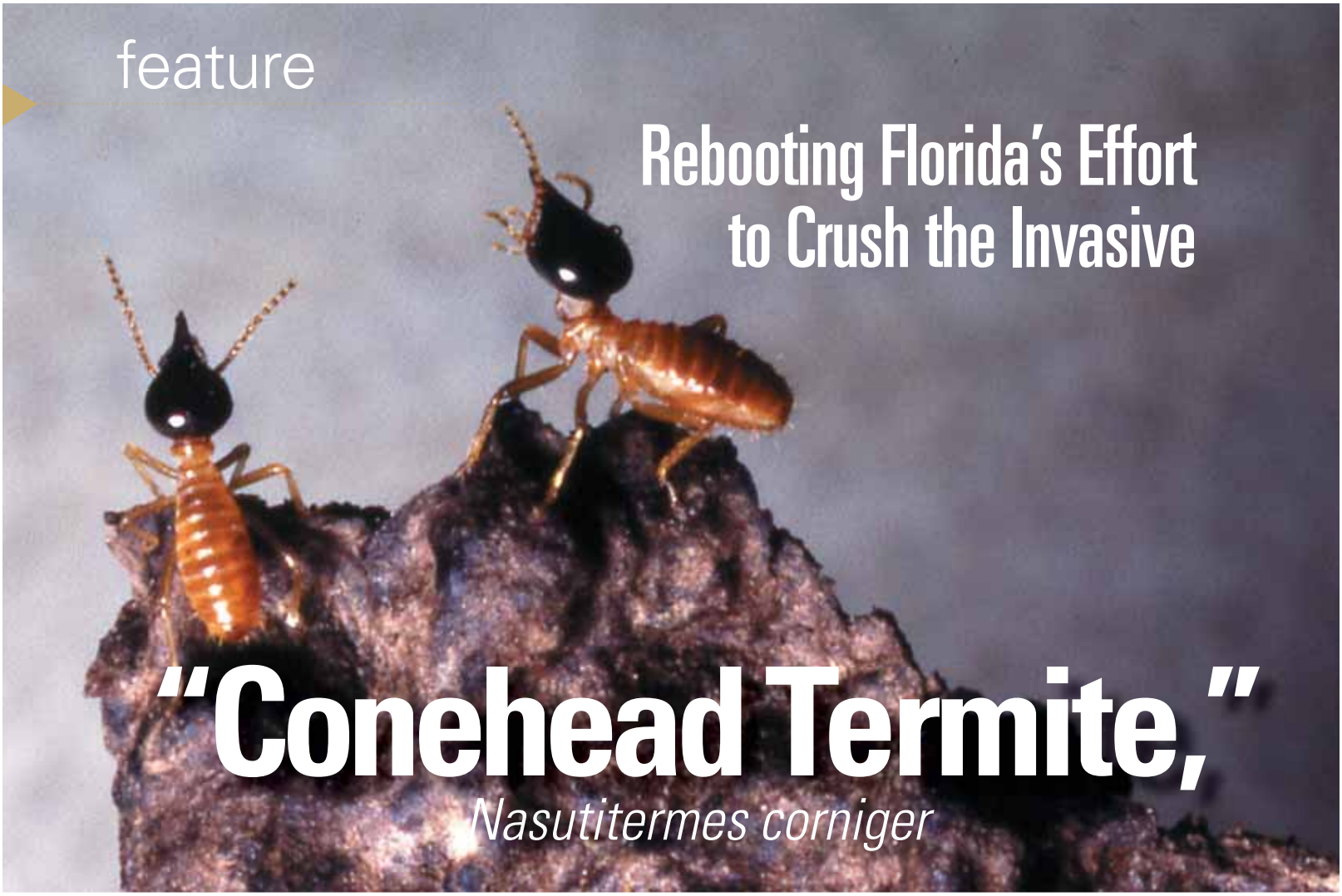

Rebooting Florida's Effort to Crush the Invasive "Conehead Termite," *Nasutitermes corniger*

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Two *Nasutitermes corniger* soldiers perched on a portion of nest carton, displaying their distinctively cone-shaped heads.

