Control of the big-headed ant, *Pheidole megacephala*, in pineapple plantations with the proprietary bait Amdro

GJ Petty
Institute for Tropical and Subtropical Crops
Private Bag X 1
Bathurst 6166
Republic of South Africa

BQ Manicom
Institute for Tropical and Subtropical Crops
Private Bag X 11208
Nelspruit 1200
Republic of South Africa

Received: August 1994
Accepted: December 1995

Control of the big-headed ant, *Pheidole megacephala*, in pineapple plantations with the proprietary bait Amdro.

ABSTRACT

In three field trials from 1984 to 1988, in the Hluhluwe district of Natal, Amdro (0.88% hydramethylnon) was applied to 0.125- or 0.25-ha plots in 5-month-old pineapple plantations at 1, 2 and 4 kg/ha for the control of the big-headed ant, *Pheidole megacephala* (*Hymenoptera: Formicidae*). Effective control for at least 21 weeks resulted from all Amdro levels when applied to a low ant infestation in spring. However, when treatments were applied in summer to a heavy infestation, the 1 kg/ha treatment was significantly inferior to the higher rates, providing less than 4 weeks of control; 2 and 4 kg/ha significantly reduced ant infestation up to 12 weeks after treatment, maintaining a minimal infestation for 10 weeks. There was a cessation of worker caste activity within 1 week of Amdro application. It is concluded that for effective and economical control of the big-headed ant, Amdro should be applied at a rate of 2 kg/ha.

Contrôle de la fourmi *Pheidole megacephala* en plantation d'ananas par utilisation d'Amdro, un appât spécifique.

RÉSUMÉ

Pour lutter contre la fourmi *Pheidole megacephala* (*Hymenoptera: Formicidae*), trois essais ont été menés en champ de 1984 à 1988, dans le district de Hluhluwe (province du Natal, Afrique du Sud), qui ont permis de tester différentes doses (1, 2 et 4 kg/ha) d'Amdro (insecticide à 0,88% d'hydraméthylnon) appliquées sur des parcelles (0,125 et 0,25 ha) d'ananas âgés de 5 mois. Toutes les doses d'Amdro appliquées au printemps sur de faibles populations de fourmis ont été efficaces pendant au moins 21 semaines, mais, en été, lors des fortes infestations, l'Amdro à 1 kg/ha a donné de moins bons résultats que ceux obtenus avec 2 ou 4 kg/ha ; ces doses de 2 ou 4 kg/ha ont réduit les infestations pendant 12 semaines après traitement, et ont maintenu la population de fourmis à un niveau minimal pendant 10 semaines. Une semaine après l'application d'Amdro, l'activité des ouvrières a cessé. Un contrôle efficace et économique de *Pheidole megacephala* peut donc être obtenu avec une application d'Amdro à 2 kg/ha.

Control de la hormiga *Pheidole megacephala* en plantación de piña utilizando un atractivo específico: Amdro.

RESUMEN

Para luchar contra la hormiga *Pheidole megacephala* (*Hymenoptera : Formicidae*), se llevaron a cabo tres pruebas en el campo de 1984 a 1988 en el distrito de Hluhluwe (provincia del Natal, Africa del Sur), que permitieron someter a prueba diferentes dosis (1, 2 y 4 kg/ha) de Amdro (insecticida con 0,88 % de hydramethylnon) aplicadas sobre parcelas (0,125 y 0,25 ha) de piñas de 5 meses de edad. Todas la dosis de Amdro aplicadas en primavera sobre escasas poblaciones de hormigas fueron eficaces durante por lo menos 21 semana ; pero en verano durante las grandes infestaciones, el Amdro con 1 kg/ha dió menos buenos resultados que los que se obtuvieron con 2 o 4 kg/ha ; estas dosis de 2 o 4 kg/ha redujeron las infestaciones durante 12 semanas después del tratamiento, y mantuvieron la población de hormigas a un nivel mínimo durante diez semanas. Una semana después de la aplicación de Amdro, la actividad de las obreras cesó. Un control eficaz y económico de *Pheidole megacephala* se puede entonces obtener con una aplicación de Amdro de 2 kg/ha.

Fruits, 1995, vol 50, p 343-346

KEYWORDS
Ananas comosus, chemical control, insect control, ants, *Pheidole megacephala*, attractants.

MOTS CLÉS
Ananas comosus, lutte chimique, lutte anti-insecte, fourmis, *Pheidole megacephala*, attractifs.

