Information for pest management professionals and pesticide applicators

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Detecting Drywood Termites in Structures With Microwave Technology

Western drywood termites (*Incisitermes minor*, Figure 1) are important pests of structural wood in California, causing millions of dollars in damage annually. These termites are very cryptic, hidden in their galleries within wood members (pieces of wood), and only emerge during swarming. As a result, wood damage usually goes unnoticed for a long time.

Control options are generally categorized as either whole-structure treatment (heat-treatment and fumigation) or local treatments (insecticide injection into the wood, high-power microwaves, electrocution, and other techniques).

Despite the high efficacy of fumigation, there has been increasing interest by property owners to use local treatments for eradicating drywood termites. This may be due to the high cost and inconvenience of fumigation. To learn more about decision-making associated with fumigation, visit urbanipmsocal.com/ipm/termites/to-fumigate-or-not-to-fumigate. Local treatment of drywood termites can be ineffective because of the difficulty in locating active infestation sites within structures.

To address this issue, practitioners and researchers have considered different detection methods using traditional and modern technologies such as borescopes, moisture meters, and heat sensors as well as devices using X-rays, acoustic emission, and low-energy microwaves. Here we provide a review and some technical details on how to operate a specific device using microwave technology for detecting termite movement in structures.

Termatrac

Termatrac[1] is the brand name of a portable device that emits and receives low-energy microwaves to detect tiny movements in wood. This device is currently available as two models: Termatrac T3i All Sensor and Termatrac T3i Radar Only. Termatrac All Sensor includes a microwave emitter/sensor, a moisture meter, and a thermal sensor. The Radar-Only version, however, includes only the microwave technology ("radar"). Both devices generate a line graph output that represents termite movement within wood (Figure 2).

Although such output can be informative, interpreting the results might not always be easy and may also require considerable expertise. First, the output's line graph may represent detection of non-termite objects or the user themselves (body movement or hand shaking while holding the device). Second, the signal intensity varies depending on the depth of

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Figure 1. Western drywood termite, *Incisitermes minor*, immatures.

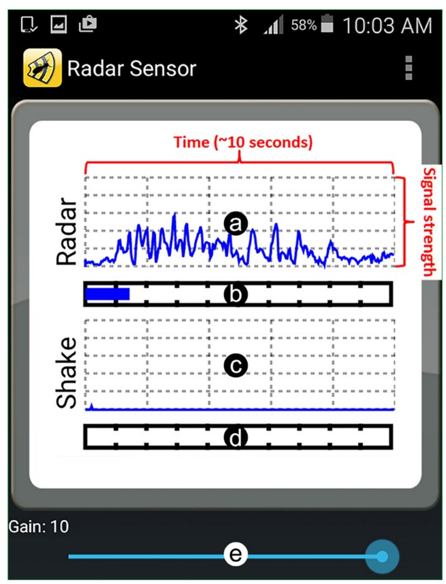

Figure 2. Termatrac's radar sensor output: (a) Radar line graph; (b) Radar bar graph; (c) Shake/Accelerometer line graph; (d) Shake/Accelerometer bar graph; and (e) Gain (sensitivity) control. (from Taravati, 2018)

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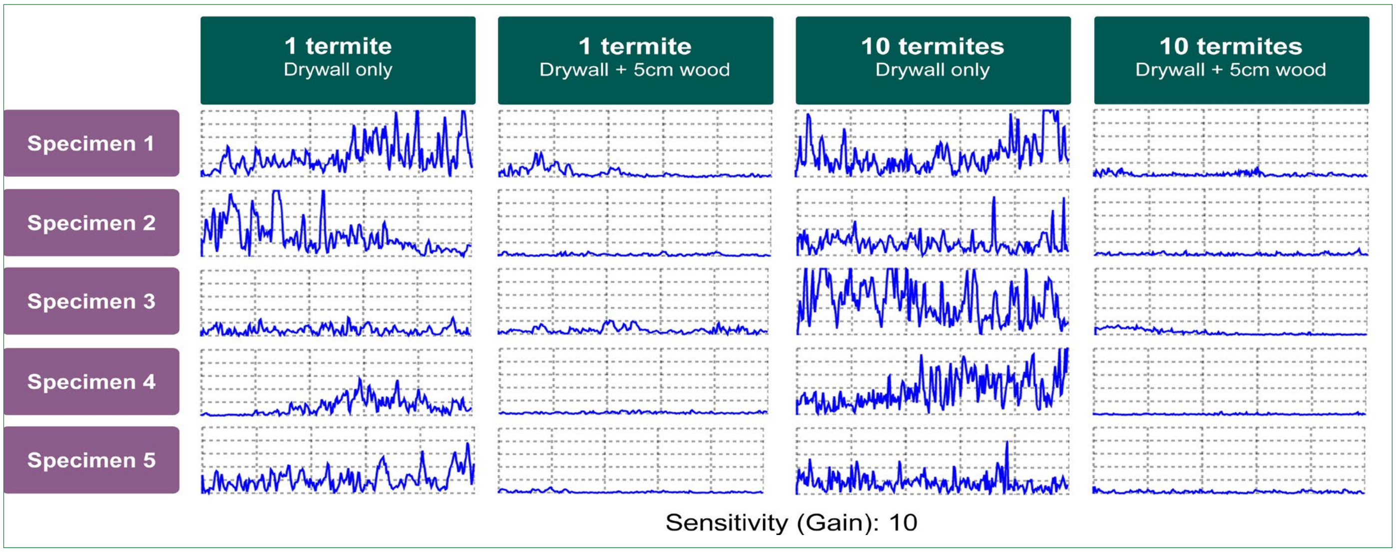

