

## Final Report

### Evaluation of the efficacy of CHINCHEX (silica based) against cockroaches and the Arizona Bark Scorpion (*Centruroides sculpturatus*)

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**Study Sponsor: Francisco Pazos**  
NO BED BUGS HK  
Hong Kong

**Initiation of test:** October 24, 2020

**Completion of test:** December 10, 2020

**Insecticide tested:** CHINCHEX

**Company:** NO BED BUGS HK

**Material treated:** Concrete slate

**Objective:** Test the efficacy of CHINCHEX against a variety of arthropods

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**Report title:** Evaluation of the efficacy of CHINCHEX (silica based) against cockroaches and the Arizona Bark Scorpion (*Centruroides sculpturatus*)

**Test Species:** *Centruroides sculpturatus* (Arizona Bark Scorpion)

*Periplaneta americana* (American cockroaches)

*Blatta orientalis* (Oriental cockroaches)

*Blatta lateralis* (Turkestan cockroaches)

*Blatella germanica* (German cockroaches)

**Location of Test Site (physical address):** Urban Entomology Research Laboratory, New Mexico State University, Las Cruces, NM

**Date of Report Completion:** December 17, 2022

## 1. STUDY TITLE

Evaluation of the efficacy of CHINCHEX (silica based) against cockroaches and the Arizona Bark Scorpion (*Centruroides sculpturatus*)

## 2. BACKGROUND

Of the more than 4000 species of cockroaches, approximately 30 can be found or be associated with human habitations (1), of these species the most common that can be found in human habitations or environments include *Periplaneta Americana*, *Blattella germanica*, *Blatta orientalis*, *Periplaneta australasiae*, and *Supella longipalpa* (2, 3), as well as *Blatta lateralis*, that has expanded its usual distribution becoming an important peridomestic pest in the last decades (4), fact that is especially true in certain areas of the United States of America (5). All these cockroaches are medically important for two main aspects, the first one are the allergens they produce, which are an important source of clinical and medical burden, particularly in children (6), the second aspect is the possibility of mechanical transmission of food-borne pathogens (such as Hepatitis Virus, *Salmonella*, *E. coli*, *Pseudomonas aeruginosa*, among others) (3), which can produce significant disease in children and affect not only the patient's life but also the caretakers. In this regard, and due to the medical importance of these insects, the control of such species, using an integrated pest management program, including several types of interventions, is important in an urban environment (7).

On the other hand, one of the most important causes of envenomation in the United States of America is the Arizona Bark Scorpion (8). This scorpion can be commonly found in Arizona, but can be found in regions of western New Mexico, southern Utah, southern Nevada and the states of Sonora and Chihuahua in Mexico. In the USA, the Arizona bark scorpion is known to produce serious medical effects on some patients (9). The scorpion's venom has several neurotoxic effects that can cause pain, numbness, tingling or burning sensations, as well it can produce severe allergic responses than can lead to death (9). The most severe responses occur in children and old patients. Fortunately, the fatal outcomes tend to be rare (8). Because of their size and ability to move, these scorpions can easily hide in their natural environment and conceal themselves and are usually found under loose tree bark, leading to their common name (10). Other places

they can be found include under rocks, crevices, but they are also easy to find in driveways, sidewalks, and walls while searching for prey (cockroaches and crickets) (10). It is during this time that scorpions might encounter insecticide residues. Therefore, it is crucial to evaluate the efficacy of commercial products for scorpion control.

In this case a dust based on silica gel, CHINCHEX, will be used to treat concrete surfaces to expose cockroaches and scorpions. To do these, forced exposure assays were used. The specimens included laboratory raised cockroaches and wild-caught scorpions exposed to CHINCHEX on concrete slates. There was no history that the experimental scorpions had been exposed previously to insecticides. This study reports scorpion and cockroach mortality data as well as behaviors that both types of arthropods displayed upon contact with the dust.

### **3. OBJECTIVE**

Test the efficacy of CHINCHEX as an insecticide, against four species of cockroaches.

Test the efficacy of CHINCHEX against the Arizona Bark Scorpion.

### **4. TECHNICAL QUESTION**

How does CHINCHEX perform as an insecticide and scorpionicide on a porous surface such as concrete?

