مجلس أبوظبي
للجودة والمطابقة
Abu Dhabi Quality &
Conformity Council

# Abu Dhabi Guideline

# دليل أبوظبي الإرشادي

ADG

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## Abu Dhabi Guideline for Public Health Pest Control Services – Ants Management

## دليل أبوظبي الإرشادي لمكافحة آفات الصحة العامة – مكافحة النمل

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# 1. Amendment Page

To ensure that each copy of this technical document (Abu Dhabi Guideline) contains a complete record of amendments, the Amendment Page is updated and issued with each set of revised/new pages of the document. This ADG is a live document which can be amended when necessary. QCC operates Abu Dhabi Guideline for Ants Management – Public Health Pest Control Services Emirates Group which prepared this document and can review stakeholder comments in order to review and amend this document, and issue an updated version when necessary.

| Edition Number | Year of Approval | Number of pages | Sections Changes | Notes |
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| First Edition | 2021 | 52 | – | New Document |
| Second edition | 2024 | 52 | All | Change to ADPHC |
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## 2. About the Abu Dhabi Quality and Conformity Council

Abu Dhabi Quality and Conformity Council (QCC) is an Abu Dhabi government entity established in accordance with Local Law No. **(3) of 2009** to raise the quality of Abu Dhabi's exports and products traded locally. QCC consists of a council of regulators and industry with a mandate to ensure provision of quality infrastructure in line with global standards.

- QCC's functions are divided into six key areas:
  - Developing standards and specifications
  - Capacity building of metrology systems
  - Strengthening testing infrastructure
  - Launching conformity schemes
  - Protecting consumer interests
  - Ensuring fair trade
- QCC's key stakeholders include regulatory authorities, consumers, retailers and wholesalers, industry, conformity assessment bodies (CABs) and importers.

QCC supports regulators and government organizations through offering quality and conformity facilities, expertise and resources that allow them to implement products safety and compliance requirements and regulations. Additionally, QCC works towards promoting a culture of quality and protecting the interests of consumers. In doing this, QCC seeks to promote the Emirate's competitiveness to become one of the world's most attractive regions for investments and human capital, and to support the competitiveness of national industries in world markets.

## 3. Acknowledgement

QCC would like to thank the members of the Working Group listed below.

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## 4. Foreword

Technical guidelines for "Pest ants" management have been prepared by ADPHC's pest control experts to standardize the most common and approved control methods used for controlling pest ants' populations in Abu Dhabi. These selected procedures have been practiced by ADPHC's pest control professionals and the information about these procedures were approved and all aspects were comprehensively studied. This TG summarizes technically and scientifically approved procedures that consider the interest of the key stakeholders.

This TG has been built based on the profound experiences of ADPHC's pest control experts. This TG is intended to be used by professionals who work in the field of public health pest control. This TG represents the acceptable and approved procedures for controlling pest ants. Therefore, all registered public health pest control professionals in Abu Dhabi shall follow its procedures and implement it during their operations. Consumers (clients) can also use this TG as reference to have better knowledge about ADPHC's quality standards for controlling ant pest.

This TG contains entire details related to the key procedures of ant pest control, including management methods, tools, equipment, and data management. Quality standards have been represented in the form of standard statements and general rules. General information and literature review about ant pests have also been provided. This TG is considered as national guide for best practices for controlling pest ants in Abu Dhabi and it can be used as reference for ant management operations, training programs and examination systems.

This TG is always subjected to change and update. Any newly developed or approved methods can be added upon ADPHC's approval as the same as any of the existing approved procedures can also be removed upon regulatory organization approval.

This TG was built based on the following legal references:

1- UAE Federal law no. 10 for the year 2020 regarding pesticides
2- UAE Federal law no. 13 for the year 2020 regarding public health
3- UAE Cabinet decree no. 27 for the year 2012 regarding public health pesticides circulation
4- Standard municipal guide for permitting requirements public health pest control companies. Issued by MOCCAE 2020

This TG is a dependent document that requires the application of ADPHC Technical Guidelines for Responsible Use of Pesticides. Therefore, all standards, regulations and rules of Abu Dhabi Guidelines for Responsible Use of Pesticides are applicable in this TG or for ant management.

## 5. Working Group

The Professional Working Group was organized by Abu Dhabi Quality and Conformity Council and established in April 2021, which was requested by Abu Dhabi Guideline for Ants Management – Public Health Pest Control Services in cooperation with the related stakeholders including representatives from government and private sectors.

## 6. Purpose

This TG is considered as national guide for best practices for controlling ant pests in UAE and it can be used as reference for ants' management services operations, training programs and examination systems

This TG has been built based on the profound experiences of UAE public health pest control experts. The TG is intended to be used by professionals who work in the field of public health pest control and it represents the acceptable and approved procedures for controlling ants pests. Thus, public health pest control professionals in Abu Dhabi shall follow the TG and implement it among their operations. Consumers (clients) can also use the TG as reference to have better knowledge about ADPHC quality standards for controlling ants pests.

## 7. Scope

This methodology is applicable for all service providers who are working in the field of public health pest control services in the Abu Dhabi. All service providers for ants control shall strictly commit to comply with all given methods and procedures of this TG. This TG and its content are applicable for all ant services. All public health pest control service providers in Abu Dhabi shall follow all instructions, methods, rules, and quality standards mentioned in this TG whenever they provide ants control services.

## 8. Terms and definitions

For the purposes of this guideline, the following terms and definitions shall be used unless the context indicates otherwise:

| TERM | DEFINITION |
|---|---|
| **Scheduled services** | Planned services provided in a regular basis for certain areas |
| **Unscheduled services** | The services provided in irregular basis upon client request or field observations |
| **Baseline survey** | The initial survey that is carried out to newly served areas in order to investigate the pest population status and infestation level. |
| **Conventional insecticides** | Any synthetic active ingredients other than biological and antimicrobial pesticides. |
| **Preconstruction treatment** | The anti-termite treatment that is carried out at the building foundation during the construction phase as preventive measure against termite infestation. |
| **Postconstruction treatment** | The anti-termite treatment that is carried out for fully constructed buildings and it could curative or preventive measure |
| **Regulatory organization** | The designated governmental organization who is responsible for managing and regulating the public health pest control sector within their local or federal jurisdiction |
| | |

## 9. Integrated pest management

Integrated Pest Management (IPM) is a common-sense and science-based approach for controlling pests and disease vectors. IPM relies on using a variety of pest management methods emphasizes on pest prevention, reduction, and the elimination of conducive factors to pest infestations. IPM program also relies heavily on citizens education and pest monitoring (EPA, 2016). Avoiding the use of unnecessary pesticides is the first step in pesticide risk reduction, IPM helps minimize pesticide use (FAO, 2019).

Integrated pest management approach is considered as the key strategy of UAE for controlling pest ant species, IPM strategy shall rely more on preventive means rather curative ones and shall focus on minimizing the pesticides usage as less as possible. IPM must be applied and incorporated in all ants control procedures.

The long-term success of an IPM program for ants often depends on the client being adequately instructed on contribution in the following key points in order to prevent ants' problems (Mallis,2013)

1. Having good sanitation.
2. Eliminate moisture damage arising from inadequate ventilation, earth-to-wood contact, clogged or overflowing gutters, and the leaky pipes.
3. Avoid and sealing cracks in foundations
4. Removing any sacked or piled bricks, stones, leaf litter, and other debris around the structures.

Integrated ant management highly depends on having good inspection and survey, applying nonchemical measures and continuous follow ups. In case if all nonchemical options failed to control ant, then chemical control can take place by using the most effective and least toxic insecticides, followed by continuous monitoring.

## 10. Ant overview

Ants are one of the most successful groups of insects. Ants are social insects and play an important role in the ecosystem in many ways (Mallis,2013). Ants live in colonies which are usually located in the ground, but they may enter building for shelter and or food. Ant will exploit situation that have sufficient moisture, provide shelter, and have a nearby source of food. Moisture sources may be stones, woods, vegetation, or any other object which can retain water and also can provide heat on their underneath side. Household ants are an important group of insect pests in the urban environment because of their close association with mankind (Holldobler and Wilson, 1990) and foraging activity in mass numbers (Chong, 1997; Robinson, 1996; Lee et al., 1999).

Of the 10,000 ant species that have been described, less than 0.5% are pests in the human environment (Lee and Robinson, 2001). Prior to the 1990s, household ants were considered a less important group of household pests than cockroaches and mosquitoes in Asia, but their status has

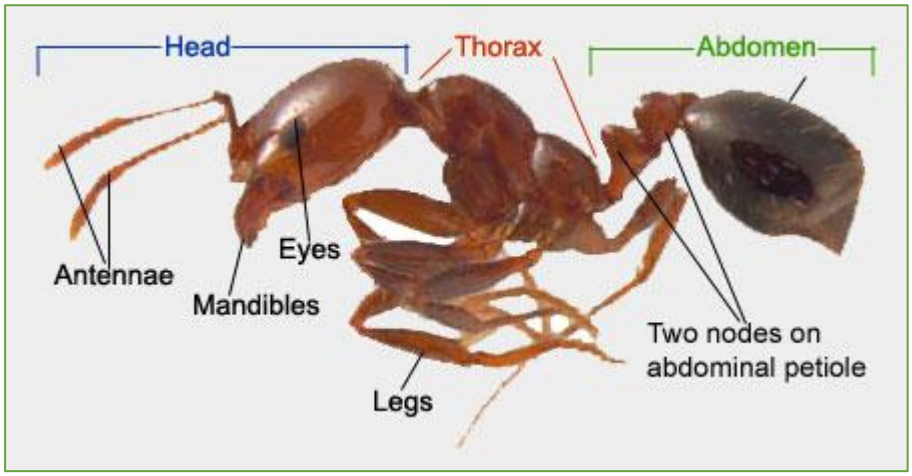
risen in many Asian developed countries, such as South Korea and Singapore. In tropical Malaysia, ant control accounted for about 10% of the business of the pest control industry in 1995 (Yap and Lee, 1996), while in other developed countries in Asia, it has a market share of between 15-30%. Since the overall number of pest ant species can be limited, the potential of having millions upon millions of a single ant species in a locality can present a significant importance of its management. Many ant species are serious pests in urban environments. They may cause damage to structures, electronic devices and affect household residents; in addition, many species can sting and/or bite. Presently there is greater awareness of the risks involved in the indiscriminate release of toxicants on the environments we live and work, thus the demand for environmentally friendly control methods is growing. (Mallis,2013)

In general , ants, as insects their cuticle could carry different microorganisms (Beatson 1972; Bueno and Campos-Farinha 1999; Santos et al. 2009), therefore, they are frequently believed to be involved in food contamination and mechanical vectoring of disease agents (Beatson 1972; Fowler et al. 1993; Olaya-Masmela et al. 2005; Moreira et al. 2005). In addition, as there are minute species, they can enter places where other, larger insects, cannot (such as cockroaches, flies, mosquitoes, etc.). Moreover, ants travel long distances searching for food, circulating in these trails from several to hundreds of individuals. These characteristics give them the potential capacity to spread pathogens in sensitive places that should be kept aseptic (Beatson, 1972).