It's back! An exceptionally adaptable, flexible and voracious termite snuck into south Florida from the tropics, originally identified in Dania Beach, Florida in 2001[1]. This challenging species has tremendous potential for swift dispersal, survival in a variety of structural and natural habitats across a broad geographic range, and decisive economic consequences. It has expansive tastes, eagerly consuming dead wood from live, or dead, trees (yes, including citrus), shrubs, roots, structures and furniture as well as cardboard and other paper products. With the recent resurgence of the infestation, the state of Florida has reinvented containment/control/eradication efforts targeting this species, and is partnering with FPMA and the broader industry to move forward with aggressive, innovative action plans. Comprehensive and strategic treatment, vigilant inspection and monitoring, diligent containment initiatives, professional training and public education and enterprising collaborations will be required to attempt to evict this invasive termite and thwart the immense impacts it could wreak. This article addresses four timely questions central to the rebooted control effort.

Why is this invasive species, formerly nicknamed the "Tree Termite," now called the "Conehead Termite?"

Both nicknames refer to the same, single termite species, scientific name *Nasutitermes corniger*. The termite's original nickname, "Tree Termite," led to confusion—primarily the incorrect inference that it always lived and nested in or on trees, as well as the false sense of security that "at least my house is safe because the 'Tree Termite' only eats trees." Not! This hungry, agile termite nests in or on—and happily consumes—trees, shrubs, roots, structures, fences, wooden furniture, scrap wood, paper products and probably many other items made of cellulose. It may build nests on open ground with no trees close by. Furthermore, "Tree Termite" does not distinguish this species to assist in unambiguous identification; subterranean, drywood and dampwood termites may occur in trees in south Florida.

The new nickname, "Conehead Termite," was adopted for several reasons:

- "Conehead" describes the distinctive shape of the soldier form's dark cone- or teardrop-shaped head. Soldiers of this species are numerous and lively, and are the most likely caste for people to see and notice. The reinvented nickname therefore

offers distinctive species diagnosis, differentiating this termite from all others in Florida, as well as from ants (often confused with termites by the public) and other bugs.

- "Conehead" is a catchy, memorably amusing nickname. Although this infestation is serious and anything but humorous, engaging the public with an easy-to-remember, comical but meaningful nickname may help evoke the attention and cooperation critical for success of the eradication effort.
- Although the name was inspired by soldier head shape rather than Saturday Night Live's popular Coneheads, these termites are exotics just like the beloved SNL characters were aliens, hence the association fits.
- Shifting to a new, more striking and descriptive nickname is one of several examples of the bold steps that the state, partnering with the industry, scientists, extension and broad educational outreach, and hopefully the federal government, is implementing as it reboots and redirects initiatives to aggressively diminish, and hopefully eradicate, this invasive species.

What are the easiest ways to identify the Conehead Termite?

Three features of this species enable swift identification in the field:

1. **TUNNELS**: Coneheads build narrow (usually half-inch wide or less) brown "tunnels" or termite highways on the sides of trees, houses, walls or almost any surface. Of course, subterranean termites may also build foraging tunnels, but Coneheads are tunnel constructors "on steroids"—the gallery networks are prominent, extensive, and often the first sign of an infestation. Subterranean termite galleries are often narrower than Conehead tunnels, although gallery width varies in both types of termite.
2. **CONEHEADS**: The soldier form of this termite has a very distinctive, dark "conehead" or teardrop-shaped head. If you break open an active tunnel, termites each about the size of a grain of rice dash out, including the odd-looking conehead soldiers which comprise up to 20-30% of the individuals in a colony (compared with 1-2% soldiers in most subterranean or drywood termite colonies).
3. **NEST**: These termites build conspicuous dark brown nests, usually in the shape of a large ball or watermelon with a crisp, bumpy surface. Nests may be on, in, or by a tree, shrub, or structure, or sometimes on open ground. Young colonies remain hidden for several years while they build population size before their "big reveal" when they construct a visible nest. The initial phase of construction creates a nest about the size of a tennis or softball, but healthy colonies rapidly expand their home such that a nest the size of a basketball or even larger may grow within a few months, and produce alates within a year. Because only older colonies build nests, however, foraging tunnels are found frequently without an apparent nest.

A colony may build multiple, connected "satellite" nests, some with queens and kings, although some nests may lack reproductives. Interconnected nests (up to 52 reported for one "colony" of this species in Panama) may cover a broad area, often spaced 60 feet or more apart[2].

Why is removal, bagging and destruction of accessible nests advantageous, considered a best practice and part of Florida's DACS standard operating procedures protocol (along with treating foraging galleries and other activity centers) for Conehead Termite infestations?