Figure 3: Termatrac's signal output for different termite densities and different depths. Higher termite densities do not always create a noticeably stronger signal. (from Taravati, 2019)

termite activity, so Gain settings may need to be adjusted for higher or lower sensitivity. Third, the relationship between termite density (number of termites per unit of area) and signal strength is not easily understood by users (Figure 3). Fourth, termites may not be present or active during inspection and this may lead to a false negative conclusion (concluding "no termites" when they are present) when inspecting an infestation. To address these issues, field and lab research experiments were conducted in California to evaluate the efficacy of the Termatrac device and to help termite inspectors accurately interpret the output signal.

Termatrac can be used in different positions (see Figure 4):

a. hand-held with radar surface flush against the inspection surface

b. mounted on a tripod with radar surface flush against the inspection surface

c. resting on a horizontal surface with radar surface flush against the inspection surface

d. with radar at 45° angle to the inspection surface using the back flap or a tripod

Field studies revealed that hand-held uses produce less accurate results than tripod/flap supported uses due to user hand shaking. Also, the device's output showed more noise (noise refers to a detected signal in the output that is not coming from drywood termites) from the user's body movement when used at 45° to the inspection surface as compared to flush against the inspection surface (Taravati 2019).

Recommendations

For optimal readings, Termatrac users should keep the following in mind. Users need to stand still when reading

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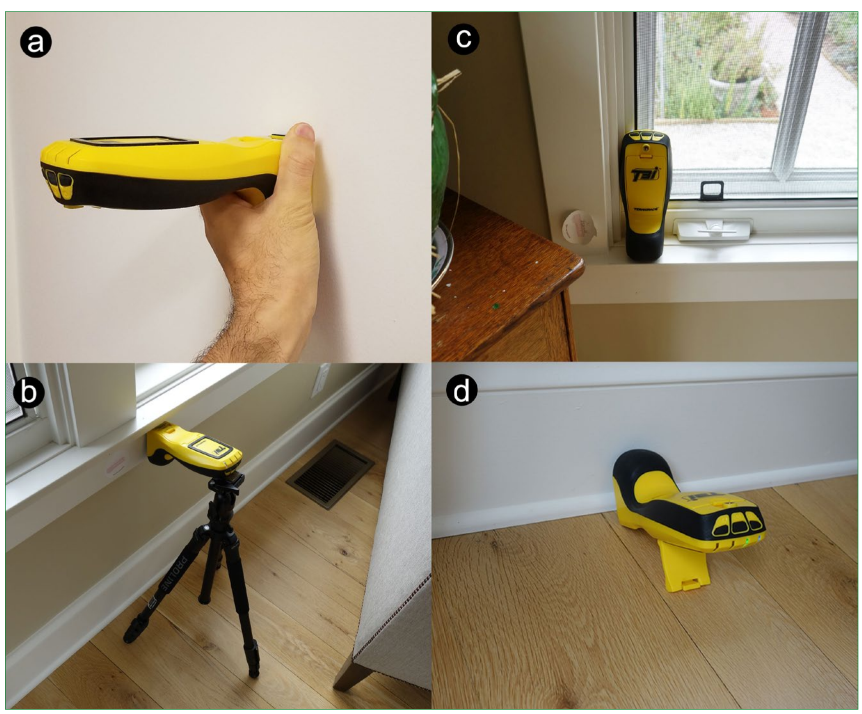

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Figure 4: Various positions/configurations for using Termatrac T3i as evaluated in the field

Termatrac *... continued from page 2*

the output or the device will pick up their body movement and produce a false positive signal. This is especially true at high sensitivities.