### **5. MATERIALS**

#### **5.1. Reagents and Surfaces**

**5.1.1. Concrete slates:** 12 X 12 X 1.5 inch commercially available concrete slates

**5.1.2. Treatment:** CHINCHEX provided by NO BED BUGS HK

**5.1.3. Rate:** One pound (453 g) per 1,000 square feet.

#### **5.2. Insects and Arachnids**

**5.2.1. Scorpions:** The experimental scorpions were collected by A. Romero in the Phoenix area in September 23-24, 2022. The animals were maintained in the lab since then and fed with crickets periodically.

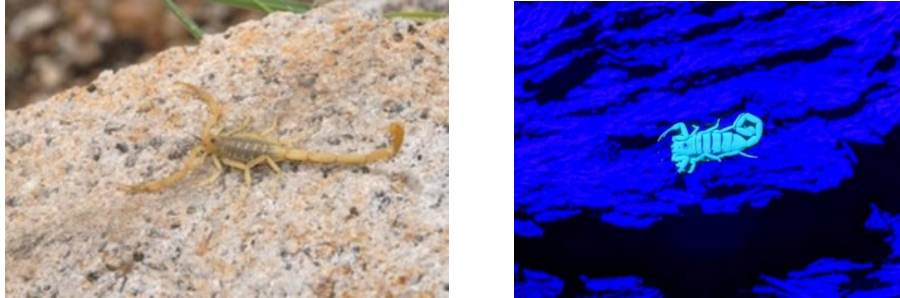


Figure 1. Arizona bark scorpion (*Centruroides sculpturatus*)

**5.2.2. Cockroaches:** The experimental roaches were obtained from the Laboratory raised and maintained colonies. The feeding of this colonies is *ad libitum*. Figures 2- through 5.



Figure 2. Oriental Cockroaches (*Blatta orientalis*)



Figure 3. German Cockroaches (*Blattella germanica*)



Figure 4. Turkestan Cockroaches (*Blatta lateralis*)



**Figure 5.** American Cockroaches (*Periplaneta americana*)

## 6. METHODOLOGY:

**6.1. Test design:** The effect of CHINCHEX on Turkestan and Oriental cockroaches were evaluated and concrete slabs (12 x 12 inches) with PVC rings (3 inches of diameter and 3 inches of height) to contain the arthropods (Fig. 6). Another experimental design was used to evaluate CHINCHEX on American and German cockroaches, and it consisted in deli cups with tiny holes to provide adequate ventilation.

**6.2. Exposure:** three replicates with 10 Turkestan, or Oriental cockroach nymphs were completed. The cockroaches were exposed for 15 minutes (Fig. 6). American cockroaches (three replicates of ten) were also exposed for 15 min.



**Figure 6.** Experiment set-up for the evaluation of CHINCHEX with Turkestan cockroaches and Oriental cockroaches

**6.3. Single exposure scorpions:** In this experiment, scorpions were exposed to 4 hours on concrete slabs (Fig. 7). Only a control was used due to limited number of scorpions. The set-up was like the one used for the cockroaches but with only one specimen per PVC ring.



**Figure 7.** Experimental set up for the exposure of scorpions to concrete slabs treated with CHINCHEX

**6.4 Ethovision XT experiment:** to assess if CHINCHEX is repellent to German cockroaches, responses of the insects to areas treated with the dust was evaluated with the ETHOVISION-video-tracking system. For this, 5 containers of 29 centimeters of diameters were used. On the bottom of such containers, a filter paper was placed. In 4 of them, half of the area of the circle was treated with the dust, while the fifth one was used as control. A cardinal point randomization (north, south, west and east) was used to place

