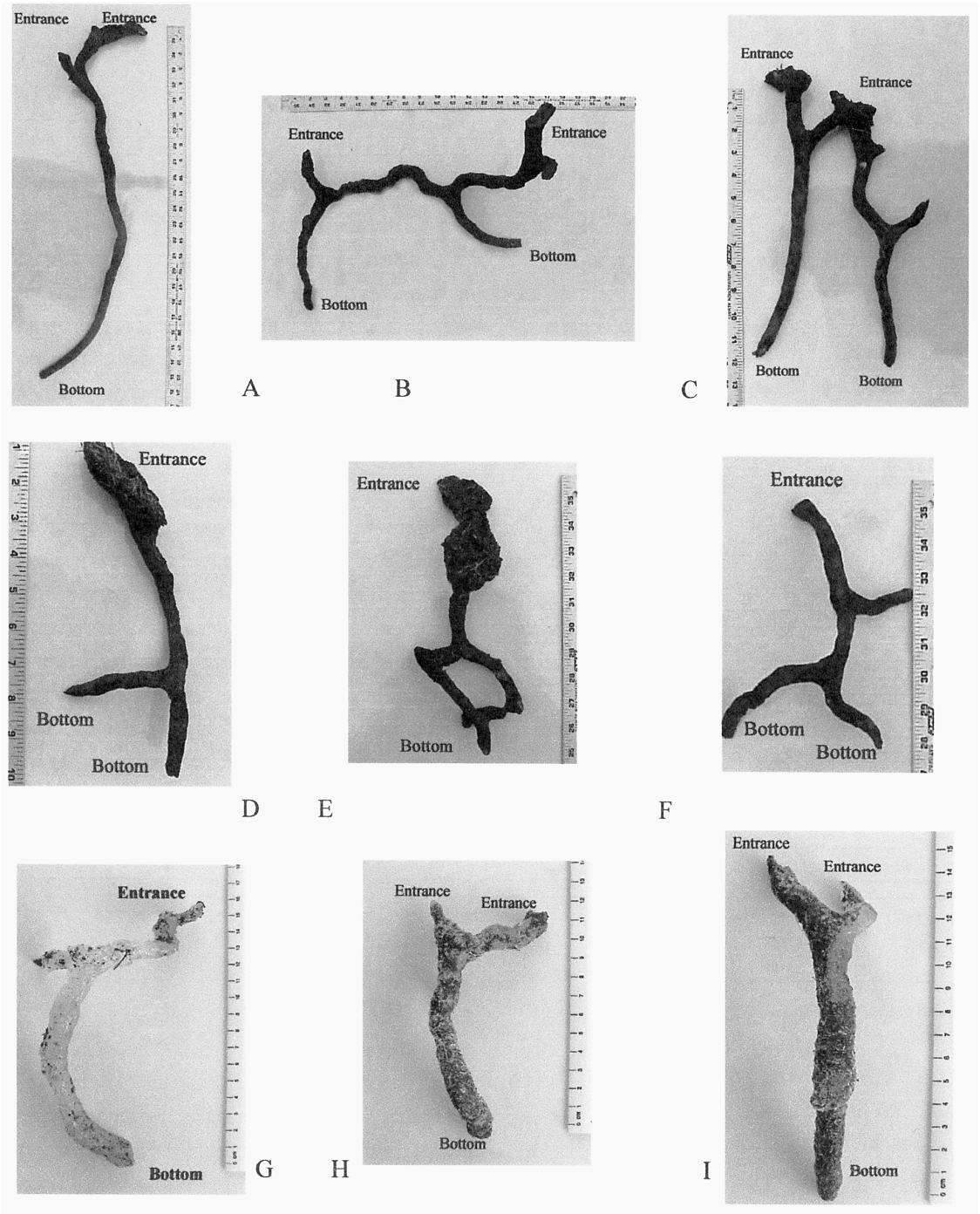


Fig. 1. Tunnel Castings of the Tawny (A, B, C), Southern (D, E, F), and African (G, H, I) Mole Cricket.

trast, tawny and African mole crickets feed on roots near the soil surface and their activity is around the branches of the "Y". They may face frequent threats from predators (Hudson et al. 1988) and need more than one entrance in a tunnel. The harder, clay soil in South Africa may also be related to the shorter tunnel structure for the African mole cricket.

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Summary

The fiberglass resin used to determine tunnel architecture of three species of mole crickets was effective in providing an accurate and durable record of mole cricket activity. The tunnel castings of the tawny mole cricket, *Scapteriscus vicinus* Scudder, and the African mole crickets, *Gryllotalpa africana* Palisot de Beauvois, almost always exhibit a "Y" shape upper tunnel structure. The tunnel castings of the southern mole cricket, *Scapteriscus borellii* Giglio-Tos, are typically an inverted "Y" shape. Tunnels of tawny mole crickets typically go deeper into the soil and are usually more complex than the other two species.

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