Users also need to ensure that there are no moving objects (vehicles, plants swaying with the wind, airborne debris such as leaves and dusts, children, or animals (such as pets and birds) on the other side of the inspection surface (a wall for instance) which may create false positive signals. Also, water passing through pipes behind inspection surfaces may produce a strong signal. However, heavy machinery around the experiment sites did not produce any detectable noise despite being very loud.

The device should not be used to inspect unstable surfaces or non-fixed objects (e.g. yard fence) since these situations will increase the chance of false positive signals and inaccurate detection of termites.

To save time and increase accuracy when inspecting standard interior walls, users should first try to locate studs using a stud finder and then use Termatrac on those areas only. Users may also choose to focus on wooden window frames and windowsills since these have been observed to be one of the most common spots where drywood termites are detected in homes.

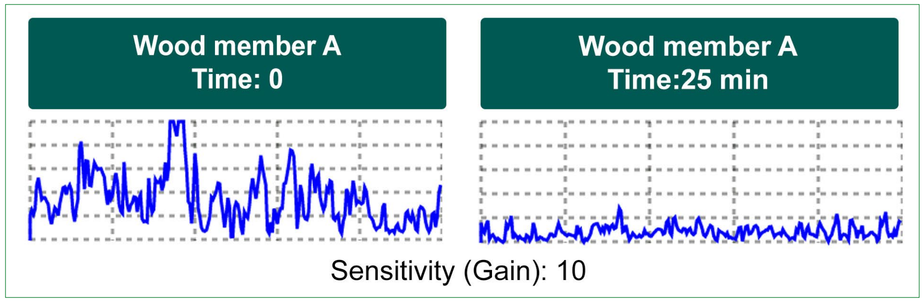

Figure 5: Termatrac's output measured at two different times (25 min apart). This structural wood member contained 47 live termites. (from Taravati, 2019)

Findings

Lab studies showed that higher densities of termites may not necessarily produce stronger signal (Figure 3). At the highest sensitivity setting, Termatrac T3i was able to detect a single drywood termite behind 5 cm (2 inch) of wood and 1.3 cm (0.5 inch) of drywall (total thickness of test "wall": 6.3 cm / 2.5 inch).

Drywood termites move within their galleries continually and therefore may not be present in all gallery regions at all times. Furthermore, termite activity may change throughout the day depending on temperature and other factors (Figure 5). As a result, if you suspect an active infestation in a wall but are not getting a detectable Termatrac signal, it is worth moving on to other areas and then returning in a few minutes to re-inspect the suspect location.

To conclude, Termatrac can be very useful in some termite detection. Like other termite detection devices, Termatrac has limitations and requires training and experience before a user can efficiently and accurately detect termites. With this said, an experienced Termatrac user can obtain valuable information about termite presence and activity when the infested wood members are in accessible locations.

[1]Mention of a product does not constitute an endorsement.

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Upcoming Meeting:

UC RIVERSIDE URBAN PEST MANAGEMENT CONFERENCE 2020

March 25, 2020, Riverside, CA
http://ucanr.edu/u.cfm?id=235

Using Hydrogels to Develop a Yellowjacket Bait

Many parks, recreational areas, and outdoor venues in California are home to yellowjacket wasps (*Vespula* spp.). Yellowjackets are commonly attracted to human food items, creating a serious nuisance and a potential stinging threat. If found, nests (usually underground) can be effectively treated with targeted insecticide applications (e.g., dusts containing pyrethroids). However, baiting could be a feasible alternative method to suppress yellowjackets over a wide area, especially if nests cannot be located. Currently, only one active ingredient (esfenvalerate) is registered for use within bait in California to control yellowjackets, and its efficacy is marginal because it is repellent and fast-acting. Effective active ingredients and optimal bait formulations have yet to be identified.

Foraging wasps seek out protein-rich foods for developing larvae in the nest. These foragers have strong preferences for some meats, and in the past, meats impregnated with insecticides have been used as baits. However, meat loses its attractiveness after less than a day, requiring the use of fresh meat, which has been a major hurdle in developing a commercial "ready-to-use" bait product.

