



The Blessed

tree

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MARCH 2020



جائزة خليفة الدولية لنخيل التمر والابتكار الزراعي
KHALIFA INTERNATIONAL AWARD FOR DATE PALM
AND AGRICULTURAL INNOVATION

**KHALIFA INTERNATIONAL AWARD FOR DATE PALM
AND AGRICULTURAL INNOVATION**



الإمارات

THE EMIRATES

MAKE IT HAPPEN



معرض أبوظبي للتمور Abu Dhabi Date Palm Exhibition 2020



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13TH SESSION 2021 AWARDS

تعلن الجائزة عن بدء استلام طلبات ترشيح الدورة الثالثة عشرة 2021
The Award Announces the Start of Applications for the Thirteenth Session 2021

وفق البرنامج التالي :

- Application Period Runs: From 01 June - 31 December 2020
- The Winners Will be Announced: February 2021
- The Award Distribution Ceremony: March 2021

- تقديم طلبات الترشيح : 01 يونيو - 31 ديسمبر 2020
- إعلان أسماء الفائزين : فبراير 2021
- حفل تكريم الفائزين : مارس 2021

 <p>فئة الشخصية المتميزة في مجال النخيل والتمر والابتكار الزراعي Influential Figure in the Field of Date Palm and Agricultural Innovation</p> <p>قيمة الجائزة Award money AED 750,000</p>	 <p>فئة الابتكارات الرائدة والمتطورة لخدمة القطاع الزراعي Pioneering and Sophisticated Innovations Serving the Agricultural Sector</p> <p>قيمة الجائزة Award money AED 750,000</p>	 <p>فئة المنتجون المتميزون في قطاع النخيل والتمر Distinguished Producers in Date Palm Sector</p> <p>قيمة الجائزة Award money AED 750,000</p>	 <p>فئة المشاريع التتموية والإنتاجية الرائدة Distinguished Pioneering Development & Productive Projects</p> <p>قيمة الجائزة Award money AED 1,000,000</p>	 <p>فئة الدراسات المتميزة والتكنولوجيا الحديثة Distinguished Innovative Studies and Modern Technology</p> <p>قيمة الجائزة Award money AED 1,000,000</p>
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بالإضافة الى درع تذكاري وشهادة تقدير

For Further Information , Please Contact:

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لمزيد من المعلومات يرجى الإتصال:

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Our Tree



UAE Devote the Culture of Impossibilities

On January 08, 2020, His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President of the UAE, Prime Minister, Ruler of Dubai, "God protect him" and His Highness Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi, UAE Deputy Commander-in-Chief of the Armed Forces, officially launched the visual media identity of the United Arab Emirates, which carried the design of the "Seven Lines", has unleashed a new phase of competition and international development entitled "Nothing Is Impossible". Following the selection of the logo by the majority of the 10.6 million people who participated in the open voting representing 185 countries around the world, in reference to the human and global dimension of the UAE Visual Media Identity Project, which will tell its inspiring success story over the next 50 years. In order to choose the logo of the UAE's visual media identity and present its inspiring story to the world as a symbol of ambition, achievement, openness, hope and the culture of the impossible.

The participants' voices were focused on the three designs displayed on the UAE's visual media identity website, the UAE in Arabic, the Palm and Seven Lines, which were co-created by 49 Emiratis, from all over the regions of UAE and from various creative disciplines.. The slogan "Seven Lines", which was chosen in the voting process, is seven lines that map the UAE, closer to towering columns, and solid pillars, fixed in its territory, indicating the high level of urgency, the rise of the dream and the acceleration of development. Seven pillars form the pillars of the United House, in recognition of the Seven Leaders who united the dreams of the people under the banner of one flag of a United Country, together we can build, together we can dream, together we can be one nation.

These national-colored pillars reflect the UAE's aspirations, leadership and people, to the future in an unstoppable development, movement, entitled progress, excellence, creativity, innovation, leadership and ambition.