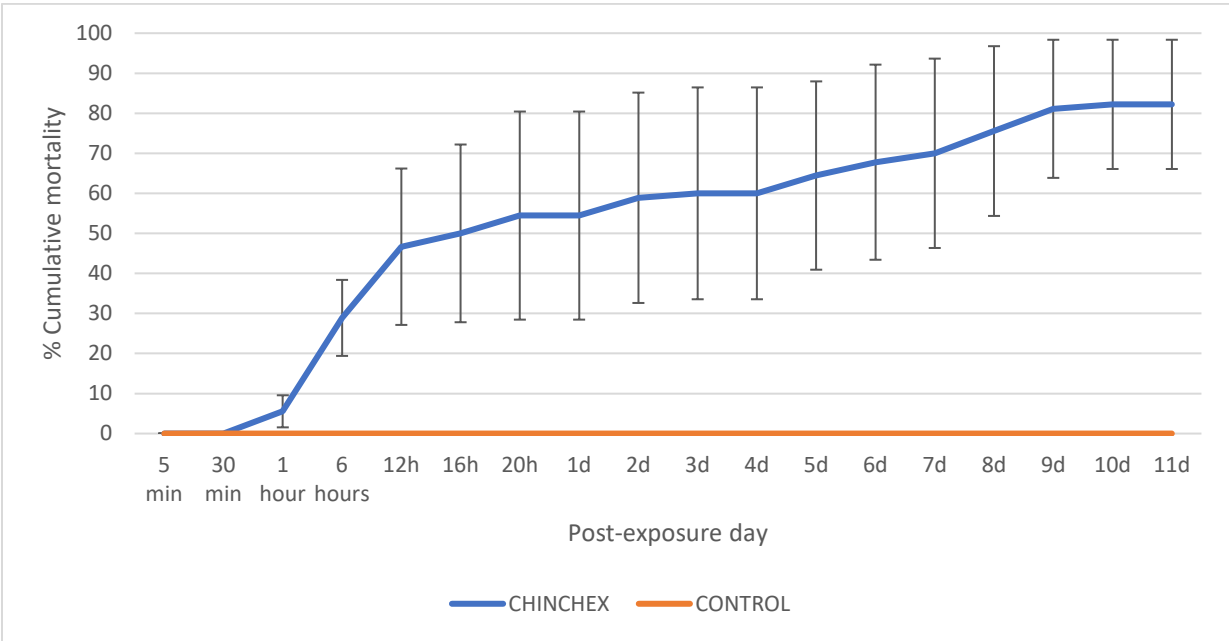


the arenas and the activity of the cockroaches were recorded for 20 minutes. Two behavioral parameters were used to evaluate the cockroach responses: distance to half-treated zones and time outside of the half-treated zones.

## 7. RESULTS

### 7.1 Results with Turkestan Cockroaches

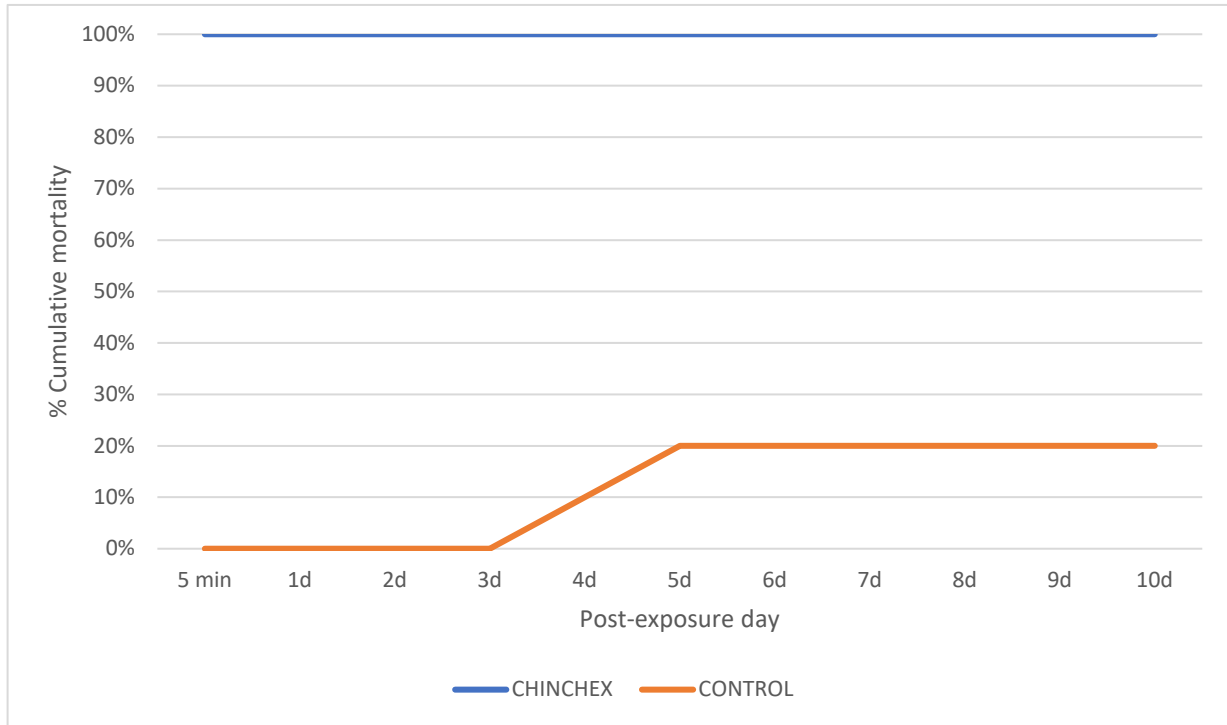
Only 15 min exposure of Turkestan cockroaches killed around 80% of them (Fig. 8). During the 15 min exposure, it was evident that the CHINCHEX adhered to the cockroach bodies. Onsite mortality was observed within 1h and reached about 50% mortality at 12h. The mortality was relatively steady until day 7, where it slightly increased to reach 80% mortality by day 11. No mortality was observed in control groups.