To overcome this challenge, a team of researchers from the University of California conducted experimental trials using non-meat materials as matrices for yellowjacket baits. Due to their high absorbency of water and water-soluble compounds as well as biological inertness, hydrogels were considered as possible candidates for this use. As a first step in this investigation, we observed whether foraging western yellowjacket wasps (*V. pensylvanica*) would accept polyacrylamide hydrogel crystals that were hydrated with chicken juice containing a toxicant.

Field Trials

The study was conducted at two different sites in southern California. Site A was a private country club (~15 acres) with supporting recreational infrastructure (e.g., picnic tables, barbecue facilities, children's playgrounds, etc.). The site was surrounded by mixed conifer and oak forest. Site B was a multiple-use regional park (~161 acres) surrounded by undeveloped wilderness areas composed primarily of riparian and coastal sage scrub.Yellowjacket foraging activity was monitored using traps containing a chemical lure, heptyl butyrate.

In 2014 and 2016, sites were baited with hydrogel bait with 0.025% (wt/wt) fipronil*. Ten yellowjackets per trap per day was used as an action threshold for baiting. To prevent consumption by non-target organisms, the bait was provided at "bait stations" within three small plastic cups placed inside a cage.

Wasps were readily attracted to the bait, manipulated the bait with their mandibles, and flew away with small pieces of the bait (Figure 1). After 24 hours, the approximate amount of bait removed from each cup in grams (g) was estimated.

D-H CHOE, UCR

Figure 1. Western yellowjacket baiting with the hydrogel bait. After a short handling behavior on the bait, yellowjackets flew away with a small piece of the hydrogel bait.

Results

For Site A, the estimated amount of bait removed per cup was 8.3–16.5 g or about 27–83% of the bait provided. For Site B, estimated amount of bait removed per cup was 5.8–8.0 g or 29–40% of the bait provided. Monitoring data clearly indicated that yellowjacket foraging activity in baited areas dramatically decreased (~74– 96% reduction) immediately after baiting (Figure 2).

The behavioral observations at the bait stations and the amount of bait taken clearly indicated that polyacrylamide hydrogel was an excellent matrix for yellowjacket baiting. The meat-like physical texture and chemical inertness of the hydrogel may explain its acceptance by foraging yellowjackets. With its ability to absorb large amounts of liquids and to resist evaporation, hydrogel bait might also remain palatable for longer periods of time compared with meat-based bait.

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WHAT IS IPM? Integrated Pest Management (IPM) programs focus on long-term prevention of pests or their damage through a combination of techniques including resistant plant varieties, biological control, physical or mechanical control, and modification of gardening and home maintenance practices to reduce conditions favorable for pests. Pesticides are part of IPM programs but are used only when needed. Products are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment.

Yellowjacket Hydrogels *... continued from page 4*

The use of hydrogel for bait formulation may enable manufacturers to develop a commercial ready-to-use bait product for yellowjacket control. Hydrogel baits could be pre-packaged in bait containers, though dehydrated formulations would need to be hydrated with a prescribed amount of water before use. We observed that very few non-target insects were attracted to these baits; Argentine ants and velvety tree ants were occasionally seen foraging at the bait stations. Ants were excluded by using commonly available pyrethroid-impregnated "ant guards" designed for hummingbird feeders. This study used the liquid contents from canned chicken meat as an attractant / feeding stimulant. We are currently working on replacing this "chicken juice" with a mixture of synthetic and natural attractants and feeding stimulants which would be better suited for commercialization.

*Use of fipronil in combination with chicken meat (or juice) is strictly experimental and is not registered for yellowjacket control in California. Such use by licensed professionals would currently be considered illegal.