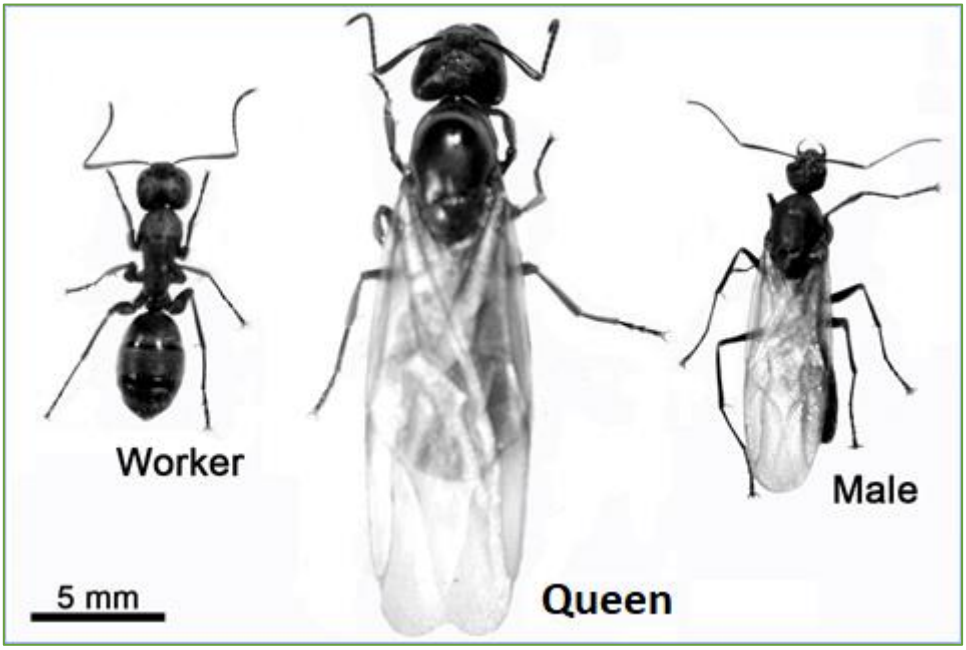
## 10.1. BIOLOGY

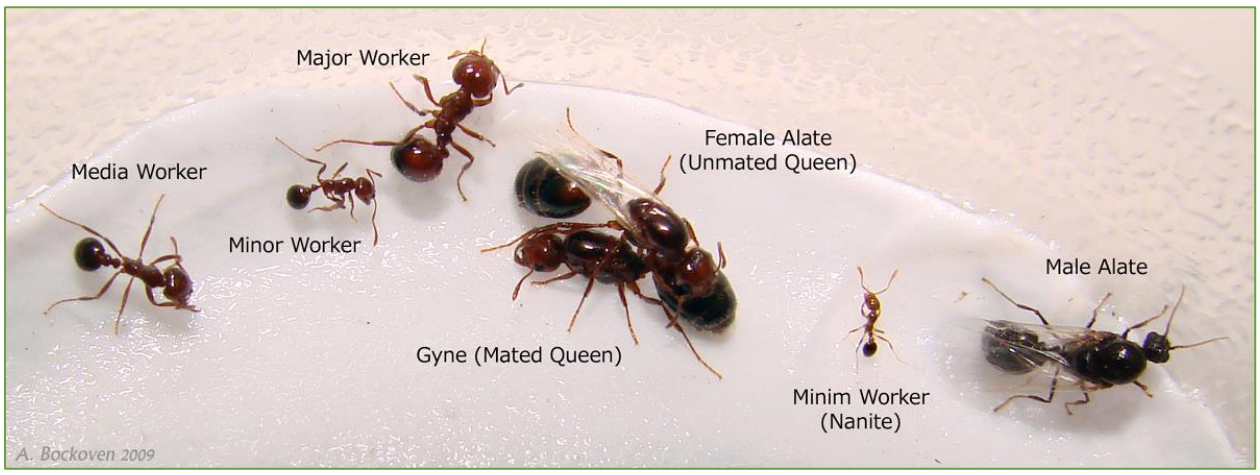
All Ants belong to one family *(Formicidae*) within the massive order of insects, the Hymenoptera. This order is divided into two major groups, the *Apocrita* and the *Symphyta*. The ants belong to *Apocrita* and thus they have waist, which is the characteristic feature of the *Apocrita*. (Gary et al., 1996)

The structural features all ants share are (1) the ability to produce both winged and wingless adults; (2) the specialization of the first segments of the abdomen to form one or two nodes which form the pedicel (ant's waist); (3) an elbowed antenna;(4) mandibulate mouthparts. (Sudd and Franks, 1987)



Ants have three chief castes: queens, males, and workers. The winged female loses her wings soon after mating and becomes a queen. Queens usually have ocelli in addition to large compound eyes and a large gaster for egg production. Males are intermediate in size between queens and workers and can be recognized by ocelli (simple eyes) on top of the head, wings, protruding genitalia, and large eyes. The sole function of the male is to mate with a winged female during the nuptial flight. Males will shed their wings and die soon after the mating. Worker, the smallest member of the colony, usually lacks ocelli and is never winged. Workers of a single species may be of one size (monomorphic) or may vary considerably in size (polymorphic). Large workers are usually called soldiers or majors; very small workers are minors. (Akre et al., 2004).



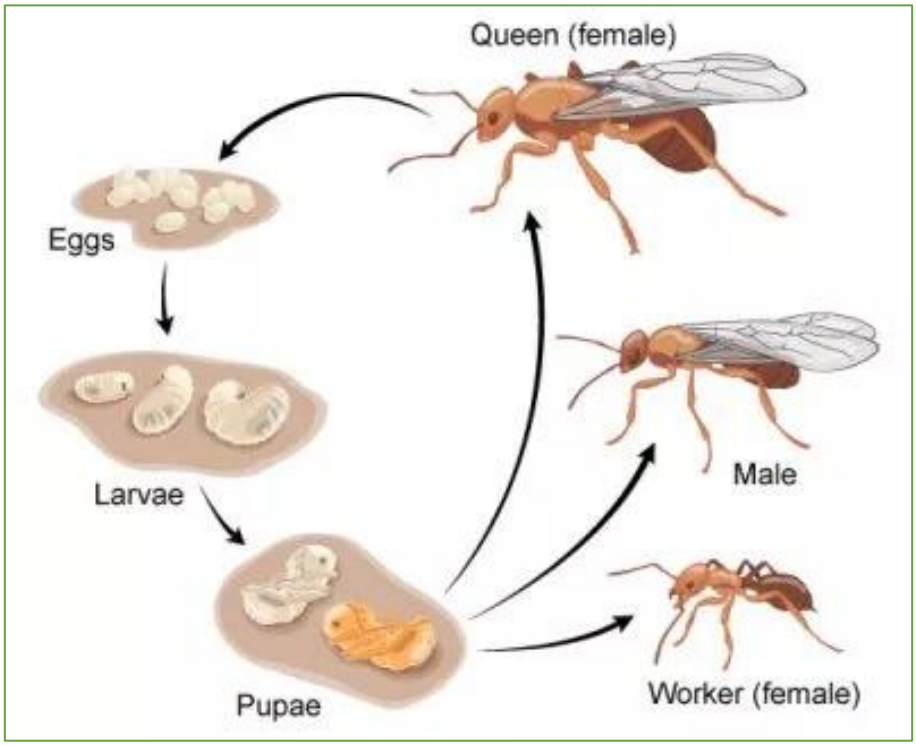




**Fire ant castes- an example of polymorphic ant**

Ants develop by complete metamorphosis: egg, larva, pupa & adult. The founding stage begins with the nuptial flight (Mallis, 2013).


**First ant mating flight – the nuptial flight**

The egg is very small (less than 1 mm) and varies in shape according to species. The larva also varies in size and shape but it usually white and always legless. The pupal stage looks like the adult, but is soft, white, and motionless; many species are enclosed in a cocoon of a brownish or whitish papery material produced by the mature larva. Ants produce winged reproductive usually at one time of the year (spring or fall, depending on species and colony disposition. (Akre et al., 2004).




**Ant life cycle. source piat.org.nz**

## Life stages of ants

Eggs are small and white. they can be deposited throughout the year, but the majority of eggs are deposited during the summer months for most species.


The legless larvae are light in color and immobile. They depend completely on worker ants for transportation, protection, and food.


Mature larvae transform into pupae and pupate for several weeks. Worker ants continue to protect the pupae until new adults emerge.

Ants, like honey bees, are social insects with duties divided among different types (castes) of adults.


*Ant development. Source: ucanr.edu*

## 10.2. DIET AND FEEDING BEHAVIOR

Ants mostly are omnivorous which means that can eat almost everything, though, there are some species are carnivorous who feed by prey on other insects and small vertebrates. Ant diet can range from leaves, seeds, fruits, honey, sugar, other insects, scavenging on dead animals and preying small vertebrates. They might invade houses searching for food residues or even any organic matter found in human dwellings.

Ant workers duties are to tend ant broods and to forage the areas searching for food sources, when a worker finds food or prospective food source it alarms other workers and tell them about its location by sending chemical signals to the colony or carry back the food by which other workers can follow her trails to that food source.

Food preference of ant varies depending on various ant species and also on nutritional needs of the colony (Nyamukondiwa & Addison, 2014). Which means that different ant species have different food preference and within the ant species these requirements are also changing over the time based on the colony nutritional needs that depend on brood development and weather conditions. These differences in food preferences also effect the timing and intervals of ant foraging which makes it very difficult to predict the time of ant foraging.