The pillars in the logo are highlighted in the colors of the UAE flag; black, green and red, while white is the common heart that binds these pillars. The pillars of different sizes and colours, refer to people representing different segments of society with their diverse backgrounds and cultures that enrich the Emirati life and enhance their attractive environment as a center for innovation, creativity and business.

As for the number of trees (10 million) that the UAE will plant in areas that are among the most affected by climate change in the world on the Indonesian island of Numford, the Shatwan and Altari Nepal, will contribute to the restoration of vegetation, enhanced biodiversity and environmental protection. It reflects the devastating consequences of climate change and the empowerment of fragile societies that suffer from its effects, while in parallel embodying the values of giving, human partnership, action for the future and instilling hope that the UAE represents and supports.

Nahayan Mabarak Al Nahayan

Minister of Tolerance

Chairman of the Award's Board of Trustees



جائزة خليفة الدولية لنخيل التمر والابتكار الزراعي
KHALIFA INTERNATIONAL AWARD FOR DATE PALM
AND AGRICULTURAL INNOVATION

Invitation to Researches, Writers and interested Scientists

out of the keen interest of Khalifa International Ward For Date Palm And Agricultural Innovation, Secretariat General to Spread the awareness and Specialized know edge in agricultural innovation and date palm industry across the world.

Therefore, we invite all academics, Specialist researchers, producers and date palm (the blessed tree) lovers to participate in either languages Arabic Or English in related matters and issues to agricultural innovation and date palm such as (cultivation, disease prevention, maintenance, food processing, marketing,...) materials should satisfy publication criteria set Out in the magazine. We value and appreciate your good efforts made to serve award.

Materials are to be sent to Head of Media Committee via email address:

magazine@kiaai.ae



Our Message



The "Date Palm" on UNESCO lists

The UAE succeeded in enlisting "The Date Palm" in the list of UNESCO cultural heritage, after a great effort by the UAE to prepare a strong file for the Date Palm, which represents a cultural symbol for United Arab Emirates, and the Arab countries, led by the Department of Culture and Tourism in Abu Dhabi, which led its inclusion in its preservation and preservation, as it is an important element in the Arab heritage, has been associated with a range of customs and traditions, in addition to famous sayings, knowledge, skills and various handicrafts.

The 14th meeting of the Intergovernmental Commission for the Conservation of UNESCO's Intangible Cultural Heritage, held in Bogotá, Colombia, from 09 to 14 December 2019, adopted the recording of the "The Date Palm: Knowledge, Skills, Tradition and Practices", among 41 project proposals this year, it was nominated in UNESCO's "Intangible Cultural Heritage" representative list.

Date palms have been associated with the local population sought for centuries and have been a source of many handicrafts, professions, traditions, social and cultural customs and practices associated with it and one of the main forms of nutrition. Date palms, knowledge, skills, traditions and practices played a pivotal role in strengthening the relationship between people and land in the Arab region and helping them meet the challenges of the harsh desert environment. This historical relationship in the region and the element has produced a rich cultural heritage with practices shared by the region's inhabitants and the knowledge and skills that have been preserved to this day. The cultural significance and spread of the element over the centuries demonstrate the commitment of local communities to preserve it; this is achieved through collective participation in many activities related to date palms, ceremonial rituals, traditions and customs.

The Department of Culture and Tourism - Abu Dhabi, under the patronage of the Organization of Education, Culture and Science, (ILESCO) of the Arab League, submitted the nomination file for the Date Palm to register with UNESCO as a joint Arab file on behalf of 14 Arab countries: United Arab Emirates, Kingdom of Bahrain and Republic of Arab Egypt, Republic of Iraq, Hashemite Kingdom of Jordan, State of Kuwait, Islamic Republic of Mauritania, Kingdom of Morocco, Sultanate of Oman, State of Palestine, Kingdom of Saudi Arabia, Republic of Sudan, Republic of Tunisia and Republic of Yemen.