The overall strategy of DACS' 2013 treatment protocol is to remove and destroy accessible nests and use termiticides to comprehensively treat trees, stumps, structures and substrates that hosted nests. Activity centers such as foraging galleries, infested wood and other dense aggregations of termites must also be treated. This aggressive combination of strategies should kill many colonies, and reduce overall population size, health and integrity of any surviving Conehead societies enough to drastically reduce alate production, thus substantially slowing or hopefully halting dispersal and expansion of the infested area. An obvious caveat is that young colonies initiated in recent years will remain hidden until they reach critical mass population size sufficient to bloom into a visible nest. We thus anticipate playing Whac-A-Mole with this infestation for years into the future. The current infestation may cover a broader area than presently delineated if, as we suspect and must plan for, young "stealth" colonies are developing—concealed within wood—in other neighborhoods. Long-term, diligent inspection, monitoring, public education, professional training and prevention of trees and shrubs, wood debris and furniture being transported out of the infested and surrounding (high risk) areas will be essential to the success of this integrated effort.

Extensive foraging tunnel network characteristic of this species, including nest on branch in upper right.

Queen, with enlarged abdomen capable of rapid egg production, along with King (right, above end of Queen's abdomen) and entourage of soldiers, workers, and nymphs (future alates).

The state will use local waste incinerators so nests can be destroyed immediately after collection and without risk of inadvertently moving a colony out of the restricted area.

The recommendation for nest removal and destruction would be a lane change for termite treatments familiar to us in the U.S., but that straightforward, effective approach is standard practice in controlling infestations of this species in its native range. The fact that Coneheads build discrete, conspicuous nests offers a huge strategic advantage to our control efforts. While it is difficult (if not impossible) to find the reproductives and nest "headquarters" of subterranean, drywood or dampwood termites, *Nasutitermes corniger* makes that quest quite convenient by constructing exposed nests that typically contain the growth center (queen(s)[3], king(s), eggs, immatures) of the colony. Thus far in the Dania Beach infestation most Conehead nests have been found on or near the ground, rendering them generally attainable. The species is capable of building nests more than 100 feet up in tall trees, so we'll have to hope that the strain that invaded Dania retains its current preference for relatively reachable perches.

There are many advantages to nest removal and destruction rather than direct application of pesticides to Conehead nests, primarily the following:

- No pesticides are used to treat, or retreat, nests, rendering this approach environmentally friendly as well as time and cost effective.
- Removal smacks growth potential of the colony by eliminating the nest's queen(s) and king(s) (normally housed within a "royal cell" embedded in the nest), along with the eggs and most juvenile termites (the "nursery"). Alate production and dispersal flights are also slashed. Reducing the risk of dispersal is a key component of the containment strategy regarding this infestation.
- This direct strategy of excising the colony growth center (nest) and then treating residual activity hubs is similar to an oncologist's approach of surgical removal of an accessible tumor (assuming it does not involve vital organs) to eliminate the growth node, then following up with chemo, radiation or other treatments to attempt to snuff any remaining cancer cells.
- Alates typically take flight from the nest surface, with the major swarm at twilight following the first heavy rains of the spring wet season. Collecting nests removes mature and developing

alates within and knocks any remaining swarmers off their game by eliminating their normal "launch pad."

- Collecting nests makes subsequent inspections and monitoring easier and more efficient because there is no confusion between existing and newly built nests.
- The original approach to treating this infestation was direct application of termiticides to nests. Upon reinspections following such treatments, there were reports that Coneheads "walled off" pesticide-treated portions of some nests, remaining active in untreated sections, thus requiring retreats. The termites are repelled by decomposing corpses of their nestmates, so that factor in addition to their natural response to evacuate from disturbance may result in relocation of some of the treated nest's population to an existing, or newly built, satellite nest. Even an egg-filled physogastric queen can readily move out and climb to a new nest site. Swift "surprise attack" nest removal foils such evasive moves, eliminating nest partitioning or relocating.
- *Nasutitermes'* nest carton is composed largely of lignin, a very hard, durable compound. A consequence of lignin's chemistry and the density of interior construction is that the thick nest carton repels liquids, making it a challenge to drench a nest with termiticide. Furthermore, pieces of nest left on site will persist for many years without decomposing. Nest carton treated with pesticides will retain residual chemicals, and may be picked up and handled by children, adults or pets. Complete removal of nests eliminates these concerns.