**Figure 8.** Cumulative mortality of Turkestan cockroaches exposed for 15 min to concrete slabs treated with CHINCHEX

## 7.2 Results with German Cockroaches

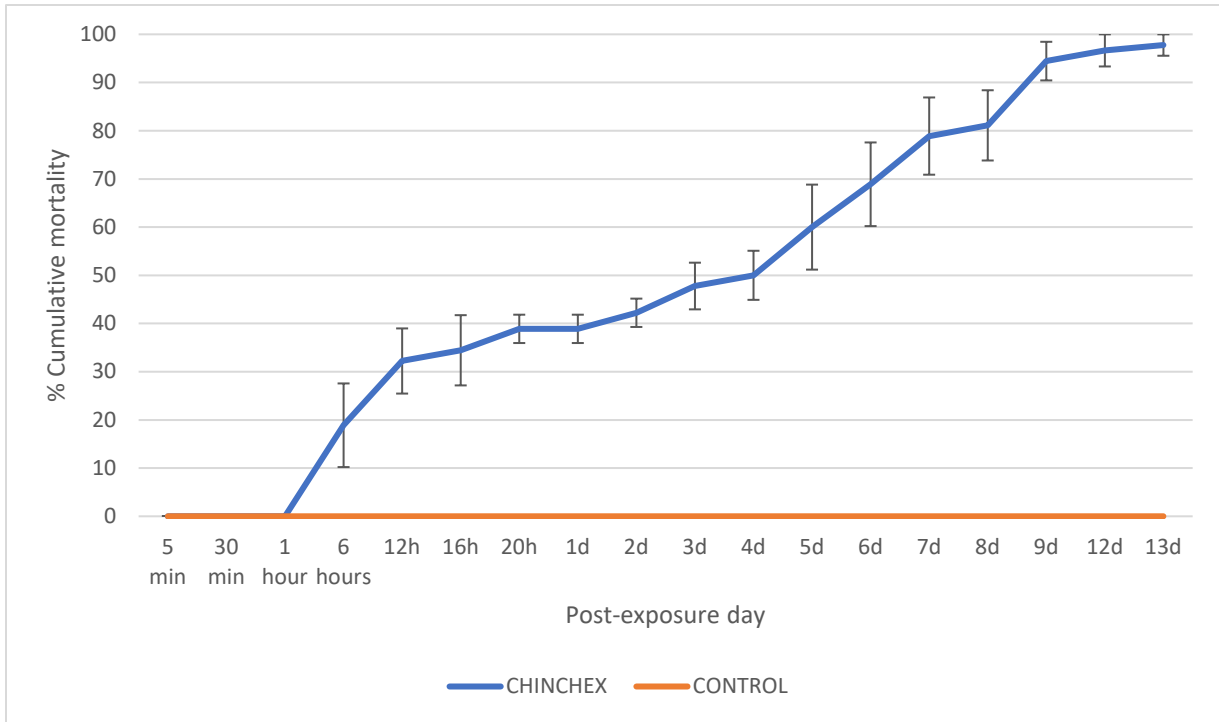
100% cockroaches died upon 15 min exposure of them to CHINCHEX (Fig. 9). Cockroaches control had a 20% of mortality by day 10 (Fig. 9).



