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MANAGEMENT OF RED PALM WEEVIL *RHYNCHOPHORUS FERRUGINEUS* OLIV., A SERIOUS PEST OF DATE PALM IN AL QATIF, KINGDOM OF SAUDI ARABIA

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ABSTRACT

The red palm weevil, *Rhynchophorus ferrugineus* Oliv, is the most serious pest of date palm in the Arabian Peninsula. As the control of the pest was not effective with any single control method, an integrated management system was developed and implemented in the most seriously affected Al Qatif region of Saudi Arabia. The methods of control included the survey of all the cultivated gardens in the region, systematic checking of all palms for infestation, periodic soaking of palms in cultivated gardens and mass removal of neglected farms. Regular survey was conducted in about 3,055 gardens with a total of 4,64,785 palms. Infestation was brought down from 6.6% in the year 1993 to around 2.5% in 1997, with proper implementation of the management practices. There has been an increase in mild infestation and decrease in severely infested palms. The weevil population in the region had also been reduced considerably after the use of mass pheromone trapping system. A total of 4,09,109 palms in neglected farms were eradicated with heavy machinery to eliminate the breeding places for the weevil. All these methods have contributed to the successful implementation of a comprehensive integrated management system in the region.

Key words: Red palm weevil, *Rhynchophorus ferrugineus,* IPM, Date palm, Pest

INTRODUCTION

One of the serious pests causing considerable damage world wide to economically important palms like coconut palm, oil palm and date palm is *Rhynchophorus* sp. The red palm weevil *Rhynchophorus ferrugineus* Oliv. (Coleoptera: Curculionidae), was first reported in the Al Qatif region of the Kingdom of Saudi Arabia (KSA) in the year 1987 and ever since its incidence was on the increase (Abraham and Vidyasagar, 1992; Bokhari and Abuzuhira, 1992). In the beginning, chemical control methods such as spraying of palms with high pressure sprayers, survey of farms and treatment of infested palms with stem (trunk) injection or use of fumigant tablets were practiced for controlling the pest. However, the success with such chemical methods only was moderate and the infestation continued to rise and the pest spread rapidly to other regions of the Kingdom. Oehlschlager *et al.*, (1995) had highlighted the influence of pheromone based mass trapping system on the incidence of red ring disease in oil palm plantations of Costa Rica. For any control programme to be successful

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against red weevil, it is necessary to integrate various methods in a judicous manner to get success (Vidyasagar and Bhat, 1991).

Although, the pest has spread to most of the date palm growing areas of KSA, the highest level of infestation was reported from the Al Qatif region in the Eastern Province. To achieve better results, all the available control technologies were either refined or modified; new methods were developed and integrated in the system. From 1994 onwards there was emphsis on research and adoption of new technologies for suppressing the pest. The aim of the study was the management of the pest with a systematic approach of survey of the farms, prophylactic application of insecticide to palms, timely curative treatment of infested palms, use of pheromone traps to attract and kill adult weevils, removal of badly damaged palms etc., and their effect on the infestation level. Therefore, in this paper the strategy of integrating various methods of control and the success achieved so far in KSA, are presented in detail.

MATERIALS AND METHODS

Survey: The date palm gardens in Al Qatif region were divided into 16 areas and allotted to plant protection teams. Each of the teams with trained staff surveyed the gardens in its area regularly with a schedule to detect any infestations and further necessary operations. Some times visits to farms were made on priority, on the basis of the information received from farmers.

Chemical methods: For the control of the pest, one of the important methods used was chemical control. This method was used either as a prophylactic or curative method. In the prophylactic or preventive treatment the palms were protected from pest attack for a certain period of time by applying insecticides. Curative treatment was applied to kill the pest stages, whenever, a palm was infested. Following are the chemical methods of tretment used in the programme.