PALABRAS CLAVES
Ananas comosus, control químico, control de insectos, hormigas, *Pheidole megacephala*, atrayantes.

introduction

Pineapple is the chief horticultural crop of the Hluhluwe district of Natal (Republic of South Africa). For a number of years, this crop has been badly affected by mealybug wilt as a result of infestation of the plants by the pink pineapple mealybug, *Dysmicoccus brevipes* (Ckll). Direct control of mealybugs by foliar insecticide sprays is not very satisfactory, as found by OSBURN (1949) who obtained good control of foliar, but not of root infestation.

Many published studies have concluded that mealybugs and mealybug wilt are best controlled by controlling the ants which are associated with pineapple mealybugs (MERNY, 1949; LEW, 1958; ABRAHAO *et al*, 1961; ELIAS, 1964; SU *et al*, 1980; DUODO and THOMPSON, 1992). Until mid-1984, mealybugs and wilt were kept in check in South Africa by controlling ants with pre-plant dieldrin and HHDN soil treatments (PETTY and TUSTIN, 1993). Subsequently, these insecticides were banned and the wilt problem increased in severity.

In southern Africa, big-headed ants, *Pheidole megacephala* (F), are one of the most important ant species which disrupt biological balance (SAMWAYS, 1985). Amdro, a proprietary product of American Cyanamid, containing 0.88% of the active ingredient hydramethylnon, is a bait-toxin formicide found by REIMER and BEARDSLEY (1990) to be extremely effective for control of the big-headed ant and by BORTH (1986) to be effective against the Maricopa harvester ant. In the light of the above, three studies were undertaken in Hluhluwe pineapple lands. Big-headed ant infestations were monitored, before and after Amdro treatments were applied, to determine rapidity, effectiveness and duration of control achieved by different dosages of Amdro.

materials and methods

trial 1

Amdro was applied by a hand operated Cyclone granule spreader to 0.125-ha plots of 5-month-old Cayenne pineapples on the farm Kroonvrug, in January 1984. Rates equivalent to 1 kg/ha, 2 kg/ha and 4 kg/ha were applied, an untreated control comprising the 4th plot.

For assessments of big-headed ant infestation, 20 150 mm × 75 mm wood laths were placed in each plot, uniformly covering the area. Ant counts were made on each lath at 08:00 h on days of assessment. At 16:00 h the preceding day, laths were painted with ant attractant composed of groundnut butter and soybean oil in equal proportions. Three counts were made, up to 6 weeks after treatment; the trial was then terminated due to the occurrence of cyclone Damoina which caused extensive flooding and the disappearance of ants in all plots.

trial 2

This trial started in October, 1984. Trial details were as for trial 1, with the following differences: plot size was increased to 0.25 ha in an attempt to reduce the possibility that ants from the untreated control, adjacent to treated areas, would be affected by Amdro treatments. Wood laths were replaced by white, plastic laths, and ant counts were continued until shortly after 21 weeks, when it was found that Amdro treated plots had become so heavily reinfested that on many laths the ant attractant had been completely removed by the ants; no count could be made in these instances.

trial 3

This trial started in January, 1988. Trial details were similar to trial 2 but plastic laths were replaced by plastic bait-stations, obtained from American Cyanamid, into which the aforementioned ant attractant was placed. Only small insects were able to gain access to the attractant, overcoming the problem of rodents which at times removed attractant before ant counts could be made. Initially, weekly counts were made for 4 weeks, starting at week 1, and then two-weekly counts from week 8 until heavy reinfestation of all Amdro treated plots was observed.

Ant counts were transformed to log $(x + 1)$ and an analysis of variance was performed for each assessment time. Fishers protected LSD ($P = 0.05$) was used as the significance test.

results

The results of ant counts for the first trial are given in figure 1. Initial populations were similar in all plots and declined naturally by approximately 30% over the course of the trial. All Amdro treatments significantly *($P \leq 0.05$) reduced ant populations to near zero at weeks 4 and 6.*

In the second trial (fig 2), initial populations were low. Numbers increased approximately sevenfold in the untreated plots over 21 weeks. The ant infestation in all treated plots was zero at the fourth and seventh weeks after treatment and significantly lower than the control at weeks 13 and 21. At week 13, the 1-kg rate of Amdro was significantly ($P \leq 0.05$) inferior to the higher rates and, at week 21, the 4-kg rate of Amdro was significantly ($P \leq 0.05$) superior to the lower rates, although all Amdro treatments gave acceptable control.

For the third trial (fig 3), the ant population in the untreated plot was relatively stable over the trial period. For all three Amdro treatments, ants were reduced to minimal numbers within 1 week of treatment and these ant numbers did not differ from each other until week 3. Thereafter, until week 12, the 1 kg/ha treatment was less effective ($P \leq 0.05$) than the higher rates, showing a heavy infestation which was similar to, or even greater than, that of the control.