By removing and destroying entire nests, aggressively treating foraging trails and other activity zones and vigilantly inspecting and monitoring the known and surrounding infested areas, this progressive IPM effort reinvents termite control to take advantage of the vulnerabilities of this industrious and challenging invasive species. As in any IPM initiative, the strategy is to capitalize

Classic *Nasutitermes corniger* nest, medium brown with slightly bumpy exterior. Shapes and host substrates vary, but nests tend to be spherical or ellipsoidal, often on or by a tree, shrub, stump, structure or other wood.

on aspects of the organism's life history that we can most easily disrupt (for Coneheads, targeting their conspicuous nests and prolific foraging tunnel networks), and design control practices that are safe and environmentally responsible as well as highly effective. In the case of this agile and hungry invasive species, the "bar" of treatment success is higher than our normal "protect the structure" goal when treating drywood or subterranean termites. We aspire to eradicate the Coneheads from the U.S., meaning that in addition to structures, treating activity in yards and landscapes is crucially important.

Why the cautious optimism that, if aggressive, multi-faceted, full-throttle efforts and actions begin now, eventual eradication of this invasive species is possible?

Witness the spread and immense impacts of fire ants, Africanized bees and the Formosan termite. Yikes! Many invasive species are difficult; exotic social insects have proven especially formidable. Those introduced ants, bees and termites defied experts' projections by spreading faster and farther than predicted, with populations now so firmly established that eradication from the U.S. is impossible.

Nasutitermes corniger has proven remarkably flexible in adapting to a wide variety of habitats, nest sites and acceptable foods. Its potential economic and ecological impacts to virtually every constituency—including homeowners, growers, businesses, institutions and natural areas such as the Everglades—cannot be underestimated. In contrast to its native range, most structures in Florida are built with wood framing and/or other components, and water is often plentiful with sprinkler systems, canals and lakes. Buildings are heated during winter chills. Although Coneheads may adjust their behaviors and food preferences, seasonal cycle and growth rate to accommodate Floridian circumstances, they can clearly thrive in habitats like Dania Beach. How far and fast they may spread is anyone's guess, but such extrapolations are likely to be brashly disregarded by the adaptable Coneheads. Once the termite spreads much further, chances for success will be extremely low, with immense implications for widespread destruction and irreversible economic consequences.

If we act intensively and relentlessly now, characteristics of this otherwise powerful foe offer several strategic advantages in the eradication effort:

- This species is easy to identify; even children will be able to diagnose Coneheads!
- These termites build conspicuous trail networks. Young colonies, still hidden within wood, build foraging tunnels before constructing a visible nest.
- Growing colonies eventually build a distinctive nest, which may be cryptically concealed within dense foliage, plant growth or other debris, but upon discovery—and if accessible—enables destruction of

the "heart" and growth center of the colony.

- Unlike invasive creatures such as fruit flies, lizards and fish, which rapidly fly or dart to avoid capture, Conehead nests do not run away. Their fixed positions grant us planning time as we strategize the best approach for surprise attacks in collecting individually situated nests.
- If we are able to suppress colony populations sufficiently to stop alate flights, game over. This termite cannot disperse far by walking. Critically, however, we must take precautions and impose restrictions to prevent termite transport ("hitchhiking") on wood and paper products as well as nursery stock moved out of the infested zone.
- Existing termiticide chemistries and application technologies are effective, and new approaches are being designed and evaluated, so our arsenal of tools is potent.

PMPs and the public throughout Florida, and beyond, need to be aware of this termite so if it disperses or hitchhikes to attempt to colonize a new area, the Conehead will be rapidly identified, immediately treated, and the region monitored for further activity. Acting quickly and decisively now, and committing to treatment and inspection vigilance for many years ahead, will be key to eliminating the current infestation and preventing future established populations.

Dr. Barbara L. Thorne, Research Professor in the Department of Entomology, University of Maryland, is an international expert on termite biology, detection, and control. This Conehead species, Nasutitermes corniger, *was the focus of her dissertation research in Central and South America and the Caribbean as she earned her Ph.D. at Harvard University, mentored by distinguished biologist Dr. Edward O. Wilson. She has published more than 20 scientific papers on this species. Dr. Thorne recently moved to Vero Beach, Florida, and now serves as the state of Florida's science advisor for this exotic termite eradication effort. Dr. Thorne can be reached at* conebeadtermite@gmail.com.

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