In general ant adults are not capable to eat solid materials, they have a sieve-like structure in their throat that prevents them from swallowing solids, instead they pick up solid food and retrieve it to the colony where ant larvae regurgitate the food and liquify it and then the workers take that liquid food and feed other workers, queen and males in the colony, this feeding behavior is known in ants' colonies and called Trophallaxis,, and it is also common in other social insects, like termites and honeybees (Mississippi State University Extension Service, 2020).

These feeding and foraging behavior are important aspects that can be used when controlling ant pests which they can limit some control methods and make others more efficient. Thus, operators must be aware about those behaviors in order to select the right control method or to select the best toxic bait.

## 10.3. MOST COMMON URBAN ANT PESTS IN UAE

So far 12629 species of ants have been described worldwide (Antbase,2011). Most of them occur in the hotter climates. Since there are so many species of ants with extremely diverse habits however, most ants that cause annoyance are omnivorous and feed on a variety of foodstuffs (Akre et al., 2004). Until now only 44 species have been reported from the UAE, which was listed by Van Harten (2005) (annex 1). Among them, the following ants are the most common ant pests in Abu Dhabi.

1. Samsum ant (*Brachyponera sennaarensis*)
2. Acrobat ant (*Crematogaster sp.*),
3. Carpenter ant (Camponotus sp.)
4. Pavement ant (*Tetramorium sp*.)
5. Pharaoh ant (*Monomorium pharaonis)*
6. Red Imported Fire ant (*Solenopsis sp*.)
7. Ghost ant *(Tapinoma melanocephalum)*

Even though ant ability to transmit some diseases has been reported, the major concern for ant in Abu Dhabi is the nuisance and psychological effects that caused by ant biting, stinging, and / or their occurrence in premises.

## 1. SAMSUM ANT (*BRACHYPONERA SENNAARENSIS*)

**Identifying Characteristics:** Body length of workers 4–6 mm, head broader than mesosoma (middle body). Gaster ending with a powerful sting. Dark brown to blackish brown. All body surfaces covered with fine and dense pubescence (Sharaf et al. 2017).


**Samsum ant worker (Brachyponera sennaarensis)**

**Live Samsum ant worker**

**Pest Status:** This is an African savanna species known from Arabia for the last 100 years. It is now spreading rapidly into most human settlements (Collingwood, 1985), and found along all major road-side developments, oases, plantations and urban areas of UAE. In UAE, this species is known as the 'Samsum ant'. *B. sennaarensis* (*P. sennaarensis)* is considered to constitute a public health hazard in the Kingdom of Saudi Arabia owing to its painful sting which has been known to cause cases of anaphylactic shock that lead to the death of some persons (Dip, 1992;Dip et al., 1992; Rizk et al., 1998). Al-Shahwan et al. (2006) reported a case of anaphylactic shock and since then several more such cases have been reported following Samsum ant stings, some of which were really critical (Al-Anazi et al., 2009). In Al Ain in 1992 there were at least 30 cases of human allergic reaction and two deaths due to anaphylactic shock following stings from *P. sennaarensis* (Dib et al., 1992).

**Biology and Ecology:** An aggressive ant with a painful sting. It is a scavenger feeding on food refuse and arthropods. New colonies form rapidly and alate queens are probably attracted to artificial lights. Humid soil conditions are needed for nest building and the irrigation of road-side plantations, gardens and parks seems especially conducive to the spread of this species. Nests are very common in urban areas where they pose a potential health hazard. This species also raids beehives and destroys honey bees (Whitcombe, 1982).

***NOTE**: The Samsum ant (*Pachycondyla sennaarensis*) belongs now to genus *Brachyponera* and the name was changed to *Brachyponera sennaarensis* (Fig. 1) (Schmidt and Shattuck, 2014)

## 2. ACROBAT ANT (*CREMATOGASTER SP.*)

**Identifying Characteristics:** Workers are 2.5 to 3 mm long and have two segmented pedicle, the gaster (abdomen) is flattened dorsally and convex ventrally. They vary in color from yellowish brown, to brown, to red and black. (Bennett ET al.1997, Klotz et al .2008)


**Acrobat ant worker**

**Pest Status:** For the most part of the world, acrobat ants are only occasional structural pests. When compared with other pestiferous ant species, acrobat ants are usually of minimal nuisance to people. Homeowners may complain that these ants are in the yard and foraging outside the home. They may nest in trees on the homeowner's property or in decayed wood around the home in places like porches and eaves (Ferster et al. 2000). They are uncommon indoors but may be observed foraging for sweets or protein inside. When they are found nesting in the home, they infest damp or rotting wood often around windows and drain spouts. They may also be found in damp foam board or insulation. These ants do minimal damage to wood, but their frass may be of concern to homeowners. Their presence also indicates the presence of wet and/or decaying wood (Swoboda and Miller 2003). Because of their limited occurrence inside the buildings, acrobat ants are referred to as occasional pest ants (Klotz et al. 1995).

**Biology and Ecology:** Acrobat ants are the most dominant arboreal ant species (Tschinkel 2002). Their name is derived from the acrobatic pose of the workers when they are alarmed, with the abdomen raised and arch above the head and thorax (their ability to hold their heart-shaped abdomen). These ants nest in soil or rotting wood (Ebeling 1975). Acrobat ant workers are aggressive and will emit a repulsive odor when disturbed (Smith 1965). These ants are in a variety of sites, usually in dead wood, including branches and stems of the trees and other plants, rotten logs, trees holes, and stumps (Vail et al. 1994). Nests may occur in the ground beneath objects.

**Dorsal view of acrobat ant live worker**

# 3. CARPENTER ANT (*CAMPONOTUS SP.*)

**Identifying Characteristics:** Carpenter ants have a one-segmented pedicel in the form of vertical scale. The workers are characterized by their evenly convex thoracic dorsum. These ants are relatively large. The queen size can range between 20-22mm, medium worker size 7-12mm, major worker 14-20mm and males about 11mm, all castes have dark brown, black and orange except males they usually have dark brown color (Fourmis home, 2020).

**Worker**

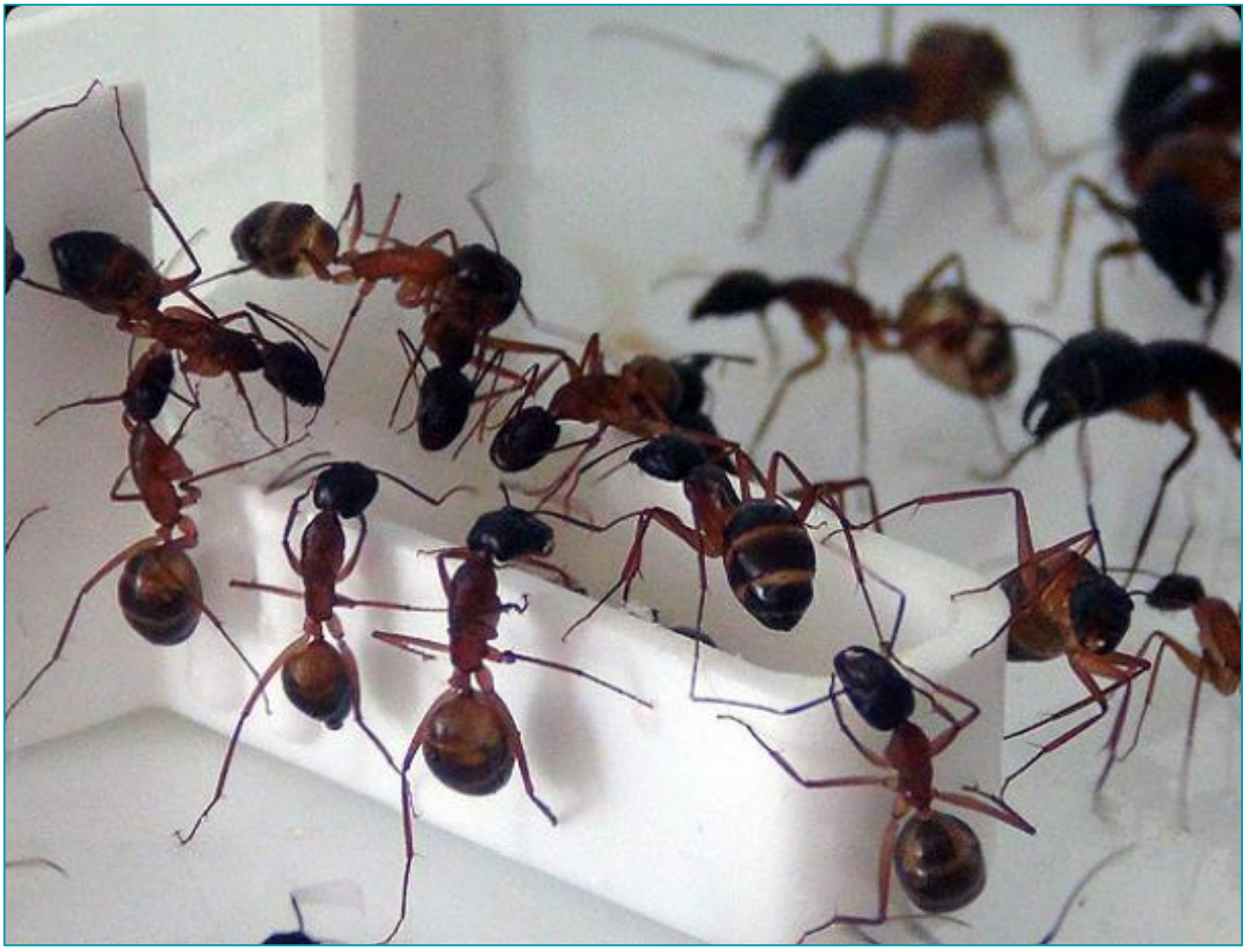
**Alate**

**Worker**

**Pest Status:** Carpenter ants cause damage because of their habit of burrowing into wood to create and expand nesting sites. Although carpenter ants have long been recognized as pest species, only recently data have indicated that carpenter ants cause vast structural and other damage. Information from university extension personnel in the states of Washington, Ohio, Minnesota, and New York indicate that carpenter ants are usually the number one insect problem for which extension receives requests for information (Akre and Hansen, 1988). In the Pacific Northwest of the United States damage caused by carpenter ants is considered equal to or more serious than that caused by termites (Furniss and Carolin, 1977)

**Biology and Ecology:** Carpenter ants enter to buildings to nest or forage. They are called “carpenter

"because they excavate their nests in wood, creating smooth tunnels and galleries. (Fowler 1986), however, stated that carpenter ants are more often found in wood that is structurally sound. Carpenter ants apparently prefers dry habitats and colonies can be found under rocks, nesting under stone next to and under Acacia trees, in dry leaf litter next to a date palm tree.