In the 2 kg/ha Amdro treatment, ant infestation increased progressively from week 8, reaching an unacceptably high level at week 12. At the rate of 4 kg/ha, ants were entirely absent until week 12, but were then also at an unacceptably high infestation level.

discussion and conclusions

The results indicate that Amdro at 1 kg/ha is likely, especially for severe ant infestations, to provide uncertain control. This may be explained by the fact that, at 1 kg/ha, only 8.8 g active ingredient was applied per 10 000 m^2 (the present formulation would only provide 7.7 g). At this rate, it is possible that there is insufficient active ingredient to kill all the minor workers as well as the subterranean immature stages, and the egg laying queen caste. The treatment effect may, however, be seen by a considerable reduction in the number of worker ants for a limited period of time, as in trial 3. Subsequently, as surviving immature workers mature, ant numbers increase as they take on their normal role of food gathering and nest hygiene.

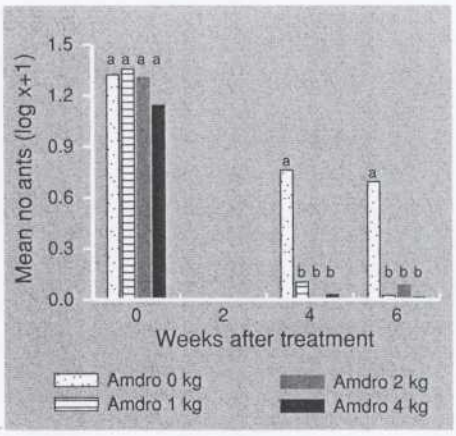

Figure 1
Mean numbers (log x + 1 transformation) of big-headed ants on wood laths in pineapple plots up to 6 weeks after treatment in January, 1984, with different levels of Amdro bait-toxin (kg/ha). Common letters signify non-significant differences ($P \leq 0.05$) at each assessment week.

It should also be noted that, because of the small volume occupied by 1 kg of the bait, there are practical difficulties associated with evenly distributing such small quantities of material, especially under windy conditions.

It is apparent that 2- and 4-kg doses of bait provide an adequate quantity of active ingredient per

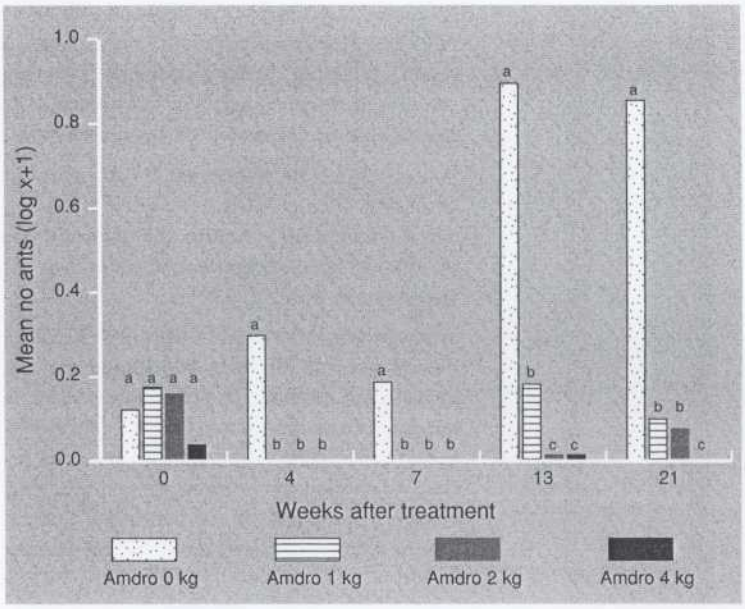

Figure 2
Mean numbers (log x + 1 transformation) of big-headed ants on plastic laths in pineapple plots up to 21 weeks after treatment, in October, 1984, with different levels of Amdro bait-toxin (kg/ha). Common letters signify non-significant differences ($P \leq 0.05$) at each assessment week.