The inclusion of " Date Palms, Knowledge, Skills, traditions and Practices" in UNESCO's representative list of intangible cultural heritage of humanity aims to raise awareness of its fundamental cultural and economic importance, and to further raise awareness of the need to preserve the date palm tree and preserve this wealth in Agriculture, which contributes to the affirmation of cultural and social identity.. The Date Palm represented the 18th element of UNESCO's national heritage, making its registration an opportunity to adopt practical steps to protect it. Date palms and associated knowledge, skills, traditions and practices deserve a prestigious place on the World Heritage List.

Prof. Abdelouahhab Zaid

Secretary General

Khalifa International Award for Date Palm and Agricultural Innovation



جائزة خليفة الدولية لنخيل التمر والابتكار الزراعي
KHALIFA INTERNATIONAL AWARD FOR DATE PALM
AND AGRICULTURAL INNOVATION

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Publishing Rules in the “Blessed Tree” Magazine

- 1- The article should be new, solely intended for the Blessed Tree Magazine.
- 2- The article should be appended with the specialized sources and references, and consisting of not less than 2000-3000 words.
- 3- Attach original pictures suitable for each article in the format (jpg) minimum 1000 KB per image
- 4- The magazine is under no obligation to return the received articles to senders, whether published or not.
- 5- Together with the scientific material, the author should send a personal photo with his C.V, showing full name with father's name, phone number and Agricultural Innovation.
- 6- The articles published in the magazine necessarily reflect the views of their authors and are not binding to Award's administration.
- 7- Arrangement of the scientific articles in the magazine is subject to technical considerations.
- 8- The magazine pages are open for all lovers of date palm and agricultural innovation worldwide for localization of knowledge and building of a sustainable community.
- 9- The Award shall have the right to dispose with the photos of the published articles in any later issue.

Magazine Correspondences

All technical and scientific materials are to be addressed to Editorial Manager, on the following address: magazine@kiaai.ae / kiaaimedia@gmail.com

Read In This Issue

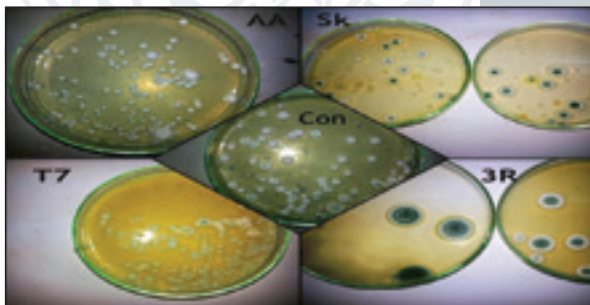
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The promising future of the pathogenic fungus *Beauveria bassiana* in the safety control against the red palm weevil, *Rhynchophorus ferrugineus* oliver.

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The red palm weevil (RPW) Rhynchophorus ferrugineus is the most destructive and dangerous pest attacking palm trees in many countries in Asia and the Middle East



Abstract:

The red palm weevil (RPW) *Rhynchophorus ferrugineus* is the most destructive and dangerous pest attacking palm trees in many countries in Asia and the Middle East. It caused mass destruction in date palm in Egypt and the Gulf countries. So, the role of these natural enemies should be maximized and involved in the integrated control program of these pests. The present study was conducted in Dakhliya governorate, throughout two successive seasons of 2009 and 2010. The seasonal activity of pathogenic fungus *Beauveria bassiana* associated with the red palm weevil (RPW) *R. ferrugineus* was evaluated under field conditions, in addition to estimated under laboratory conditions. The

obtained data revealed that the pathogenic fungus, *B. bassiana*, was found and recorded on the red palm weevil (last larvae, pupae, adult inside cocoon) and emergence adult had rarely records. In the first season (2009), the pathogenic fungus *B. bassiana* exhibited three peaks of seasonal activity in the field. These peaks were recorded on February (4%), March (4%) and May (4%), respectively in the first season (2009). While, the second season (2010), activity started from January to June and these peaks were recorded on February (6%), April (6%) and May (14%), respectively. On the other hand the *B. bassiana* found that the response of activity started inside the cocoon recorded the highest peak of activity on the pre emer-

gence adult (9.095%). And the second peak of activity was on pupae (4.445%). While, the third peak of activity was recorded on post emergence adult (3.033%). **KEY WORDS:** Natural enemies; *B. bassiana*; pathogenic fungus; cocoon; *R. ferrugineus*.