*Camponotus thoracicus: (Fabricius).*

# 4. PAVEMENT ANT *(TETRAMORIUM SP.)*

**Identifying Characteristics:** Length 3.4 to 4.5 mm; antennae 12-segmented. The antennae of the workers are 11 or 12-segmented, with a 3-segmented club. The propodeum is armed with a pair of spines above, and a pair of flanges below near the insertion of the petiole (waist). The tip of the sting has a triangular to pennant-shaped extension projecting upward from the shaft (visible only when the sting is extended. Color from light yellow brown to bright orange-yellow, gaster deep brown or blackish brown.


**PAVEMENT ANT (Tetramorium sp.). A) Parallel rugae (ridges) running along thorax. B) Petiole has two, boxy segments. C) Propodeal spine. D) Anteroventral tooth. E) Stinger. Photograph by Michael Branstetter from www.AntWeb.org.**

**Pavement ant worker. Copyright © 2019 Kevin Wiener**

**Pest Status:** Potential to be minor urban nuisance entering houses and nesting in gardens. Capable of stinging. Pavement ants are often considered invaders of homes because sidewalks, walkways,

and patios make ideal habitat for these animals. However, it remains unclear whether these ants can infest homes with damaging consequences or whether inquisitive workers just become aesthetic pests when they make it into residences or are abundant on a patio (Vitone & Lucky, 2017)

**Biology and Ecology:** The pavement ants derive its name from its habit of nesting beside and under sidewalks, driveways, and foundations. Colonies are small to moderate in size. Nests are to be found in exposed soil or under stones, rotting logs (AWD pers. obs.), or in plant stems or under bark (Smith 1965). This species has been known to feed on a variety of foodstuffs in houses.

## 5. PHARAOH ANT *(MONOMORIUM PHARAONIS)*

The Pharaoh ant is a notorious nuisance pest. The area of origin is not confirmed but has been considered as South America, Afrotropical or probably Indian origin (Vail and Williams, 1994) by various scientists. Today this ant has globally spread to almost every area of the world.

Pharaoh Ant workers (Monomorium pharaonic)- source www.aepma.com.au and J-E Nystrom

**Identifying Characteristics:** The ant color varies from yellowish to reddish brown (Smith, 1965), with abdomen often darker to blackish (Smith & Whitman, 1992). The average size of worker ranges from 1.5mm- 2mm (Haack and Granovsky, 1990). Males are 2-3mm long and queen about 4-6 mm long with dark reddish color (Smith & Whitmann, 1992). Body has very sparse (light) pubescence. Very often Pharaoh ant is confused with thief ant but can be distinguished by 12 segmented antennae (10 segmented in thief ant) and 3 segmented antennal club (2 segmented in thief ant) (Smith & Whitman, 1992).

**Pest Status:** They are opportunistic nuisance pest and can occupy any crack and crevice with favorable warmth and humidity. They are found to nest both indoors (temperate areas) and outdoors (tropical areas). Due to its habit of colony multiplication by budding, areas with repeated/residual application may lead to development of various satellite colonies and infestation may spread over an entire building. Potentially dangerous for hospitals due to their ability to transmit disease organisms (Beatson 1972)

**Biology and Ecology:** The eggs, once laid take about 5-6 days to become a larva. Larval instars take 22-24 days to reach a prepupal stage, which lasts for 2-3 days, after which the pupa is converted to adults. Thus, the complete life cycle takes 38-45 days in total (John A. Jackman, Bastiaan M. Drees, 1998). Queens can produce 400 or more eggs in batches of 10 to 12 (Peacock et al. 1950). Queens can live four to 12 months, while males die within three to five weeks after mating (Smith and Whitman 1992). A stinger is present but is rarely exerted (thrust outward). (Haack and Granovsky 1990) Another distinguished feature about these ants is that they do not swarm, but they multiply

by budding, making many smaller sub colonies from the parent colony. The ideal temperature and site for development is 26 to 30°C with relative humidity of 80 % near sources of food and/or water, such as in wall voids, under floors, behind baseboards, windowsills, kitchens, sinks, heating ducts. The Pharaoh ant is polygynous, meaning its colonies contain many queens (up to 200). An individual colony normally contains 1,000–2,500 workers but a high density of nests gives the impression of massive colonies. Colonies also lack nestmate recognition so there is no hostility between neighboring colonies, which is known as unicoloniality. They feed on a wide variety of foods including jellies, honey, shortening, peanut butter, corn syrup, fruit juices, baked goods, soft drinks, grease, dead insects, toothpaste and even shoe polish. They can also gnaw holes in silk, rayon, and rubber goods (AEPMA, 2020).

## 6. RED IMPORTED FIRE ANT *(SOLENOPSIS SP.)*

Red imported fire ant (RIFA), believed to be originated in South America is now present in various parts of the world.

**Identifying Characteristics:** Workers consist of many sizes (polymorphic) between 2.4 to 6 mm (Hedges 1998). Body color is usually red to brown in color with a black gaster (Hedges 1997). Antennae is 10 segmented with 2 segmented antennal club. Pedicle is 2 segmented. A stinger is present. Females reproductive are 8mm long and are similar in color to workers. Males are black in color.


**Red imported fire ant (Solenopsis invicta). Minor worker top, major worker bottom. Photo by Joe A. MacGown and Ryan J. Whitehouse- Mississippi State University**

**Pest Status:** Red imported fire ants are omnivorous, opportunistic feeder and found to feed on any plant or animal materials they encounter (Lofgren et al., 1975). Their primary diet is insects and other small vertebrates and act as scavengers by feeding on carrions. Due to habit of inflicting painful bites, it is considered as the most notorious ant pest species. When a mound is disturbed the ant emerges aggressively to bite and sting the intruder. It is known to inflict painful sting and the sting causes a white pustule to form on the skin within 24 hours. This white pustule is diagnostic for RIFA bite (Stafford et al., 1989).

**Red imported fire ant stinging. Source:** University of California- Center Of Invasive Species Research

**Biology and Ecology:** A mature queen lays hundreds of eggs each day. Eggs hatch to grub like larva in 7-10 days and reach pupal stage in next 1-2 weeks. Pupae looks like curled up adult and cannot move and in 1-2 week they acquire reddish brown pigmentation and turn into adult. Early studies of imported fire ant biology indicated that colonies contained single queens (monogyne). However, since 1973, reports have become more frequent of the occurrence of multiple queen (polygyne) colonies. Multiple queen colonies have closer and more numerous mounds per acre of land. Mounds are built of soil and are seldom larger than 46 cm (18 in) in diameter. Also, the queen in multiple queen colony produce more eggs as compared to single queen. When a mound is disturbed, ants emerge aggressively to bite and sting the intruder. In urban settings, the RIFA may nest under patio slabs, in lawns, under edges of sidewalks, foundations, concrete driveways, and electrical boxes. After a heavy rain, the colony may move to higher ground or inside homes to take refuge from saturated soil. If nesting under patio slabs of concrete walkways, the nest cavity may cause the concrete slab to fall and cause damage to the sidewalk (Vinson and Sorenson 1986).

## 7. GHOST ANT (*TAPINOMA MELANOCEPHALUM*)

The origin of Ghost ant is debatable and is assumed to be originated from the African or Oriental regions (Smith, 1965) by few scientists while some presume it to be originated from Indo-Pacific region (Wetterer 2008).


**Ghost ant worker (Tapinoma melanocephalum)**

**Identifying Characteristics:** Ghost ant workers are extremely small, 1.3 to 1.5 mm long and monomorphic (one-sized). They have 12-segmented antennae with the segments gradually thickening towards the tip. Antennal scape surpasses the occipital border. Head and thorax are deep dark brown with gaster and legs opaque or milky white (Creighton 1950). The thorax is spineless. The gaster (swollen part of abdomen) has a slit-like anal opening which is hairless (Smith and Whitman 1992). The abdominal pedicel (stalk-like structure immediately anterior to the gaster) consists of one segment that is usually hidden from view dorsally by the gaster (Creighton 1950). Stingers are absent. The small size, combined with the pale color, make ghost ant workers hard to see and gives them their characteristic name (Smith and Whitman 1992).


**Ghost ant worker (*Tapinoma melanocephalum*).**
**Source: GISD**

**Pest Status:** It is observed as a significant urban pest capable of infesting residential kitchens and commercial food outlets in large numbers (Lee, 2002). It can enter buildings through screens and small cracks and be a general annoyance (Deyrup et al., 2000). They are especially fond of sugary food and Clark et al., 1982 reported them to be frequently the only ant present on sugar water baits. Inside houses they are found behind baseboards, shower curtain rods, breadboxes, potted plants. Foraging activity is typically concentrated in kitchens. They are attracted to honeydew secreting insects and are observed to feed on dead and live insects (Smith 1965). Outside, they nest in soil next to foundations, shrubs, porches, trees. Hollow framing of pool is a favorite nesting site (Hedges, 1997). The health impacts of *T. melanocephalum* vary tremendously. Some people suffer a slight irritation of the skin following contact with *T. melanocephalum* (Collingwood et al., 1997). *T. melanocephalum* may also have a role in disease transmission. It is abundant in hospitals in South America, and capable of transporting pathogenic microbes including seven types of bacteria, such as *Enterobacter cloacae* and *Staphylococcus sp*. (Fowler et al., 1993).

**Biology and Ecology:**

These ants have medium to large sized colonies with numerous queens (Smith 1965). The nesting habits of the ghost ant are similar to that of the Pharaoh ant, *Monomorium pharaonis* (Linnaeus) (Smith and Whitman 1992). They excrete a distinct rotten coconut odor (also known as Tapinoma odor), when crushed.

They have 12-segmented antenna with scape (first antennal segment) long and surpassing the posterior border of the head. Eyes are large, with 9-10 ommatidia in the longest row. The propodeum is without spines; the upper surface is shorter than the rear surface. One rudimentary node is present, which lacks a distinct forward face and is partially or completely concealed when viewed from above by forward projection of the first segment of the gaster. The gaster has four segments on its upper surface. There is a dense fine pubescence all over the ant, with erect setae on clypeus and gastral apex only. Stinger is absent. The ants cannot withstand desiccation (Appel et. al 2004) and thrive well in humid habitats. They are also reported to nest at the base of palm fronds in decaying organic matter (Vail et al. 1994).