**Figure 9.** Cumulative mortality of German cockroaches exposed for 15 min to CHINCHEX deposited in Deli cups

## 7.3 Results with Oriental Cockroaches

Exposures of Oriental cockroach nymphs to CHINCHEX for 15 min showed that this insecticide is highly effective (Fig. 10). Cockroaches started to die after 6h post-exposure and increased steadily since day 4. Significant high mortality was observed since day 9, and almost 100% of cockroaches were dead by the end of the evaluation period (13d) (Fig. 10).



**Figure 10.** Cumulative mortality of Oriental cockroaches exposed for 15 min to CHINCHEX deposited in Deli cups

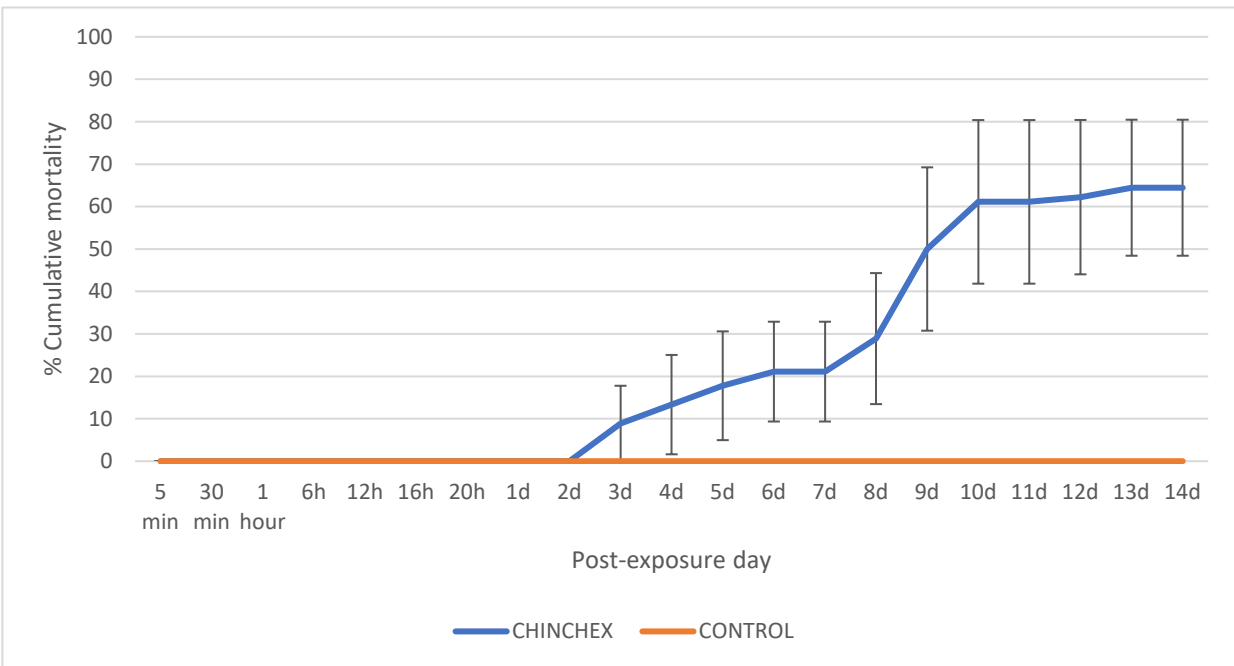
#### 7.4 Results with American Cockroaches

Cockroaches after their exposure to CHINCHEX were completely covered with the dust particles (Fig. 11).