Prophylactic: Before the start of this new programme in 1994, all palms in a garden were routinely sprayed with a pesticide under high pressure. By this method pesticide was not completely reaching the inner parts of leaf axils where the adult weevils generally hide, besides causing splashing of pesticide all over the place resulting in the pollution of the surrounding environment. A new method referred to as soaking method was introduced, wherein the insecticide solution was poured through the inner most leaf axils with the help of a long aluminium lance measuring about 3-4m in length. The motor was operated at low pressure so that the insecticide solution reached all the leaf axils besides drenching the stem. The pesticide solution required to soak a single palm was approximately 20-30 L depending upon the size of the crown and age of palm. The quantity of chemical used per palm by this method was slightly higher than the conventional high pressure spray with nozzle. Some of the pesticides used for soaking of palms for four years were chlorpyriphos 40EC, metasystox R 50EC, cypermethrin 10EC, endosulfan 35EC, decis (deltamethrin) 2.5EC, trichlorphon 80SP, supracide (Methidathion) 40EC, salut (cypermethrin + dimethoate) 50EC, actelic 35EC, carbaryl 85WP, etc. In general all these pesticides were used at 0.1%

level except Decis, which was used at 0.01%.

Curative: The infested palms detected during the checking of gardens were treated according to the intensity of infestation. The damage to date palms caused by the pest falls broadly into three categories *viz.*, mild, medium and high (severe) infestation. The first two categories of infestations *i.e.* mild and medium were treated by stem injection, fumigation or clean and apply pesticide methods.

Stem (trunk) injection: First of all the damaged site was superficially cleaned and several holes were made around the damaged site with the help of electric drill or iron rod. The holes were made at an angle of about 45 degrees in the stem about 15 cm deep. Based on the results of a few field trials the dose of injection was reduced to 2% pesticide solution from a much higher dose. The pesticides used in this method were Salut, Supracide, Metasystox R, and Trichlorphon. The crown and stem of palms were also treated by drenching or soaking.

Fumigation: The palms exhibiting medium damage having a small cavity were treated by fumigant tablets of Aluminium phosphide 10% (Celphos or Phostoxin 10%). The damage site was sealed after placement of fumigant with fiber/plastic sheet and plastered with mud to prevent escape of gas.

Cleaning and applying pesticide: From 1995 onwards a new method in the form of cleaning of the damaged site and applying pesticide was brought into practice. Since several palms were showing very mild or slight infestation, with superficial wounds, such wounds were cleaned and a pesticide was applied over the cleaned surface. Generally, in such cases there was no trace of tunnel or bore hole. Such sites were treated by a pesticide to prevent any future attack.

Mass pheromone trapping: The mass pheromone trapping with Ferrolure (4-methyl-5-nonanol) or Ferrolure+ (4-methyl-5-nonanol+4-methyl-5-nonanone) was started in August, 1994 and was integrated as a management package. The standard Saudi bucket trap baited with Ferrolure/Ferrolure+were used to trap and kill the adult weevils. The pheromone lures were supplied by Chem Tica International, Costa Rica. The old lures were replaced with new ones as and when the pheromone was exhausted. The servicing of traps was done at weekly intervals in summer (May - October) and biweekly intervals in winter (November - April). The traps were uniformly distributed in gardens under survey.

Removal of palms: Until the year 1993, the palms badly damaged were also retained in the field after treating by fumigants and injections. However, from 1994 onwards a decision was taken to eradicate badly damaged palms without resorting to any curative method. The task of cutting and removing the freshly damaged palms as well as old infested palms was taken up on a massive scale with the help of electric chain saws, shovels, trucks, etc. The removed palms were either cut into smaller bits and applied with pesticide and/or set on fire. In some cases the removed palms were transported to a vacant dumping area and set on fire.

There were large numbers of neglected or abandoned gardens in and

around Al Qatif region. These gardens were not covered under control programme. Therefore, these neglected gardens were harboring large populations of the pest and serving as reservoirs. The Ministry of Agriculture and Water has embarked upon a programme of mass removal of such neglected gardens. For this purpose special teams were created with heavy machinery like bulldozers, loaders, backhoes, trucks etc. This programme started in 1994 was continued every year up to 1997.

RESULTS AND DISCUSSION

Survey: From a total of 2,270 gardens in 1993, the number of gardens surveyed rose to 3,055 (regular) + 417 (household) in 1997. Consequently the number of palms has increased from 365,309 in 1993 to a high of 464,785 in 1997. In the year 1994 a special programme was implemented in Um Musahik, one of the worst affected areas of the region by deploying all the plant protection teams for about three weeks to survey and treat damaged palms. During this operation, an additional 15,500 palms distributed in 52 gardens were brought under the control programme. In all areas put together a total of 48,816 palms were newly brought under the survey during 1994. From 1995 onwards the number of household gardens surveyed in Dammam and Khobar area was separately listed from the regular gardens. The progressive increase in gardens and palms in 1995, 1996 and 1997 was 2788+288, 2961+376 and 3055 + 417 gardens and 434,746, 451,317 and 464,785 palms respectively. In very few countries there was such systematic syrvey conducted on the incidence of red palm weevil.