## 11. Roles and responsibilities

Basically, the key stakeholders for pest ants control programs in Abu Dhabi are:

1- Service providers (registered public health pest control companies)
2- Clients, who receive the ant control service in their premises
3- ADPHC (Regulatory organization), which is the regulatory authority who manages and monitors the public health pest control sector.

Table 1 summarizes the roles and responsibilities for key stakeholders

Table1

## Ant pests control team responsibilities

| Stakeholder | Roles and responsibilities |
|---|---|
| Service providers | 1- Fully aware about Abu Dhabi Guidelines for ants management.<br>2- Good knowledge about ants biology and behavior<br>3- Good knowledge about insecticides use and safety precautions<br>4- Aware about local and federal requirements and regulations<br>5- Aware about the required tools and equipment and their use, maintenance and disposal. Record all data related to service orders, contracts, chemical consumption, infestation level and geographical distribution of treated objects on maps or layouts.<br>6- Record all data related to service orders by providing clients with a logbook which contains (but not limited to) the following: contracts, MSDS, chemical consumption, daily visit report, infestation level and mapping geographical distribution of treated areas.<br>7- Have good communication skills<br>8- Capable to identify ant infestation<br>9- Capable to document all processes<br>10- Fully aware about the IPM techniques<br>11- Service providers shall provide the contact details of control team to the client, contact details shall include name, position, mobile phone, email address for all control team members |
| Clients | 1- Client shall contract only registered and approved companies permitted from local regulatory organization<br>2- It is recommended for clients to have a look and get familiar with Abu Dhabi Guidelines<br>3- Clients shall provide any data required by regulatory organization about ant control or ant activity<br>4- Clients shall follow the service provider recommendations that will help reducing or preventing ant population, but these recommendations must only be limited on cultural and physical practices including:<br>- Sanitation<br>- Closing entry points<br>- Removing rubbish, scrap, abandoned stuff.<br>- Regular cleaning and waste removal<br>- Repairing and maintenance required for the buildings or premises. |
| ADPHC (Regulatory organization) | Act as regulatory party who shall provide guidance and regulations |

Table 2

## Ants control team required skills and qualifications

| Team member | Skills | Qualifications |
|---|---|---|
| Supervisor | 1- Fully aware about Abu Dhabi Guidelines for ants management.<br>2- Good knowledge about pest ants biology and behaviour<br>3- Good knowledge about insecticides use and safety precautions<br>4- Aware about local and federal requirements and regulations<br>5- Aware about the required tools and equipment and their use, maintenance and disposal.<br>6- Have good communication skills<br>7- Capable to identify ants infestation<br>8- Capable to document all process<br>9- Fully aware about the IPM techniques | 1- Valid permit for supervisor issued from ADQCC<br>2- Sufficient experience in the same field<br>3- Bachelor's degree certificate in medical entomology, entomology, public health pest control, plant protection, pesticides chemistry, agriculture science or related majors. |
| Technicians | 2- Good English skills enable him to read insecticides labels and inserting data<br>3- Have good physical fitness<br>4- Good communication skills<br>5- Know how to use all tools and equipment properly<br>6- Aware of all safety precautions related to ants control<br>7- Sufficient knowledge about insecticide usage and safety<br>8- Sufficient knowledge about ants biology.<br>9- Enough knowledge about all safety precautions related insecticides usage. | 1- Secondary school certificate<br>2- Valid permit for technician issued from ADQCC |

## 12. Ants management

Remember that ant is beneficial insect that maintains our ecosystem by scavenging on wastes and preying other pests insects and their role in the environment is very important for biodiversity which they also considered as food for other animals, so ant control is only applicable in case if ant cause problem for human beings, otherwise they must not be controlled.

Ant management is one of the hardest pest control operations that most frequently failed to eradicate ant invasion and result in losing clients and lower satisfaction. The control failure is most likely to happen due to many factors such as

1- Ignoring the key control measure which is sanitation. Sanitation is the most important control measure for eradicating ant infestation especially for indoor settings.
2- Poor inspection. Many operators fail to determine or locate ant nest and they just follow trails and miss the nest.
3- Ignoring entry ants points sealing and harborage reduction inside the premise
4- Relying on insecticides surface and drenching applications by treating ant trails and openings where ants come from. These applications might reduce ant population and bring some temporary relief, though, ant back again in few days or even hours. That usually happen because the ant nest is well protected and able to recover the ant shortage in relatively short time. Ant will keep showing unless the queen or their nest is completely destroyed.
5- Ant is a prolific insect, that found in large numbers and form large and multiple nests which makes very hard to get rid of it easily. Thus, it may require several treatments, especially in outdoor settings

However, in this section we will be discussing all details related to ant control and the approved procedures.

## 12.1 SERVICE DESCRIPTION

Ants control means suppressing, reducing, and maintaining the ants populations under the threshold level in order to eliminate nuisance and health risk associated with their existence in human dwellings and food processing areas or anywhere they can cause a trouble for people.

## 12.2 SCOPE

Ant control service scope includes any chemical or non-chemical treatments aim to control ants in any area where they are recognized as pest by occupants due to their nuisance or public health risk of disease transmission or allergic reactions that could be resulted from ant stinging or biting.

## 12.3 SERVICE FREQUENCY

Generally, the service frequency of ant is undetermined because the service shall be provided in irregular manner or unscheduled service upon client request. In case of ant, regular service is not required. However, follow up treatments must be carried out in a standard manner. Table 3 lists the rules of follow up.

Table 3
General rules of follow up

| | |
|---|---|
| 1 | Follow up is the treatment that is carried out to investigate the ant activity status and measure the effectiveness of previously implemented treatments and it may or may not incur any further control treatments. |
| 2 | Any ant control program shall at least include one follow up treatment. During the follow up treatment if any ant activity been detected, then another follow up shall take place until ensure zero activity level and the infestation is totally off. |
| 3 | Follow up treatment must be carried out within maximum 7 days. If any activity found, another follow up shall be carried out within maximum 7 days and so on. |

## 12.4 ACTION THRESHOLD

Remember that ant is beneficial insect that maintains our ecosystem by scavenging on wastes and preying other pests insects and their role in the environment is very important for biodiversity which they also considered as food for other animals, so ant control is only applicable in case if ant cause problem for human beings, otherwise they must not be controlled

Tolerance limit (action threshold): The level at which a pest causes sufficient damage to warrant public health attention and intervention. Real or perceived damage can be aesthetic and can have economic, psychologic, and medical consequences (CDC, 2006). Since the ant can cause any of these damages the action threshold for this insect depends upon the tolerance of the people living in the infested dwelling.

According to UAE standards, action threshold level for ants depends on people or client requests. Which means any time client complaint about ant population in their premises is considered the action threshold, thus, immediate intervention is required. In some sensitive places where ant infestation may pose high risk the action threshold then will the presence of any ant in that facility. Sensitive areas my include (but not limited to) hospitals, hotels, restaurants and food processing areas, …etc.

## 12.5 TOOLS & EQUIPMENT

The range of required tools and equipment varies according to what procedures are being implemented, however, in this section we have listed the minimum range required to carry all types of procedures.

Table 4
Tools &equipment

| | Tool | Photo | Purpose | Standards |
|---|---|---|---|---|
| 1 | Flashlight |  | To be used during performing inspection for ant infestation in dark places | Professional torch |
| 2 | Sprayer machine |  | To be used for spraying liquid insecticides | -Maximum capacity of 5 litres<br>-Stainless steel tank<br>-Equipped with pressure gauge<br>-Designed for heavy duty<br>-Metallic sprayer gun |
| 3 | Measurement cup |  | For insecticides calibration | Made of plastic with clear scales |
| 4 | Chemical cartridge respirator |  | To be worn during liquid insecticides application for respiratory protection | Chemical cartridge respirator with organic vapor cartridge |

| | | | | |
|---|---|---|---|---|
| 5 | Latex gloves |  | To be used when handling traps and non-poison baits and gel application | - Latex<br>- Heavy duty |
| 6 | Insecticides Duster |  | To deliver insecticides in the formulation of dust powder into cracks and crevices | Professional design |
| 7 | Ant bait station |  | To hold ant baits and provide protection against weather conditions and non-targeted organisms | Ready made<br>Professional design |
| 8 | Electrical duster |  | To be used for dust application | - Battery-powered duster<br>- Carpet attachment<br>- Paint Brush attachment<br>Multi-speed dial |
| 9 | Uniform |  | To be worn during all procedures by technicians to protect their bodies from any contact with pesticides or any hazardous materials during their work. | - Made of fortified fabric<br>- reflective tapes on it<br>- Long or full sleeve<br>- It can be one or two pieces. |

| | | | | |
|---|---|---|---|---|
| 10 | Chemical protection gloves. |  | To be used by pesticide handler for hands protection against liquid or solid pesticides | - Code: DIN EN 374 (Industerial Chemica, 2016)<br>- Chemical protection glove in nitrile<br>- Length 33 cm<br>- Thickness 0.38 mm<br>- Flocked inside, good grip<br>- Food contact approved<br>- Sizes 7-11 |
| 11 | Safety goggle |  | Eye protection | EN166 3459B for clean-up (Killgerm Chemicals Ltd, 2010) |
| 12 | Fabric gloves |  | Hands protection for helpers for setting ladders | 1- Heavy duty<br>2- Professional design |
| 13 | Dust mask |  | To be used by all team member for respiratory protection | DIN EN-149:2001 (Industerial Chemica, 2016) |
| 14 | Safety shoes |  | Foot protection | 1- Chemical resistant<br>2- Oil & slip resistant<br>3- steel toe cap |

| | | | | |
|---|---|---|---|---|
| 15 | Data entry device, Handheld data entry terminal |  | For systemized or digital data entry | Professional |
| 16 | Magnifying glass |  | To be used for ant identification at work field | - Professional design<br>- Minimum magnifying power of 5X |
| 17 | Gram-based calibration spoon |  | To be used for adequately calibrating solid insecticides | - Electronic<br>- Scaled by 0.01 gram minimum<br>- Heavy duty |
| 18 | Disposable shoes cover |  | To be used when carry out indoor treatment for cleanliness | - Professional design<br>- Single use / disposable<br>- Sterilized |
| 19 | Sweeping brush |  | Cleaning. | - Heavy duty (rough) |

## 12.6 PROCEDURES

According to UAE control strategy, control procedures have been built based on the effective implementation of IPM approach. Basically, ant IPM shall follow the following procedures.