Introduction:

The red palm weevil (RPW) *Rhynchophorus ferrugineus* Olivier, (Coleoptera, Curculionidae) causes mass destruction in date palm in Egypt and the Gulf countries. It also attacks coconut trees, oil palm through South-east Asia (Kalshoven, 1950). The RPW was accidentally introduced for the first time to the Gulf region, since its appearance in United Arab Emirates in 1985, then Saudi Arabia on 1986, Iran in 1992, Egypt 1993, Jordan in 1998 and

very wide geographical area involving different climates (Abraham et al., 1998 and Soroker et al., 2005). The palm trees mature; there is a reduction in areas suitable for infestation by the RPW larva. In trees 5-years old or less, the bole, stem or crown may be infested but in palm trees more than 15-years old the area is reduced to the crown (EPPO, 2008). The high costs of chemical control, continuing economic losses, secondary pests' problems and environmental considerations suggested the need for ecologically oriented (RPW) management strategies (Henneberry and Naranjo, 1998). The biological control by use of entomopathogenic fungi has been explored (Poinar, 1972). There for, the efforts to control RPW in the Arabian Gulf region focused mainly on traditional insecticide or elimination of infested trees, the attention now controlling this pest by using biological control. However, recent concern of Gulf countries about the side-effects of chemical pesticides on the environment has resulted in the restriction in the use of these products. Thus, interest has now turned to biological control. Current efforts are examining the potential of developing a biopesticide, based on nematodes, viruses and bacteria. The ecology of the RPW and the natural enemies of this and other palm weevils

and the basis of population outbreaks (Gush, 1997). Current management techniques through the development and integration of biological control. The using of biological control in the management of insect pests has increased in recent years (Amiri et al., 2000 and Bandani et al., 2000). Successfully developed an IPM program which, in addition to mass pheromone trapping, included a survey of all cultivated gardens, systematic checking of all palms for infestation, periodic soaking of palms, and mass removal of neglected farms (Vidyasagar et al., 2000). Therefore, the present investigation aims to study the following topics :-

- 1-Surveying the pathogenic fungus *B.bassiana* associated with red palm weevil (RPW).
- 2- Study role of the pathogenic fungus *B.bassiana* regulating (RPW) populations.
- 3- Studying the effect of mean temperature and relative humidity on the activity of the pathogenic fungus.
- 4- Studying the effect of the *B. bassiana* on different stages of (RPW) in field and laboratory.

Materials And Methods

Field experiments: An area of 5000 palms tree covered with different date palm cultivars (Samany, Zaghlool and other date palm) at Dakahlia region was chosen to study the incidence of the Red

Palm Weevil *R.ferrugineus* (RPW) and its associated the pathogenic fungus *B.bassiana* for two year (2009 –2010). Weekly, orchards of the palm cultivars were visited. In each visit, other twenty five trees of each cultivar were randomly chosen as a sample to be examined for RPW infestation. Each cultivar was represented by three samples. The visited orchards included different date palm ages. As a concealed tissue borer and its stages are found inside the palm trees, trees were examined.

1-Sampling program:

Each visit, the highly infested trees were shopped and all stages of the RPW expect eggs, were carefully gathered. Every sample consisted of 100 cocooned stages (adult, pupa) and 100 larvae. The collected specimens were directly put in separated sterilized jars and transferred to the laboratory. Under aseptic conditions, the RPW individuals were maintained and examined for viability. The natural mortality percentages were estimated and the noticed insect were observed, separated under a binocular stereoscopic microscope and identified at Department of Agricultural Microbiology, Faculty of Agric., Mans. University. To full estimate of *B. bassiana* natural infection, further incubation of the naturally dead individuals was performed

in damp chambers as described. The RPW individuals covered with flat white mycelial growth bearing mealy white conidia were considered, and microscopic preparations were used to assure the specific characteristics of *B. bassiana* (Balsamo) Vuilemin recorded by (Domsch et al., 1980). Percentages of the natural infection by *B. bassiana* on the dead individuals were calculated. Also recorded as field observations.