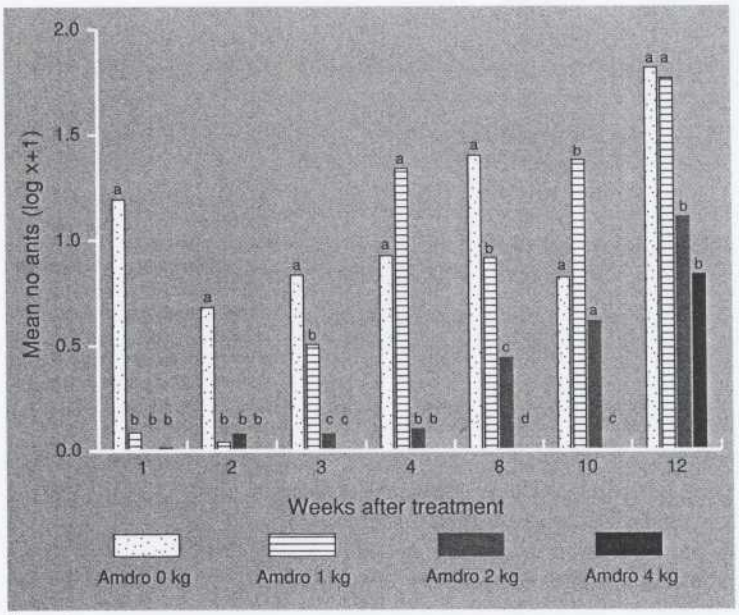

Figure 3
Mean number (log x + 1 transformation) of big-headed ants in bait-stations in pineapple plots up to 12 weeks after treatment, in January, 1988, with different levels of Amdro bait-toxin (kg/ha). Common letters signify non-significant differences ($P \leq 0.05$) at each assessment week.

hectare, even for severe ant infestations. Cessation of worker activity occurred within 1 week of treatment applications.

An aspect which was apparent from these trials is that the duration of control is dependent on time of year, for example, at least 21 weeks good control was obtained when treatments were applied in the month of October (early summer in South Africa). This was reduced to about 8 weeks for January treatments. This aspect is probably a reflection of seasonal variation in ant activity as regards 'budding' (colony dispersal). New ant colonies in the previously ant-free area arise by migration from the untreated surrounding area.

It is concluded from these studies that, because of the high efficacy attained in control of big-headed ants with 2 kg/ha Amdro, the additional cost incurred by applying greater quantities than this would not be justified.

Subsequently, PETTY and TUSTIN (1993) studied the relationship between big-headed ant and mealybug infestations. In a plantation, where no ant control was applied and both ant and mealybug numbers were high over a 1-year study period, no relationship between ant and mealybug numbers was found. It was concluded that ant numbers exceeded a level at which they became limiting to mealybug multiplication. In another plantation, where ants were kept continuously under control with Amdro treatments being applied when monitoring detected their presence, there was a highly significant linear correlation between severity of ant infestation and mealybug infestation on leaves ($r = 0.978$, $P < 0.01$) and roots ($r = 0.769$, $P < 0.01$). Under substantially ant free conditions, mealybug leaf and root infestation decreased to near zero within 12 weeks and remained so for most of the rest of the year with a significant 17% ($P < 0.01$) increase in plant growth.

Amdro has since been registered for use on pineapples in South Africa and is widely used by growers who find that, as a result of good ant control, mealybug numbers remain low and mealybug wilt disease does not assume significant levels.

references

Abrahao J, Torres SCA, Andrade AC (1961) Decline in pineapples caused by mealybugs. *Biologico* 27, 237-241

Borth PW (1986) Field evaluation of several insecticides on maricopa harvester ant (*Hymenoptera: Formicidae*). *J Econ Ent* 79 (6), 1632-1636

Duodo Ya, Thompson W (1992) Management of ant-mealybug complex in pineapple fields in Guyana. *FAO Plant Prot Bull* 40 (3), 82-88

Elias R (1964) A murcha vermelha do abacaxi. *Supl Agric Sao Paulo* 10 (460), 14

Lew GT (1958) Pineapple mealybug control in Taiwan. *Hopchen Briefe* 11, 114-120

Merny G (1949) Les maladies de l'ananas. *Fruits* 4, 327-331

Osburn MR (1949) Parathion dust for control of the pineapple mealybug. *J Econ Ent* 42, 557

Petty GJ, Tustin H (1993) Ant (*Pheidole megacephala* F) - mealybug (*Dysmicoccus brevipes* Ckll) relationships in pineapples in South Africa. *Acta Horticulturae* 334, 387-396

Reimer NJ, Beardsley JW (1990) Effectiveness of hydramethylnon and fenoxycarb for control of big-headed ant (*Hymenoptera: Formicidae*), an ant associated with mealybug wilt of pineapple in Hawaii. *J Econ Ent* 83, 74-80

Samways MJ (1985) Appraisal of the proprietary bait Amdro for control of ants in southern Africa citrus. *Citrus J* 621, 14-17

Su TH, Beardsley JW, McEwen FL (1980) AC-217300, a promising new insecticide for use in baits for control of the big-headed ant in pineapple. *J Econ Ent* 73, 755-756