Table 5
Ant control procedures

| | |
|---|---|
| 1 | Survey (Inspection) |
| 2 | Non-chemical control |
| 3 | Chemical Control |
| 4 | Data entry |

## SURVEY AND INSPECTION

Effective ants management highly depends on good and effective survey. Ant survey is the key process by which inspectors can determine ant species, ant nest locations, factors conducive to infestation and checkup the workplace status to decide the best control procedure to be applied.

Survey is the key process used in ants IPM. The benefits of conducting survey are:

1- Reduce the usage of pesticides which will be used only when most needed, as result, survey will help to reduce the cost of pesticides and more importantly will reduce the environmental impact of pesticides.
2- Survey is important to identify the ant pest species that infested the premise enabling the team to carry more effective treatments.
3- Survey is also important to define the root cause and source of infestation by identifying the ant nest location, factors conducive to infestation and then treat the nest and eliminate ant infestation permanently in that location.
4- Inspection results are also needed to decide the best control method for that particular site by observing the specifications of the inspected areas such as the premise type, size, plantation, water resource, people and many other factors that shall be considered during carrying out treatments.
5- Survey is the best method to measure the effectiveness of any treatments, methods, or materials as it evaluates the infestation level before and after the treatment.

Ant survey and inspection can be done as the flowing procedures:

1- At the beginning inspectors need to meet the clients and listen to them and get the information about the ant problem including ant location, the problem ant causing and how they look like…etc. Sometimes ant could be disappeared at the time when inspectors arrive the place, in this case clients are the only source for information so it is important to listen carefully to them.
2- Inspectors shall identify ant species whether by examining existing ant worker or by predicting it from information provided by the client.
3- The inspectors should observe the ant worker movement and identify their trails and food source they feed on and it is very important to determine the location of their nest by tracing ant trails and tunnels.
4- If ants are disappeared and inspectors failed to know what the ant species or define their location, they shall arrange with client to back again at the time when ants are active and can be examined.
5- Inspectors shall search carefully for ants workers. Inside the structure, the inspector should inspect the holes and cracks where ant workers enter, old or new moisture stains, food debris, activity near appliances, around bathtubs and showers, in drawers, and in adjoining rooms. Outside the structure, the inspector should inspect for ant workers behind vines, shrubs, other plants near the house, expansion joints, slabs, patio blocks, bricks, boards, plant pots, under and inside wooded columns and pillars, outside doors, and windows frames. Inspect the telephone wires, air-conditioning refrigerant pipes which penetrate through the house walls and provide harbor to ant colonies; the overhanging limbs that touch or even scratch shingles which provide access to houses; water/electrical meters, and storm drain inspection manholes. Inspect plants for ants tending aphids, mealy bugs, etc.
6- Night inspection is preferred for locating the carpenter ant nests, as most species of the carpenter ants are nocturnal, large number of carpenter ants emerge after sundown, similarly big number of ants disappear into the nests after sunrise. (Mallis, 2013)

## EXCLUSION AND SANITATION PRACTICES

Ants trapping is not effective because it will not kill the queen and ants will keep showing, thus there is no ants traps approved in UAE and for this reason the key non-chemical control methods is by applying good sanitation and exclusion practices that will prevent ants form having food and water supplies, suitable places for nesting and prevent them from entering client premises. These sanitation and exclusion practices include (but not limited to):

1- Storing the food and food waste in containers with tight-fitting lids to eliminate access by ants.

2- Keeping the living room, office, and storage spaces free of food debris as possible to prevent the entry of foraging ants.
3- Sealing the crack with silicon caulk to eliminate the entry of ants.
4- Long term ant management depends on correcting the conditions which is favorable to ants infestation in and around the structure such as, caulk wall penetrations and mortar masonry cracks, caulk door and window frames, repair water leaks, trim shrubbery away from the house, move firewood stacked against the house, and also control ant tended aphids and mealy bugs.
5- For carpenter ants. Removal and replacement of infested structural wood with new one in case of nesting inside. Adequate ventilation and repairing of the areas where moisture causing damage, like roofing, guttering, leaky pipes, earth to wood contact etc. Recommend trimming or removal of trees where branches touch a structure or overhang roofs.
6- Remove stones that are sheltering ants.
7- Advise clients to wipe down any indoor ant trails with soapy water.
8- Nests located around building foundations, doors and windows should be destroyed physically
9- Need- based store supplies. Avoid bulk storage.
10- Rearrangement, cleaning, and rotation of store supplies to expose any ant nest.
11- Sanitation of food areas before bedtime and emptying of any lying open water container.

These sanitation and exclusion practices likely to be done by the client, however it is the responsibility of the service provider to officially advise the client about the recommended practices.

# CHEMICAL CONTROL

When non-chemical practices failed to eradicate ant infestation or are not applicable chemical control shall take place. Chemical control for ants mainly includes using toxic ant baits and insecticides spray. As always chemical control must be the last option after carrying out non-chemical methods. Using chemical does not mean there is no need for other non-chemical practices, in contrast, chemical control will not be effective without having good sanitation and housekeeping practices.

The key concept of effective ant chemical treatment is to ensure killing the queen and destroy the nest. Otherwise, ant will keep coming and the problem will not be solved. It is important to know the species of ant by which it determines what type of insecticide to use. Whenever possible, select formulations with low toxicity, such as insecticidal soap, boric acid, and pyrethrum for baits, dust, and sprays.

## 1. TOXIC BAITS

Toxic baits are the most effective chemical control method for controlling ant. Because ant adults are not capable to eat solid food they pick up the food and carry it to larvae who regurgitate it and liquefy it, and then ant worker feed on it and share with other castes in the colony in the process called Trophallaxis, (food sharing) which is also common in other social insects, like termites and honeybees (Mississippi State University Extension Service, 2020).

The food sharing behavior (Trophallaxis) of ant makes ant toxic baits the ideal and most effective solution for delivering insecticides to the queen and other castes in the colony and ensure colony destruction. Therefore, toxic baits shall be considered as the first and best chemical solution for controlling ant.

Ant toxic baits usually slow acting insecticides that contain active ingredient and other nutritional materials, these nutritional materials can be sugar, oil, or protein-based materials or it can be a combination of multiple nutritional materials. When ant feed on that baits and carry baits back to larvae and then share the food with other castes in the colony, active ingredient will be cascaded to the colony and most importantly the queen.

Most ants eat a wide variety of foods, although some have specialized tastes for example Pharaoh ants feed on sugars, proteins, oils, and insects and Carpenter ants prefer sugars and insects.

Usually ant food preference for certain food changes throughout the year depending on how much brood is being produced, the developmental stage of the brood, and colony current nutrition requirements in the nest. This variance in food preference has some consequence on the use of baits for ant control which the ant species that attracted to sugar-based baits could change their interest to protein-based baits. Thus, changing from sugar-based baits to protein or oil-based baits may be important in maintaining the ants' interest in the toxic baits IGR's (Koehler, Vazquez, & Pereira, Ants, 2013).

Ants baits with stomach poisons or with insect growth regulators are excellent in critical areas such as kitchen, electrical, computer, and hospital rooms. Do not spray or dust around baits. Never store baits or bait materials where they can be contaminated with any other odors especially fumes of pesticides. Ants and other insects can detect minute amounts of foreign or repellant chemicals.

Ant toxic baits are available in many formulations such as granules, gel, and liquid baits. Ant baits can be scattered directly, or they can be applied using ant bait stations.

Granule baits are suitable to be used for outdoor and indoor treatments but they are very vulnerable to moisture so they need to be used for outdoor treatment when there is no rain or any irrigation water and it is better to be used with designed ant bait station that can protect bait granules for being scattered away or being ruined by weather conditions and moisture.


**Examples of granular ant baits**


**Examples of liquid and gel baits**

Gel and liquid ant baits can also be applied directly, or they can be applied using bait station. Some liquid baits come in ready to use packaging directly. Mostly liquid and gel baits are used for indoor treatments and also, they can be used for outdoor treatments.


**Examples of ant bait stations**

**Bait selection**

Ants must eat bait, as mentioned earlier food preference of ant is changing, thus when place a bait you have to wait for a while and check if the ant picked the bait or not. The best way to save your time and select the right bait for particular treatment is to place several baits with different nutritional attractants (sugar, protein, oil) and see which one ant start consuming and use it. By doing so, you will be sure that you have used the most effective bait.


**Testing different ants baits in order to select the most attractive and effective bait for the treatment**

**Instructions for successful ant bait application**

1- Select the right bait that ants are attracted to and have consumed it.
2- Use only fresh and valid bait. If the bait is not fresh ant will not be attracted and will not eat it, so the bait will be ineffective. Even if the expiry date still on some baits get spoiled due to bad storage conditions in pesticides store or while being kept on the vehicles, thus, you have to check if bait is spoiled or still fresh.
3- Wash your hands before baiting to prevent contamination from other products.
4- Do not smoke while baiting. The nicotine will contaminate the bait.
5- Timing of the application is as important as the choice of control. Granular broadcast applications should be done in good weather. A good rule of thumb is to bait on a day that you would have a picnic; about 22°C to 32°C and not immediately before or after a drenching rain. Also, turn off any irrigation for a few hours before and after baiting.
6- Bait after the dew, rain, or irrigation has dried. Water can ruin most baits.
7- Use the proper bait stations in cases where direct application is not applicable.
8- Bait where you see the ants foraging but do not place baits right on ant tunnel and block their tunnels opening which that may let the ant to refuse the bait.
9- Store bait in an airtight container and place in a cool dry place, away from other pesticides or potential contaminants.
10- Gel baits are particularly useful in crack-and-crevice treatments.
11- In all cases of bait use, do not spray any insecticides around the bait application. Sprays are repellent, and if they contaminate the bait the bait treatment will be ineffective because the ants will not eat it.
12- Wear full PPE when use ant bait and follow product label instructions for application rate and method and other safety precautions.