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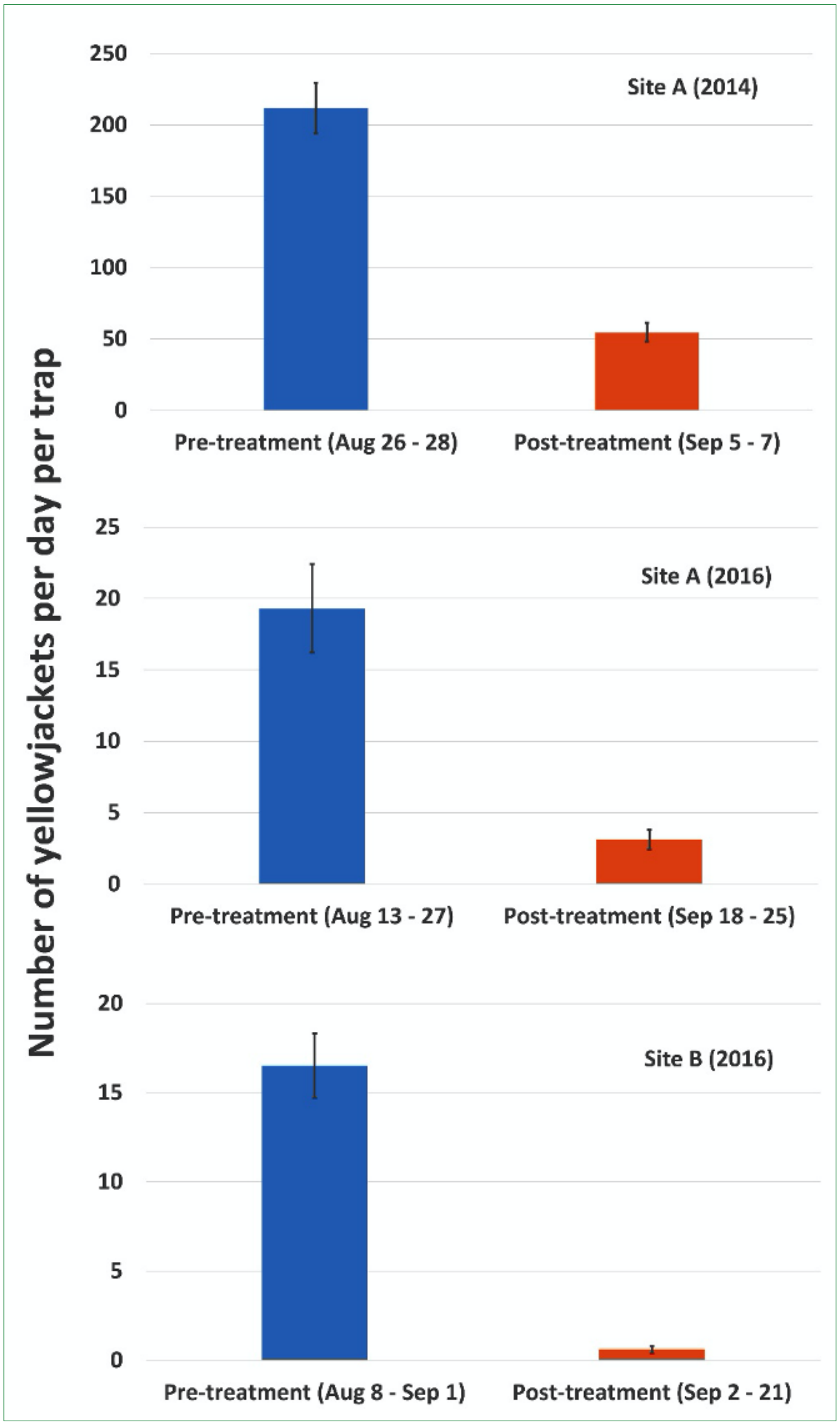

Figure 2. Yellowjacket foraging activity level comparisons between pre- and post-treatment monitoring periods. The hydrogel baits were deployed on 30 August 2014 (site A, 2014), 17 September 2016 (site A, 2016), or 1 September 2016 (site B, 2016). For all 3 trials, numbers of yellowjackets per trap per day were significantly lower in the post-treatment monitoring periods compared to the corresponding pre-treatment periods. (from Choe et al., 2018)

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Choe, D. -H., K. Campbell, M. S. Hoddle, J. Kabashima, M. Dimson, and M. K. Rust. 2018. Evaluation of a hydrogel matrix for baiting western yellowjacket (Vespidae: Hymenoptera). *J. Econ. Entomol.* 111: 1799–1805.

Rust, M. K., D.-H. Choe, E. Wilson-Rankin, K. Campbell, J. Kabashima, and M. Dimson. 2017. Controlling yellow jackets with fipronil-based protein baits in urban recreational areas. *Int. J. Pest. Manage.* 63: 234–241

Revised *Pest Notes*


Pest Notes, Publication 74171
Armillaria Root Rot

Armillaria Root Rot

Armillaria root rot is a severe fungal disease that can rapidly kill trees, woody plants, and some herbaceous plants. No plants are completely immune to Armillaria root rot, so prevention is key to managing the disease. In the new *Pest Notes: Armillaria Root Rot,* UCCE Advisors A. James Downer and Igor Lacan details research-based techniques for prevention and management of this common disease of landscape trees and plants, and provides color photographs to aid in identification.

ipm.ucanr.edu/PMG/PESTNOTES/pn74171.html


Pest Notes, Publication 7467
Cockroaches

Cockroaches

Cockroaches can create public health problems by contaminating food and producing allergens. Pesticides alone will not control a cockroach problem and are most effective when combined with sanitation and exclusion.