Prophylactic: During the survey, the engineers checked all palms in a garden for any infestation by red weevil (Fig. 1). After reorganization of the programme with new field staff, there was an increase of 76,300 palms checked in 1994 as compared to 1993. However, the high level of checking was not sustained in the subsequent years due to the diversion of available

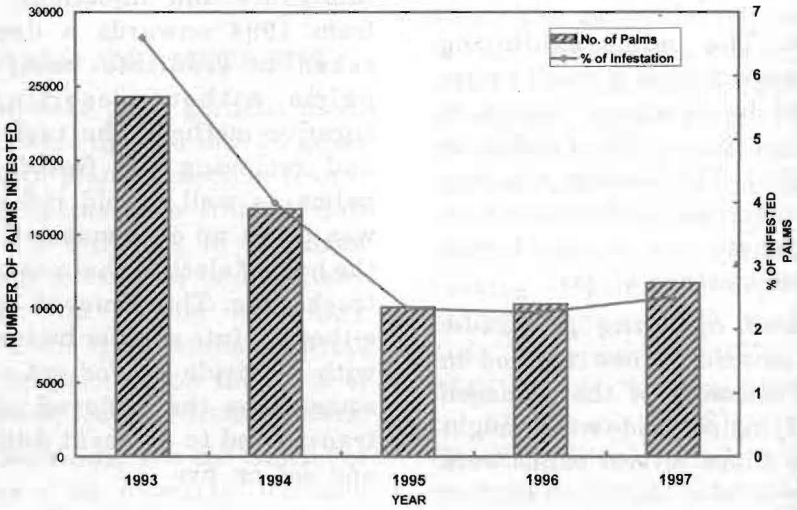

Fig. 1. Number and percentage of infested palms from 1993 to 1997.

resourcestocarryoutmassphero-mone trapping from the later part of 1994.

Filling of leaf axils with a mixture of BHC 5%, dust and sand was recommended as a prophylactic measure against red weevil in coconut (Mathen and Kurian 1966). However, in date palms it was not a suitable method due to its morphological characters. Therefore, the palms were soaked with a suitable insecticide at 0.1%. In the year 1993, the number of palms sprayed was much higher because the conventional high pressure spraying was much faster than the new method of soaking. The total number of palms soaked in 1994, 1995, 1996 and 1997 was 321,805, 299,386, 275135, and 257,385 respectively. In some years during certain months, the number of palms soaked was lower than the normal, due to intermittent rains. From 1994 onwards the soaking of palms with fruits was stopped every year, starting from July to September. However, soaking was continued in non-bearing young palms. This restriction was applied to avoid any possible pesticide residues in the fruits.

Curative: The earliest method for the control of red palm weevil in coconut was the stem injection with 1.0% Pyrocon E (Piperonyl butoxide) (Nirula, 1956). After testing seven insecticides, it was found that Trichlorphon 0.2% was the best against red weevil (Abraham *et al.*, 1975). For the integrated control of red palm weevil in coconut in India, Carbaryl 1.0% or Endosulfan 0.1% stem injection and adult trapping using coconut logs was found to be successful (Sathiamma *et al.*, 1982). Several newer groups have come into use and some of them were tested and found to be effective in controlling the red palm weevil in date palm. The promising chemicals used were Supracide, Salut, Metasystox R and Trichlorphon (Vidyasagar, 1998). The data on the percentage of infestations recorded in different areas from 1993 to 1997 are presented in Table 1. In 1993, the overall percentage of infestation was 6.6%. After the initiation of intensive IPM programme in 1994, the infestation level has come down to 4.0%. There was further decrease in the number of infested palms and percentage of infestation in 1995 with 10,041 infested palms and 2.3% infestation. The year-wise data on the total palms infested and the percentage of infestation is presented in Fig. 1. This level of infestation remained more or less the same in the subsequent two years. However, there was a slight increase in the percentage of infested palms in the year 1997. This slight increase may be attributed to a few reasons like intermittent rains making the prophylactic soaking of palms ineffective and the inclusion of several new farms under control programme for the first time. Apart from this, for two successive years of 1995 and 1996 there was a shortage of pheromone lures and hence mass pheromone trapping was not done continuously.