**Direct application of ant bait**

Ant gel application


Liquid bait application

Ant feeding on liquid bait

Ant picking up granular bait to the colony

## 2. LIQUID INSECTICIDE SPRAY

Liquid insecticides spray can also be used for treating ant in two ways. First it can be applied to knock down current active ants on the place by directly spraying liquid contact insecticides on ants trails or moving workers on the place, or it can be pointed at ant tunnels, crack and cervices to bring quick relief, however knock down treatment effect is temporary and short. Thus, it can only be used as subside treatment to reduce ant infestation and bring initial knockdown and other treatments shall take place along with it.

The second treatment is barrier treatment by which long lasting and none-repellent insecticides are used to treat the surrounding areas, perimeters, cracks, and crevices. It also can be applied where ant activities are noticed, for example if ant trails are spotted on a tree, tree trunk can be treated. For barrier treatment insecticides with formulation of MC, ME are more recommended. When ants come across insecticides barriers they may die after a while and their dead bodies can be seen in or around the premises.

Barrier treatment is not recommended for Pharaoh ant, it may lead to colony budding and will spread the infestation in the entire building.

Liquid insecticides can be effective when treating small ant nest inside homes such as Ghost ant by injecting high pressured insecticide solution directly into the nest.

Remember always use insecticides whose label contains ant in their pest range and follow the label instructions and wear full PPE.

It is important always to follow up ant treatment and check the result of applied treatments, follow up treatment shall be carried out at maximum one week after the application.

Remember that liquid insecticide treatment is the least recommended treatment which it will bring temporary relief and they must be accompanied with other control methods such as ant toxic baits and sanitation practices.

**Spraying liquid insecticides on premise perimeters as barrier treatment**

## 3. INSECTICIDAL DUST TREATMENT

Insecticidal dust treatment is done by placing insecticidal dust or ready to use insecticides in dust formulation, they can be applied directly on ants aggregations or their nests. Dust application are recommended for outdoor treatment. You have to follow product label. Use dust in wall voids and crack and crevice treatments. Dusts such as diatomaceous earth and silica gel have a drying effect on insects. Boric acid powder has a low toxicity to humans but acts as a stomach poison for ants. These dusts are effective when blown into cracks and wall voids before they are sealed. Other insecticidal dust that have conventional active ingredients are also can be used as residual treatment around the ant mounds and in cracks and crevices.
Like liquid spray, insecticide dust treatment will kill exposed ants and are not able to kill the queen, so they can be used to prevent ant from entering the premises or to bring temporary relief. Thus, it must be accompanied with other control methods such as ant toxic baits and good sanitation and housekeeping practices.

## 4. DATA ENTRY

All data and information must be documented and reported, data can be reported manually or by using data software, all data must be inserted including:

1- Client / premises location and address
2- Client name
3- Found ant species identification
4- Nest location
5- Workplace type (kitchen, toilets, food processing area, yard, garden …etc.)
6- Control team details (company name/ personnel name)
7- Service type (follow up/ treatment/ both)
8- Date and time
9- Survey results
10- Infestation signs found
11- Infestation level
12- Infestation distribution
13- Treatment details including used baits, tools and equipment, pesticides
14- Next service date
15- Number and types of installed traps
16- Recommendations
17- Data to be presented on layouts or maps for ant nests and installed baits stations

## 12.7. GENERAL RULES

| Table 6 General rules for ant management | |
|---|---|
| 1 | Ants are beneficial insects and shall only be controlled if they cause problem for people and having complained about it. |
| 2 | Follow ups are required for any ant treatment until the infestation totally eradicated and it must be done in maximum one week after the last treatment. |
| 3 | Action threshold level for ants depends on people or client requests. Which means any time client complaint about ant population in their premises is considered the action threshold, thus, immediate intervention is required |
| 4 | This TG has mentioned the most common ant species in UAE; however, other ant species can be found. Anyway, the procedures mentioned in this TG can be apply for all kinds of ant species and they must be followed for any ant treatment. |
| 5 | Ant survey and inspection shall always be carried out before applying any treatment and it must be done by following the procedures mentioned in survey section. |
| 6 | If ants are disappeared and inspectors failed to know what the ant species or define their location, they shall arrange with client to back again at the time when ants are active and can be examined |
| 7 | Sanitation and exclusion are the best method for controlling ant. Sanitation and exclusion practices are likely to be done by the client, however it is the responsibility of the service provider to officially advise the client about the recommended practices. |
| 8 | When non-chemical practices failed to eradicate ant infestation or are not applicable chemical control shall take place. Chemical control for ants mainly includes using toxic ant baits, insecticides spray, and dust. |
| 9 | As always chemical control must be the last option after carrying out non-chemical methods. Using chemical does not mean there is no need for other non-chemical practices, in contrast, chemical control will not be effective without having good sanitation and housekeeping practices. |
| 10 | The key concept of effective ant chemical treatment is to ensure killing the queen and destroy the nest otherwise, ant will keep coming and the problem will not be solved |
| 11 | The food sharing behaviour (Trophallaxis) of ant makes ant toxic baits the ideal and most effective solution for delivering insecticides to the queen and other castes in the colony and ensure colony destruction. Therefore, toxic baits shall be considered as the first and best chemical solution for controlling ant. |
| 12 | Ants must eat bait, as mentioned earlier food preference of ant is changing, thus when place a bait you have to wait for a while and check if the ant picked the bait or not. The best way to save your time and select the right bait for particular treatment is to place several baits with different nutritional attractants (sugar, protein, oil) and see which one ant start consuming and use it. By doing so you will be sure that you have used the most effective bait. |
| 13 | In case of applying ant toxic bait you have to follow the Instructions for successful ant bait application as mentioned in section 1 of chemical control. |
| 14 | Remember that liquid insecticide treatment is the least recommended treatment which it will bring temporary relief and they must be accompanied with other control methods such as ant toxic baits and sanitation practices |

## 13. Abbreviations and acronyms

| | |
|---|---|
| UAE | United Arab Emirates |
| ADPHC | Abu Dhabi Public Health Centre |
| MOCCAE | Ministry of Climate Change and Environment |
| IPM | Integrated Pest Management |
| WHO | World Health Organization |
| EPA | Environment Protection Agency of United State |
| FAO | Food and Agriculture Organization of UN |
| TG | Technical guidelines |
| UN | United Nations |
| PPE | Personal Protective Equipment |
| ADQCC | Abu Dhabi Quality and Conformity Council |
| MSDS | Material Safety Data Sheet / Safety Data Sheet |
| ULV | Ultra-Low Volume |

## 14. References

AEPMA. (2020). Pharoah Ant. Retrieved from Australian Environmental Pest Managers Association Ltd: https://www.aepma.com.au/PestDetail/13/Pharoah%20Ant

Akre, R.D. and A.L. Antonelli. 2004. Thatching ants. Washington State University Extension Publication EM 0 33 E.

Akre, R.D. and L.D. Hansen. 1988. Carpenter Ants. Proc. Nor. Con$ Urban Enr. College Park, MD. 2: 59-63.

AL-Anazi et al., 2009; M. AL-Anazi, AL-Shahrani, M. AL-salamam Black ant stings caused by Pachycondyla sennaarensis: a significant health hazard; Ann. Saudi Med. J., 29 (2009), pp. 207-211

Andersen AN 2002. Common names for Australian ants (Hymenoptera: Formicidae). Australian Journal of Entomology 41: 285–293.

Appel A. G., J.P.S. NA, and C.Y. Lee. 2004. Temperature and humidity tolerances of the ghost ant, *Tapinoma melanocephalum* (Hymenoptera: Formicidae). Sociobiology 44:89-100.

Beatson, S.H. 1972. Pharaoh's ants as pathogen vectors in hospitals. The Lancet. Feb.19.425-427.

Bennett, G.W., R.M.Corrigan, and J.M.Owens, (1997).Truman's scientific guide to pest control operations .Advanstar communcitions.Cleveland, OHIO, 520 PP.

Bolton B 1995. A new general catalogue of the ants of the world. Harvard University Press. 504 p.

Chong, A.S.C. and Lee, C.Y. 1999. Household ants. In: Lee, C.Y., Yap, H.H., Chong, N.L. and Jaal, Z., eds. Urban Pest Control – A Malaysian Perspective. Penang: Universiti Sains Malaysia Press, pp. 66-80.

Clark DB; Guayasamín C; Pazmiño O; Donoso C; Villacís VP de, 1982. The tramp ant Wasmannia auropunctata: autecology and effects on ant diversity and distribution on Santa Cruz Island, Galapagos. Biotropica, 14(3):196-207.

Collingwood CA; Tigar BJ; Agosti D, 1997. Introduced ants in the United Arab Emirates. Journal of Arid Environments, 37(3):505-512; 18 ref.

Collingwood, C.A. & Agosti, D. (1996). Formicidae (Insecta: Hymenoptera) of Saudi Arabia M (Part 2). Fauna of Saudi Arabia, 15: 300–385.

Collingwood, C.A. & van Harten, A. (1994). A General Guide to the Ants of Yemen. YemeniGerman Plant

Collingwood, C.A. (1985). Formicidae (Insecta: Hymenoptera). Fauna of Saudi Arabia, 7:230–302.

Collingwood, C.A. 1979. "The Formicidae (Hymenoptera) of Fennoscandia and Denmark". *Fauna Entomologica Scandinavica*. **8**: 1–174. Retrieved 5 February 2015.

Creighton, W.S. 1950. The ants of North America. Bull. Mus. Comp. Zool. Harv. Coll., vol. 104.

Deyrup M; Davis L; Cover S, 2000. Exotic ants in Florida. Transactions of the American Entomological Society, 126(3/4):293-326.

Dib et al., 1992; G. Dib, R.K. Ferquson, V. Sljivic: Hypersensitivity to samsum ant Lancet, 339 (1992), pp. 552-553

Dib et al., 1995; G. Dib, B. Guerin, W.A. Banks: Systemic reactions to the samsum ant: an IgE-mediated hypersensitivity J. Allergy Clinic. Immunol., 96 (1995), pp. 465-472

Don AW, Jones TH, Flournoy RC, Zottig VE 2001. Venom chemistry of Monomorium antipodum Forel (Hymenoptera: Formicidae) from New Zealand and its relevance to the taxonomy of the species. New Zealand Entomologist 24: 49–52.

Drees BM, Jackman J. 1999. Pharaoh ant. A Field Guide to Common Texas Insects. http://insects.tamu.edu/images/ insects/fieldguide/cimg358.html.