**Figure 11.** American cockroach nymphs covered with CHINCHEX dust after a 15 min exposure.

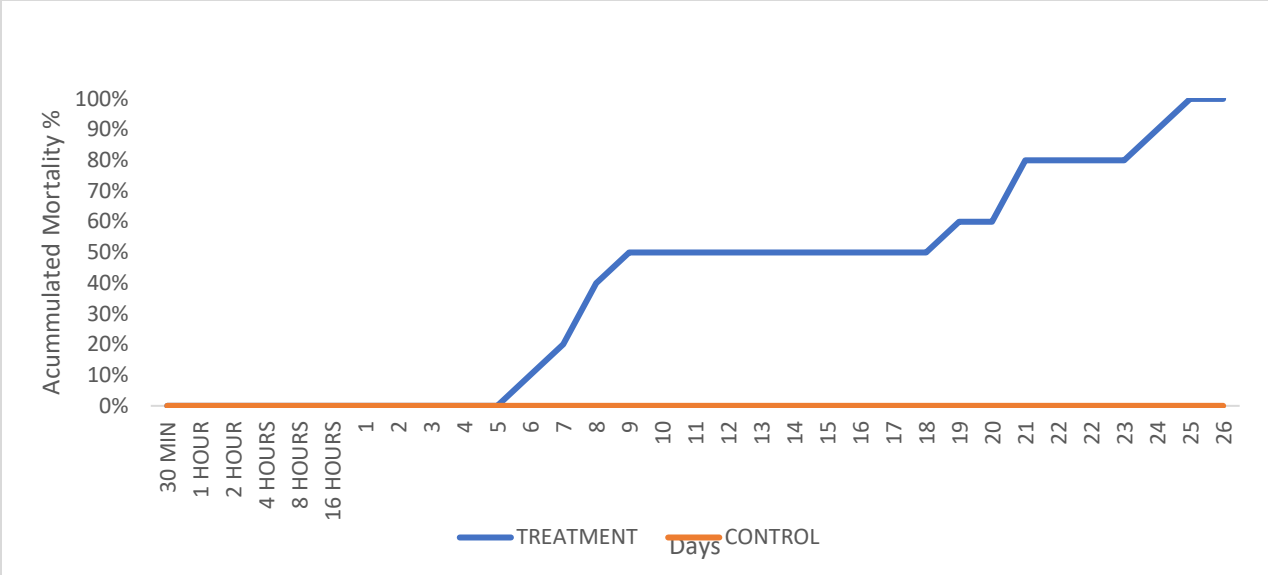
Rate of mortality of American cockroach was somehow slower than other cockroaches (Fig. 12). The first dead cockroaches were observed after 3day post-exposure, but a steep increase of mortality was observed since day until day 10. By the end of the experiment moderate mortality was observed (~60%) (Fig. 12)



**Figure 12.** Cumulative mortality of American cockroach nymphs exposed for 15 min to CHINCHEX deposited in Deli cups

### 7.5 Results with scorpions

No mortality was observed during 14 days of follow up and 15 minutes of exposure. However, a 4 h exposure the mortality began at day 5, and 50% of the scorpions were dead by day 9. No more deaths occurred in the treatment group after day eight until day 18. 100% of the scorpions were dead by day 26. No deaths occurred in the control specimens.



