# Comparison of efficacy and attractiveness of five commercial cockroach control gel formulations in laboratory tests

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We report the results achieved in laboratory tests conducted to compare the efficacy and the attractiveness of commercial gel formulations, containing abamectin, fipronil, indoxacarb, acetamiprid and imidacloprid, for the control of nymphs and adults of cockroaches. The tests were replicated 4 times and were carried out by in special arenas of 1 sq.m surface each; *Blattella germanica* (L.), *Periplaneta americana* (L.) and *Periplaneta australasiae* (F.) were the species considered in the study. In particular *Periplaneta australasiae* settled recently in several cities in Italy, probably due to the importation of food from the South-East Asia and sold in speciality stores.

## Introduction

*Blatta orientalis* (L.), *Blattella germanica* (L.), *Periplaneta americana* (L.) have long been established in Italy in food industry and restaurants, while Supella longipalpa (F.) is to be found more easily in houses. Recently, *Periplaneta australasiae* (F.) has been found in different locations and must now be regarded as having settled in Italy (Dutto and Suss, 2013). The control technique for these insects has gradually evolved from generalized treatments, to localized operations with the arrival of gel formulations. Several insecticides gel formulations have proven effective against cockroaches. In particular abamectin (Koeler et al., 1991; Rose, 1993); fipronil (Kankeh et al., 1997); imidacloprid (Appel and Tanley, 2000); indoxacarb (Dangsheng Liang, 2005). These last substances showed variable levels of efficacy according to different palatability and compatibility to the active ingredients; in some cases they showed aversion to specific active ingredient and vice-versa. The use of gels has long been studied. Several authors have presented results achieved in the laboratory as well as in real environments with reports covering; consumption of bait; food competition favored by debris in the environment; efficacy of different formulations; and insecticide activity on different strains of cockroaches (Appel et al., 2000; Changlu Wang et al., 2004; Dangsheng Liang, 2005). Comparative data of different gel efficacies in respect of a single species of cockroach have been also provided (Appel and Tanley, 2000). Since we can consider that these gel formulations can be used also for the control of *P. australasiae*, with this study we wanted to test in the laboratory if there is difference in efficacy and speed of action in the comparison of 5 gel formulations currently available in Italy.

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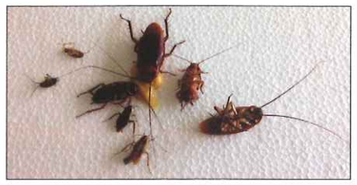
## Materials and methods

The species used in this study were *B. germanica*, *P. americana*, and *P. australasiae* bred for several generations in the Laboratory of Applied Entomology belonging to AGROBLU Srl, from captures carried out in Milan (*B. germanica* and *P. australasiae*) and Perugia (*P. americana*). 16 nymphs aged II and III, and 8 adults all shared in 4 replications (each arena represented a replication) were used for each test (one species and one product). The limited number of individuals used for each test and replication is justified by the fact that we wanted to avoid any possible competition on food, consisting of 2 drops of gel in each of the 4 arenas. Inducted mortality has been assessed after 48 hours with removal of the insecticide. Individuals that at the end of the test, although stimulated with the help of tweezers, showed low motility were also considered dead. The tests were carried out under controlled environmental conditions at the temperature varied between 24 and 25 °C and a RH between 65% and 70%. The formulations used were Avert® (abamectin 0.05%),