When the data on the infested palms in different months were examined, it was found that infestations recorded were more during the months of June and July and Novemeber and December (Fig. 2). The data on different aspects of plant protection operations carried out from 1994 to 1997 are given in Table 2. Compared to 10,003 stem injections administered in 1994, there

Table 1. ***Data on the year-wise infestations in different areas between 1993 and 1997***

Area	% infested palms				
	1993	1994	1995	1996	1997
Awamiya	8.90	4.50	2.00	1.12	1.31
Area No. 3	16.60	5.50	2.90	5.11	3.78
Owjam	5.60	3.40	2.30	2.03	2.31
Abuman	7.10	5.50	3.40	4.15	3.64
Al Qhudeh	6.90	3.30	1.60	0.74	1.03
Al Jesh	5.70	4.00	2.20	2.96	3.02
Tarut	8.10	3.70	1.00	1.27	2.50
Um Al Hamam	8.70	6.50	2.00	2.55	4.08
Al Jerrodiya	4.40	1.90	1.60	1.86	2.62
Um Musahik	5.00	7.40	4.50	4.21	3.31
Safwa	4.30	2.50	0.90	1.13	2.88
Tobi (Qhwaldiya)	7.50	3.40	2.30	1.86	1.80
Tobi II			2.30	2.15	1.29
Ayashi	5.50	1.50	0.70	1.65	2.13
Saihat	5.00	3.40	5.50	3.56	3.38
Dammam		4.30	1.60	1.16	1.49
Total	**6.6**	**4**	**2.3**	**2.27**	**2.51**

has been a decrease in the number of stem injections administered in the subsequent years.

In certain cases where the damaged cavities were treated by a fumigant, the palms developed tissues covering the cavity, especially in Qatif area because of high humidity. Over the past four years there has been a reduction in the number of palms treated by this method. Up to 1994, the number of palms treated by fumigation method

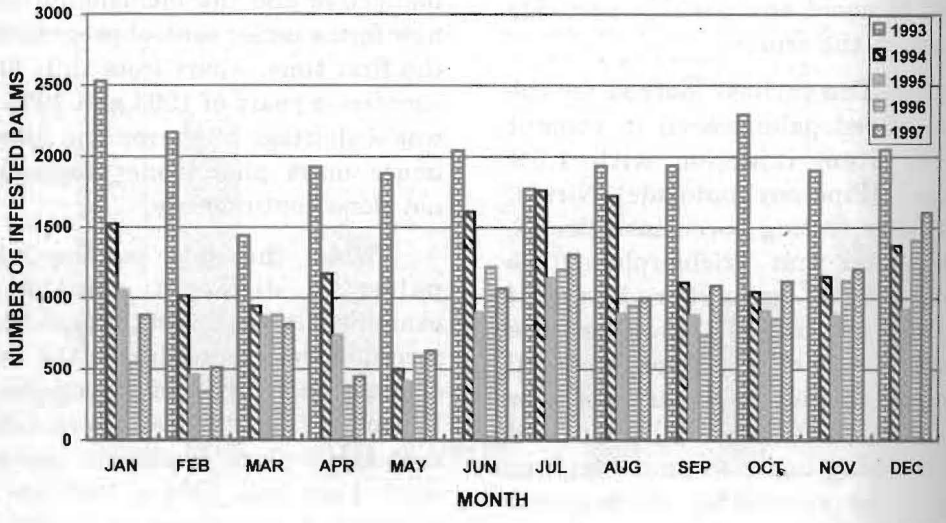

Fig. 2. Number of palms infested by red palm weevil in different months.

Table 2. ***Details of various plant protection operations carried out from 1994 to 1997 in Al Qatif***

S.No.	Description	Year			
		1994	1995	1996	1997
1.	No. of infestations (S. No. 6-7)	16694	10041	10241	11693
2.	No. of injections	10003	5287	4865	5091
3.	No. of fumigations	4542	1033	914	899
4.	No. of injection + fumigation	–	1039	1025	1264
5.	No. of Clean + insecticide	–	1940	2683	3697
6.	Total palms treated (S. No. 2-5)	14545	9299	9487	10951
7.	Total palms removed	2149	742	754	742
8.	Old palms removed	2718	2104	1827	770
9.	No. of palms soaked	321805	299386	275135	257385

was quite high as could be seen from the data presented. However, from 1995 onwards the treatments have been further classified into fumigation alone and injection + fumigation and palms treated by such methods has decreased from 1995 to 1997.