2- Evaluate the role of the natural enemies:

2-1- Entomopathogenic fungi:

The collected samples were investigated and each red palm weevil larval or (pupa and adult) species was counted. Living and dead individuals from each sample which show general infected symptoms were distinguished and put into sterilized tubes throughout the two studied seasons. All damaged individuals were counted and the percentage of infected larvae or (pupae and adults) (Diseased %) was calculated as follows:-

$$\text{Diseased \%} = \frac{N_{\text{dis.}}}{N_L + N_d}$$

Where, $N_{\text{dis.}}$ is the number of diseased individuals. While, N_L and N_d are the numbers of living and dead individuals. On the other hand daily records of mean

temperatures along with relative humidity obtained from the Agro meteorological station.

Laboratory experiments:

Insect rearing: A (RPW) colony was established in the laboratory on sugar-cane as both food and oviposition substrate, following (Rahalkar et al., 1985).

Isolation and identification of fungus: Sabouraud's dextrose agar with yeast extract (SDAY) medium (Goettle and Inglis, 1997). The medium has the following constitution: 10g peptone; 40g dextrose extract; 15g agar and 2g yeast extract /1000 ml tap water or (PDA) constitution 200g Potatoes extract; 20g dextrose; 15g agar /1000 ml tap water (Atlas, 1995). The developed fungus was examined by microscopic.

3- Preparation of inoculums:

The *B. bassiana* isolates to *R. ferrugineus* pupa was tested in the first screening. The fungal isolates used in this study from various insects in pupa. Fungus was grown for 2 weeks at 25° C on Sabouraud dextrose agar (Difco). Spores were harvested by washing the dishes with an aqueous solution of 0.01% Triton X-100; Spore concentration was determined with a hemacytometer and adjusted to 1×10¹⁰ spores/ml-1 for egg, larval and adult bioassay.

4- Pathogenicity and efficiency of microbial isolates:

4-1- Effect of the isolated fungus on egg RPW stage.

The *B. bassiana* isolate was evaluated in this bioassay. Five dilutions of prepared inoculums in distilled water were prepared as follow: 1x10⁶, 1x10⁷, 1x10⁸, 1x10⁹ and 1x10¹⁰ spore / 1 ml. Strips of muslin on which the eggs had been laid (containing 25 eggs 1-3 days old each) were dipped for two seconds in each of the suspensions. In each treatment 0.025 Tween 100X was used. After dipping, treated and untreated (water only) eggs strips were left to allow the excess moisture to dry out, then placed the eggs were placed in plastic boxes (35x12cm) each containing 5g sugar-cane sawdust pre-treated as follows and held at laboratory conditions until hatch. Five replicates of each treatment were used for each inoculums suspension. The treated and untreated eggs were investigated daily until hatching, the hatchability percentages of treated and untreated eggs were calculated, also larvae hatched from treated and untreated eggs were then individually put in plastic boxes (35x12cm) containing sugar-cane logs and was tightly closed by a plastic cover until pupation and adult emergence.

Percentages of larval, pupa mortality and malformed pupae and adult were calculated.

4-2-Effect of the isolated fungus on larval, pupa and adult stages.