Goliath® Gel (fipronil 0.05%), Advion® (indoxacarb 0.6%), Foval Gel Scarafaggi (imidacloprid 2,15%) and Dobol® (acetamiprid 2.00%). The tests were carried out in polymethylmethacrylate arenas each one by a surface of 1 sq. m with 30 cm walls treated with Teflon® to prevent the escape of insects. A refuge point and a vial with water ad libitum were placed in the centre of each arena, while feed pellets (Purina Pet Food for Cats), routinely used in breeding of cockroaches, were placed in two opposite corners. However, following the manufacturer's instructions, a drop of gel insecticide was placed in each of the other two empty corners of the arenas. In the Control only Purina Pet Food and water was available. Each test started after 5 days of acclimatization of the cockroaches in the arenas. In case of dead or dying individuals during this acclimatization period, they were replaced. The data assessed were transformed in % of mortality and subjected to analysis of variance using ARM 9.0 software (GDM Inc.) and Student-Newman-Keuls test ($P<0,05$) was used to compare the difference between treatment means. Untreated treatment was excluded from ANOVA and subsequent post-hoc test.

## Result and discussion

In all assessments, all the cockroaches placed in the Untreated Control arenas remained alive and fully active. In terms of number of individuals dead, all the products showed a variable activity on the three species of cockroaches considered, but as the Table 1 shows, in two cases no mortality was recorded, while in other two cases full mortality was observed. On the base of the mortality percentage achieved, the data indicates that after 48 hours, only the fipronil gel showed a statistically significant difference against both stages of *B. germanica*, which was totally controlled. All the other treatments, including fipronil on *P. americana* and *P. australasiae*, recorded a mortality of cockroaches without significant statistical differences.


## Conclusion

The tests carried out, which must be considered as preliminary study, allow us to confirm that the different gel formulations currently available in Italy for the control of cockroaches, 48 hours after application, show a low efficacy with no significant difference statistically among them against *P. americana* and *P. australasiae*, at any stage of development. However, the gel containing fipronil 0.05% reached an efficacy statistically significant and higher than the other gel formulations against *B. germanica* at both stages of development, while on *P. americana* and *P. australasiae*, achieved an efficacy statistically similar to the other 4 gel formulations tested. In case of limited control by gels in the short term, traditional sprays are recommended, limiting the use of the gel only at points of infestation deemed not at serious risk of diffusion, such as electrical cabinets, closets, toilets.

*Table 1 - Percentage of mortality*

| Rating Unit | % OF MORTALITY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SE Description | AVERT | | GOLIATH | | DOBOL | | ADVION | | FOVAL | |
| PERIAM Nymphs | 0 | a | 6.3 | b | 12.5 | a | 12.5 | a | 56.3 | A |
| PERIAM Adults | 0 | a | 12.5 | b | 62.5 | a | 62.5 | a | 62.5 | a |
| PERIAU Nymphs | 2 | a | 25 | b | 31.3 | a | 31.3 | a | 43.8 | a |
| PERIAU Adults | 1.7 | a | 25 | b | 0 | a | 0 | a | 12.5 | a |
| BLTTGE Nymphs | 14.1 | a | 100 | a | 37.5 | a | 37.5 | a | 56.3 | a |
| BLTTGE Adults | 30.9 | a | 100 | a | 50 | a | 50 | a | 75 | a |
| LSD (P=.05) | 1.14t | | 26.26 | | 57.51 | | 48.27 | | 48.43 | |
| Standard Deviation | 0.76t | | 17.43 | | 38.17 | | 32.03 | | 32.14 | |
| CV | 126.95 | | 38.91 | | 118.19 | | 99.2 | | 62.97 | |
| Skewness | 0.8345 | | 0.2945 | | 0.7611 | | 0.8315 | | -0.0802 | |
| Kurtosis | -1.3234 | | -1.7006 | | -0.7683 | | -0.5897 | | -0.9922 | |
| Replicate F | 0.727 | | 1.686 | | 0.113 | | 1.853 | | 1.101 | |
| Replicate Prob(F) | 0.5518 | | 0.2127 | | 0.951 | | 0.181 | | 0.3795 | |
| Treatment F | 2.675 | | 24.771 | | 1.477 | | 2.096 | | 1.78 | |
| Treatment Prob(F) | 0.0639 | | 0.0001 | | 0.2552 | | 0.1225 | | 0.1776 | |

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