The mild infestations were treated by cleaning the wound and applying pesticide. Over the past three years *i.e.* from 1995 there was an increase in such mild infestations. In 1995, this type of infestations recorded was 1,940, whereas, in 1997 a total of 3,697 palms were treated by this method alone (Table 2). This clearly indicates that the infestations were detected at a very early stage.

Mass pheromone trapping: In oil palm plantations of Costa Rice use of pheromone trapping for collection and killing of *R. palmarum* was successfully demonstrated (Oehlschlager *et al.*, 1993). The pheromone trap for mass trapping red palm weevil in Saudi Arabia was developed and used in large scale (Vidyasagar, 1995 and Abozuhairah *et al.*, 1996). One of the important components in the management of this deadly pest was the mass trapping with pheromone-based traps. There were 2252 traps distributed in various areas in 1997. The total number of adults captured in 1994, 1995, 1996 and 1997 was 1,11,399, 2,64,747, 1,98,247 and 2,20,264 respectively. Initially the number of weevils per trap per week was about 4.12 weevils per trap per week which was reduced to 2.02w/t/w in 1997. This clearly indicated a decreasing trend in the population of weevil.

Removal of palms: The eradication of severely damaged palms in cultivated gardens was done regularly. The Fig. 3 shows the number of palms removed in different months in cultivated gardens from 1993 to 1997. In 1994 a total of 2,149 palms were removed from the cultivated gardens. From 1995 to 1997 this number has come down to about one third and remained more or less the same (Table 2). It can be seen that maximum number of palms removed in a single month was in April 1994. A total of 4,867 palms including the old palms were removed

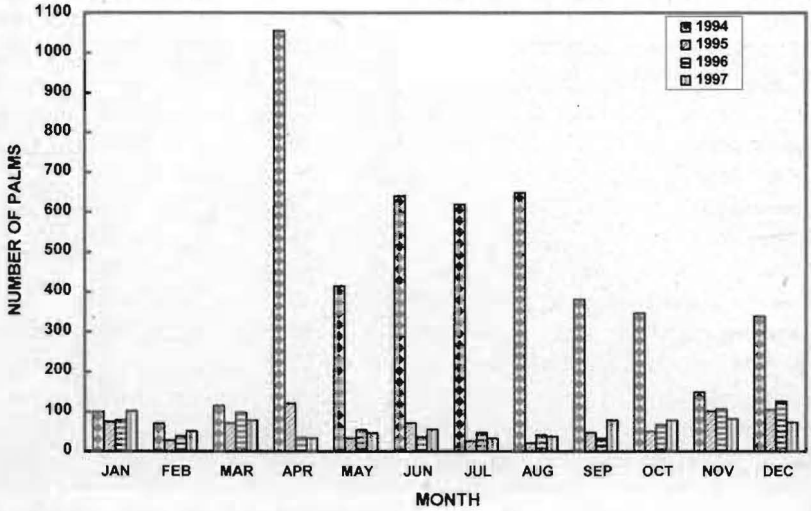

Fig. 3. Total number of badly damaged palms removed in cultivated gardens.

in 1994, whereas, 1,504 (fresh and old) were removed in 1993. Once the gardens were cleared of the backlog of palms, the number of removals became reduced later on.

Due to some socio-economic reasons, many gardens were neglected by absentee farmers in this region. Such neglected gardens were a constant source for breeding and dispersal of weevils. So the palms in such abandoned gardens were eradicated *en masse* with heavy machinery. The palms after removal were transported to a dumping area where they were set on fire and covered with soil. Wherever possible the removed palms were set on fire at the same place. A total of 4,09,109 palms were removed in various areas between 1994 and 1997. It is anticipated that by adopting this method cf mass removals, the populations of pest are likely to be reduced further in the coming years.

From the foregoing account it can be seen that the number of infestations have been brought under control by the judicious use of chemical methods, pheromone trapping, mechanical methods *etc.*, in the most badly affected region of the KSA. By continuing these integrated pest management techniques, it is hoped that the pest level could be brought down further in the near future.

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