The previously mentioned five dilutions were bioassay against the newly hatched larvae, medium and last instars” larvae”, pupae and adults of the RPW by fungal conidia produced on natural mycosed weevils were used to prepare a suspension containing: 1x10⁶, 1x10⁷, 1x10⁸, 1x10⁹ and 1x10¹⁰ conidia/ml of sterilized 0.1% Tween 20 water solution. Contaminate by dipping them individually for 3 seconds in the suspension. Individuals dipped in sterilized 0.1% Tween 20 water solution served as check treatment. Each treatment was twenty “newly hatched larvae, medium and last larvae instars “, pupae and adults of the RPW and replicated 5 times .The treated individuals were placed in sterilized plastic boxes (20x40cm.). Each containing with fresh pieces of sugar-cane recommended by (Rahalkar and Rananavare,1972) for RPW rearing. Another plastic boxes (20x40cm.). On the other hand individuals dipped in distilled water and used as controls. Larvae were allowed to feed on the sugar-can sawdust. Larvae mortality was recorded at 3, 5 and 7 days.

During the investigation period, entomopathogenic fungus B. bassiana (Balsamo) was found and recorded on the red palm weevil last larvae, pupae, adults inside cocoons and emergence adults.

After these feeding periods, dead larvae were counted and the live larvae were transferred individually to plastic box 20x40cm, containing untreated logs sugar-can. The mortality percentages were corrected by Abbott’s formula (Abbott , 1925). The experiments were repeated five times and maintained under laboratory conditions of 28±2oC and 75±4% R.H. Treated and untreated larvae were investigated until pupation and adult emergence .So treated of the adult. Results were illustrated graphically as log/probit regression line were obtained according (Finney, 1971).

4-3- Effect of the infested trees (palms) ooze by larvae stages of the RPW on isolated fungus.

The *B. bassiana* conidia isolates, produced on natural mycosed

RPW were used to prepare a suspension containing 10¹⁰ conidia/ml of sterilized 0.1% Tween 20 water solution. The suspension was dispersed surface on the artificial media (PDA) which covered half by infested trees ooze of larvae stages inside Petri-dishes and groups previously mentioned with out ooze and ooze with out artificial media (PDA).Each method was replicated five times. The effects of infested trees ooze by larvae stages of the RPW on the *B. bassiana* conidia (spores) isolates were evaluated in this bioassay.

Result And Discussion.

1-Entomopathogenic fungi.

1-1- Entomopathogenic fungi activity on (RPW) population:

During the investigation period of the two years of study, entomopathogenic fungus *B. bassiana* (Balsamo) was found and recorded on the red palm weevil last larvae, pupae, adults inside cocoons and emergence adults.

1-1-1- Seasonal activity of pathogenic fungus on RPW population.

As shown in Figure (1). The pathogenic fungus *B. bassiana* activity to attack RPW exhibited two seasonal periods of activity. The first period (2009) of activity started on the January till the May. The pathogenic fungus *B.*