Ebeling, W. 1975. Urban Entomology. University of California Division of Agricultural Sciences 695 pp.

EBPF. (2002). Guideline on Best Practice in the Use of Rodenticide Baits as Biocides in the European Union. The European Biocidal Products Forum.

Ferster B, Deyrup M, Scheffrahn RH, Cabrera BJ. (2000). The pest ants of Florida. (29 July 2014)

Fowler HG; Bueno OC; Sadatsune T; Montelli AC, 1993. Ants as potential vectors of pathogens in hospitals in the state of Sao Paulo, Brazil. Insect Science and its Application, 14(3):367-370.

Fourmis home. (2020). Camponotus thoracicus. Retrieved from Fourmis home France: https://www.fourmishome.fr/Camponotus-thoracicus-bbaaaabIa.asp

Furniss, R., and V.M. Carolin. 1977. Western forest insects. USDA FS Mirc. Publ. 1339. 654p.

Gary J. Skinner, G.J., Allen W. G., 1996. Ants, Naturalists' Handbook Series, Richmond Publishing Ltd. Pp 84.

Industerial Chemica. (2016). VARAT BLOCCO SAFETY DATA SHEET. Industerial Chemica.

Haack KD, Granovsky TA. 1990. Ants. In Handbook of pest control. Story K, Moreland D (editors). Franzak & Foster Co., Cleveland, OH. pp. 415–479.

Hansen, L.D. and A.L. Antonelli. 1914. Identification and Habits of Key Ant Pests of Washington. Washington State University Extension Publication EB0818.

Hedges SA. 1997. Handbook of Pest Control, 8th Ed. (Moreland D, editor) pp. 531-535. Mallis Handbook and Technical Training Company.

Hedges SA. 1998. Field Guide for the Management of Structure Infesting Ants, 2nd Ed. (Moreland D, editor) pp. 202-216. G.I.E. Publishers, Cleveland, Ohio.

Hedges, S.A. 1997. Chapter 12: Ants, pp.503-589. In: Hand-book of Pest Control. 8th Ed. (S. Hedges, Ed.) Mallis Handbook and technical training company.

Holldobler, B. and Wilson, E.O. 1990. The ants. Cambridge: Harvard University Press. 732 pp

J.H. Sudd, J.H., Franks, N.R., 1987. The Behavioural Ecology of Ants. Springer Netherlands.

Killgerm Chemicals Ltd. (2010). Safety Data Sheet RATIMOR WAX BLOCKS. Denholme Drive, Ossett, West Yorkshire, WF5 9NA.

Koehler, P., & W.H. Kern, J. (2013). Rat and Mouse Control. In J. W.H. Kern, P. G. Koehler , E. A. Buss, W. H. Kern, Jr, R. M. Pereira, & R. W. Bladwin, Pests In and Around the Southern Homw (p. 283). UF/IFAS Extension - Univeristy of Florida.

Koehler, P., Vazquez, R., & Pereira, R. (2013). Ants. In C. a. Management, Pests In and Around the Southern Homw (pp. 119-124). UF/IFAS Extension - Univeristy of Florida.

Klotz JH, Mangold JR, Vail KM, Davis, Jr. LR, and Patterson RS. (1995). A survey of the urban pest ants (Hymenoptera: Formicidae) of Peninsular Florida. Florida Entomologist 78: 109-118

Klotz, J., L.Hansen, M.Rust, R.Pospischil, (2008): Urban ant of North Americaand Europe; Identification, Biology and Management Comstock publishing Associates, Cornell University Press, Ithaca, pp.196.

Lee CY, 2002. Proceedings of the 4th international conference on Urban Pests [ed. by Jones SC, Zhai J, Robinson WH]. Viriginia, USA: Pocahontas Press, 3-8.

Lofgren, C.S., W.A. Banks and B.M. Glancey. 1975. Biology and control of imported fire ants. Annu. Rev. Entomol. 20:1-30.

Mississippi State University Extension Service. (2020). Fire Ant Biology. Retrieved from Mississippi State University Extension Service: http://extension.msstate.edu/content/fire-ant-biology

Mostovski, Mike & Brothers, Denis. (2008). Arthropod Fauna of the UAE. Volume 1. Editor Antonius van Harten. Abu Dhabi United Arab Emirates: Dar Al Ummah Printing, 754 pp.

Nyamukondiwa, C., & Addison, P. (2014). Food preference and foraging activity of ants: Recommendations for field applications of low-toxicity baits. Journal of Insect Science.

Nova Scotia Structural Pest Control Training Manual, 2nd Edition 2006. The Nova Scotia Department of Environment and Labour.

Peacock, A.D., D.W. Hall, I.C. Smith and Goodfellow, A. 1950. The biology and control of the ant pest Monomorium pharaonic (L.) Dept. of Agr. Of Scotland. Misc. Publ. No.17.

Ponerinae (Hymenoptera: Formicidae), with a review of Ponerine ecology and behaviour Zootaxa, 3817 (1) (2014), pp. 001-242

Protection Project, Sana'a, Republic of Yemen. Eschborn, Germany: Deutsche Gesellschaft fur Technische Zammenarbeit (GTZ) GmbH.

Schmidt and Shattuck, 2014: C.A. Schmidt, S.O. Shattuck The higher classification of the ant subfamily

Sharaf, M.R. (2006). Taxonomic and ecological studies on family Formicidae (Order: Hymenoptera) in Egypt including some protectorates with a study of some insect fauna associated with ant species [unpublished thesis]. Cairo: Ain Shams University, Faculty of Science, Entomology Department; 340 pp.

Smith EH, Whitman RC. 1992. Field guide to structural pests. National Pest Management Association, Dunn Loring, VA.

Smith MR. 1965. House-infesting ants of the eastern United States: Their Recognition, Biology, and Economic Importance. USDA-ARS Technical Bulletin 1326. 105 p.

Smith, M.R. (1965).House infesting ants of the Eastern United States----- U.S.D.A.Tech. Bull. No. 1326.

Stafford, C.T., D.R. Hoffman and R.B. Rhoades. 1989. Allergy to imported fire ants. South. Med. J.82: 1520-1527.

Swoboda L, Miller DN. (2003). Acrobat ant. Virginia Cooperative Extension Knowledge for the Commonwealth.

Tschinkel WR. (2002). The natural history of the arboreal ant, Crematogaster ashmeadi. Journal of Insect Science 2:1-15. (29 July 2014)

Harten, A. V. (2005). Arthropod Fauna of the UAE.

Vail, K. M. and Williams, D.F. 1994. Foraging of the Pharaoh ant, Monomorium pharaonic: an exotic in the urban environment, pp. 228-239. In: Exotic Ants: Biology, Impact and control of the introduced species (D.F. Williams, Ed.) Westview Press, Boulder, Colo.

Vail, K.M. and William, (1994): Foraging of the Paroah ant: an exotic in the urban environment. Pp. 228-239

Vinson SB, Sorenson, AA. 1986. Imported Fire Ants: Life History and Impact. The Texas Department of Agriculture. P. O. Box 12847, Austin, Texas 78711.

Vitone, T., & Lucky, A. (2017). Featured Creatures-pavement ant. Retrieved from entnemdept.ufl.edu/: http://entnemdept.ufl.edu/creatures/MISC/ANTS/pavement_ant.htm

Wetterer, J.K. 2008. Worldwide spread of the ghost ant, Tapinoma melanocephalum (Hymenoptera: Formicidae). Myrmecological News 12:23-33.

Whitcombe, R.P. (1982). Ants (Formicidae) especially those associated with honeybees (Apis spp.) from the Sultanate of Oman. Report VII 2C No. 3. Durham University, Khabura Development Project. 28 pp

## 1. Annex 1 : Ants species of UAE

The following table contains the 44 ant species that have been identified by Van Harten (Harten, 2005)

| Ant species reported by Antonius Van Harten from the UA | | | |
|---|---|---|---|
| S.No. | **Subfamily** | **Genus** | **Species** |
| 1 | Ponerinae | Hypoponera | Hypoponera eduardi |
| 2 | | | Hypoponera punctatissima |
| 3 | | | Hypoponera ragusai |
| 4 | | Panchycondyla | Panchycondyla sennaarensis |
| 5 | Dolichoderinae | Cerapachys | Cerapachys longitarsus |
| 6 | | | Cerapachys wroughtoni |
| 7 | | Iridomyrmex | Iridomyrmex anceps |
| 8 | | Tapinoma | Tapinoma melanocephalum |
| 9 | | | Tapinoma simrothi |
| 10 | Pseudomyrmicinae | Tetraponera | Tetraponera ambigua |
| 11 | Myrmicinae | Cardiocondyla | Cardiocondyla( Brachyponera)bicoronata |
| 12 | | | Cardiocondyla emeryi |
| 13 | | | Cardiocondyla gallagheri |
| 14 | | | Cardiocondyla mauritanica |
| 15 | | | Cardiocondyla shuchardi |
| 16 | | Crematogaster | Crematogaster aegyptiacus |
| 17 | | | Crematogaster antaris |
| 18 | | | Crematogaster mosis |
| 19 | | | Crematogaster oasium |
| 20 | | | Crematogaster senegalensis |
| 21 | | Messor | Messor ebeninus |
| 22 | | | Messor foreli |
| 23 | | | Messor hismai |
| 24 | | | Messor medioruber |
| 25 | | | Messor meridionalis |
| 26 | | | Messor rufotestaceus |
| 27 | | Solenopsis | Solenopsis geminata |
| 28 | | | Solenopsis omana |
| 29 | | Monomorium | Monomorium abeillei |
| 30 | | | Monomorium abyssinicum |
| 31 | | | Monomorium acutinode |
| 32 | | | Monomorium areniphilum |
| 33 | | | Monomorium bicolor |
| 34 | | | Monomorium destructor |
| 35 | | | Monomorium pharaonis |
| 36 | | | Monomorium barbatulum |
| 37 | | Tetramorium | Tetramorium sericeiventre |
| 38 | Formicinae | Camponotus | Camponotus oasium |
| 39 | | | Camponotus xerxes |
| 40 | | | Camponotus compressus |
| 41 | | | Camponotus thoracicus |
| 42 | | Cataglyphis | Cataglyphis laylae |
| 43 | | | Cataglyphis niger |
| 44 | | Lepisiota | Lepisiota elegan |