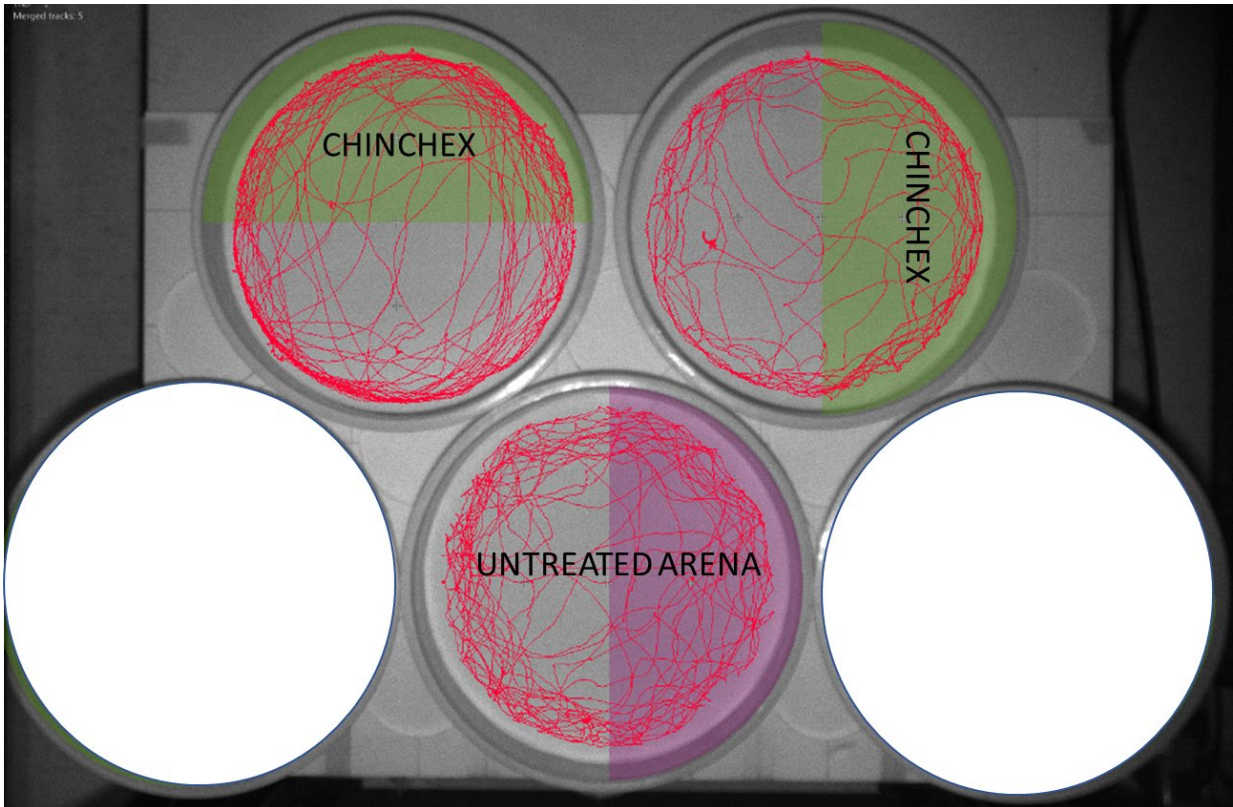
**Figure 13.** Mortality of Arizona bark scorpions after 4 hours of exposure to CHINCHEX

## **CONCLUSIONS -EXPERIMENT OF FORCED EXPOSURE OF COCKROACHES AND SCORPIONS**

- CHINCHEX, due to its lightness, appears to form a cloud on the initial application. The advantage of such characteristic is that it covers quickly the insect body.
- CHINCHEX was effective at killing domestic (German cockroaches), peridomestic cockroaches (Turkestan, Oriental and American cockroaches), as well as Arizona bark scorpions.
- The fastest mortality of cockroaches was observed in German cockroaches which died (100%) after 5 min exposure. The cockroaches were found completely covered with the dust within 2 min of exposure.
- The slowest (and lowest) mortality in cockroaches was observed in assays with American cockroaches. The reason for this could be the size of the insect as well as the cuticle composition.
- Significant mortality (~80%, 11 days) was observed in assays with Turkestan cockroaches. It is possible that the rate of mortality gets increased if longer exposure (>15 min) are used.
- A higher (near 100% mortality) is also reported in Oriental cockroaches when exposed to CHINCHEX. As with other cockroaches, increasing the exposure time (longer than 15 min) will most likely reduce the time to kill 100% of cockroaches.
- Scorpions was the animal with the longest time needed to be killed. This result is reasonable given that these arthropods have a cuticle that must stand the harsh environmental conditions of deserts.

## REPELLENCY TEST – GERMAN COCKROACHES

The objective of this experiment was to measure the responses of German cockroaches to areas treated with CHINCHEX to get a sense whether the insect avoid or not these deposits.



**Figure 14.** Tracks of German cockroaches while interacting with arenas whose halves were treated with CHINCHEX (green halves). Clear halves were untreated, while the arena with half purple was the control arena.

The tracks on the top clearly showed that German cockroaches wandered all over the areas of the arenas, including the halves treated with CHINCHEX, and similar pattern of activity was observed in control arenas. These results indicate that cockroaches do not avoid crawling on areas treated with CHINCHEX. No avoidance behavior of German cockroaches to areas treated with CHINCHEX means that the insect will pick up readily the dust and could eventually die within 5 min as shown in the forced exposures.

## References

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