UCCE IPM Advisor Andrew Sutherland and UC Riverside entomologists Dong-Hwan Choe and Michael Rust tackle the problem of cockroach management in the newly revised *Pest Notes: Cockroaches.*

ipm.ucanr.edu/PMG/PESTNOTES/pn7467.html

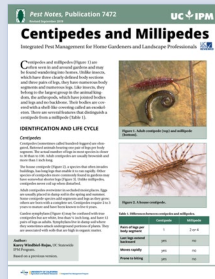

Pest Notes, Publication 7478
Plantains

Plantains

Turfgrass managers and home gardeners alike struggle to control the perennial weeds buckhorn and broadleaf plantain. UCC IPM Advisor Maggie Reiter has updated *Pest Notes: Plantains* with tips on management and a table of currently registered herbicides.

ipm.ucanr.edu/PMG/PESTNOTES/pn7478.html

Visit UC IPM's *Pest Notes* web page for these and many more titles
ipm.ucanr.edu/PMG/PESTNOTES


Pest Notes, Publication 7472
Centipedes and Millipedes

Centipedes and Millipedes

Centipedes and millipedes are commonly spotted in gardens, although the house centipede lives in buildings where it hunts pest insects. Learn more about these many-legged arthropods in our recently updated *Pest Notes: Centipedes and Millipedes* by Karey Windbiel-Rojas of the UC Statewide IPM Program.

ipm.ucanr.edu/PMG/PESTNOTES/pn7472.html


Pest Notes, Publication 74117
Deer

Deer

Many people enjoy seeing deer, but not when they're ravaging gardens, orchards, and vineyards. For management techniques, see the newly updated *Pest Notes: Deer*. Robert Timm, UCCE Advisor (emeritus) expanded the publication with information about fencing, repellents, and new images.

ipm.ucanr.edu/PMG/PESTNOTES/pn74117.html


UC IPM Pest Notes, Publication 7463
Roses: Diseases and Disorders

Roses: Diseases and Disorders

The newly revised *Pest Notes: Roses: Diseases and Disorders* by UCCE Advisor John Karlik and Deborah Golino and Maher Al-Rwahni of UCD Foundation Plant Services, provides an integrated approach to managing rose problems that includes careful variety choice, proper irrigation, correct pruning, and sanitation.

ipm.ucanr.edu/PMG/PESTNOTES/pn7463.html


Pest Notes, Publication 7466
Roses: Insects and Mites

Roses: Insects and Mites

Find solutions for common invertebrate pests on roses in UC IPM's recently updated *Pest Notes: Roses: Insects and Mites*. This revised publication by rose experts Mary Louise Flint, Extension Entomologist (emerita) and John Karlik, UC Cooperative Extension Advisor will help you identify insect pests, and consider management options.

ipm.ucanr.edu/PMG/PESTNOTES/pn7466.html

Ask the Expert!

Q: How can I tell the difference between drywood, dampwood, and subterranean termites?

A: All three termites are commonly found in California, although the dampwood termite is most often found in cool, humid areas along the coast. Termite colonies contain several forms, or castes, including workers, soldiers, and reproductives. These castes look different depending on the type of termite. The photos below show the differences between these termites.

Workers (left to right) of subterranean, drywood, and dampwood termites.

Soldier caste (left to right) of drywood, subterranean, and dampwood termites.

Reproductives (left to right) of dampwood, drywood and subterranean termites.

For more information about termite identification, including more photographs of different termites and other signs of an infestation, see:

Pest Notes: Subterranean and Other Termites

ipm.ucanr.edu/PMG/PESTNOTES/pn7415.html

Pest Notes: Drywood Termites

ipm.ucanr.edu/PMG/PESTNOTES/pn7440.html

Always read and carefully follow all precautions and safety instructions provided on the pesticide container label, as well as any other regulations regarding the use of pesticides. Not following label directions, even if they conflict with information provided herein, is a violation of state and federal law. No endorsements of named products are intended, nor is criticism implied of products not mentioned.

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For more information about managing pests, contact your University of California Cooperative Extension office, or visit the UC IPM website at ipm.ucanr.edu.