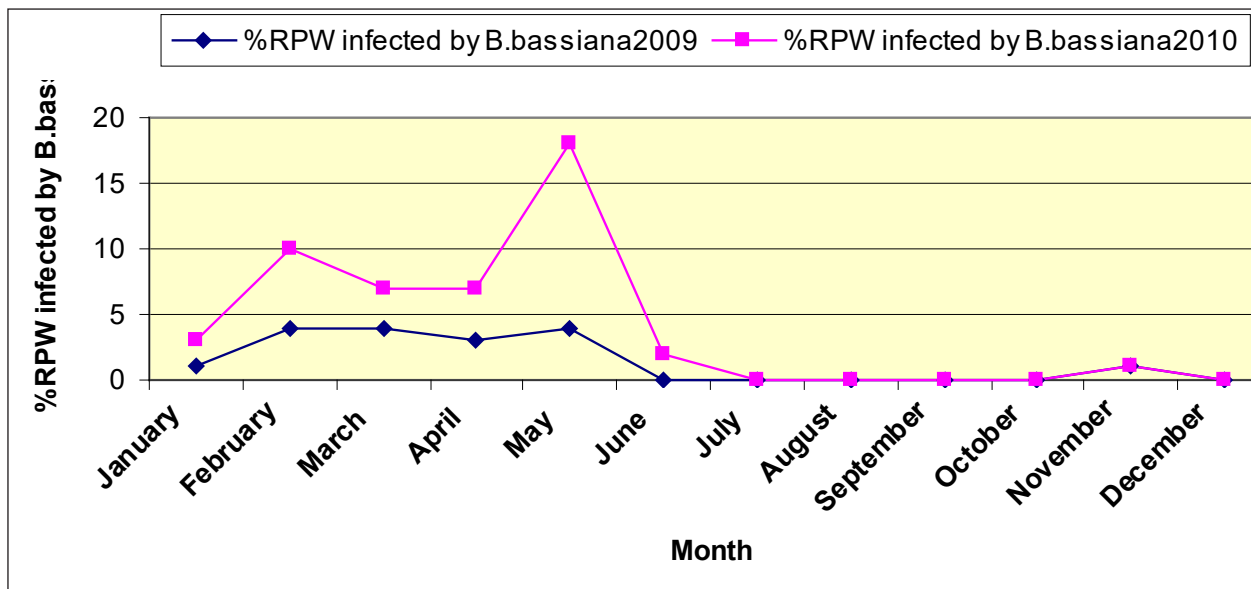


Figure (1). Seasonal activity of (RPW) fungal pathogens during seasons 2009 –2010 at Dakahlia governorate.

bassiana exhibited three peaks of seasonal activity. These peaks were recorded on February (4%), March (4%) and May (4%), respectively. While, the second season (2010), of activ-

ity was recorded from January to June and these peaks were recorded on February (10%), April (7%) and May (18%), respectively.

1-2-The effect of weather factors on activity of the fungus *B. bassiana* on (RPW). Data presented in Table (1). Showed the fungus *B. bassiana*

Table (1).Survey of *B. bassiana* from different infected palms with RPW during seasons 2009and 2010.

Survey date	No. of insects	No. of infected insects		Infection %		Temperature Degree%		Humidity %	
		2009	2010	2009	2010	2009	2010	2009	2010
1 st Jan.	400	4	8	1	2	12.6	15.5	60.3	71.5
1 st Feb.	200	8	12	4	6	12.8	16.3	61.2	67.4
1 st Mar.	200	8	6	4	3	14.7	18.4	59.5	67.7
1 st Apr.	400	12	16	3	4	20.7	21.2	64.0	64.4
1 st May	200	8	28	4	14	21.4	23.7	61.9	61.7
1 st Jun.	400	0	8	0	2	26.2	26.1	59.5	60.4
1 st Jul.	600	0	0	0	0	27.8	27.9	65.7	62.4
1 st Aug.	600	0	0	0	0	27.4	29.1	67.5	63.2
1 st Sep.	400	0	0	0	0	24.7	27.1	64.4	63.9
1 st Oct.	200	0	0	0	0	20.6	25.2	63.1	63.0
1 st Nov.	400	4	0	1	0	17.7	21.8	68.4	63.5
1 st Des.	400	0	0	0	0	15.7	15.9	69.2	63.4

on RPW is existed all over the year and there peaks all over the year 2009 , the mean of total high infected start within the beginning of January then increased gradually to reach the first peak of February, March , April and May average (4,4,3,4) respectively. Also it is law infection with highly temperature but negative with humidity and showed the fungus *B. bassiana* on RPW is existed all over the year and there peaks all over the year 2010 , the mean of total high infected start with

in the beginning of January then increased gradually to reach the first peak of February , April and May (6,4,14) respectively. Also it is law infection with highly temperature but negative with humidity, reason in palm high moister and rain in season winter. On the other hand period activity infection synchronization decreased activity RPW. As shown in Figures (2,4). There were significant and highly significant correlations between the fungus activity and

mean temperature during seasons 2009 and 2010 ($R^2=0.2339$, $R^2= 0.0464$). While in Figures (3, 5). Indicated that, there were no correlation between the fungus activity and the relative humidity in the first season ($R^2 = 0.0234$) and insignificant correlation in the second season ($R^2 = 0.0096$). The common effect of mean temperature and relative humidity and (high moister which found mainly in the palm and rain) on the fungus activity represented by and % in the first and second seasons.

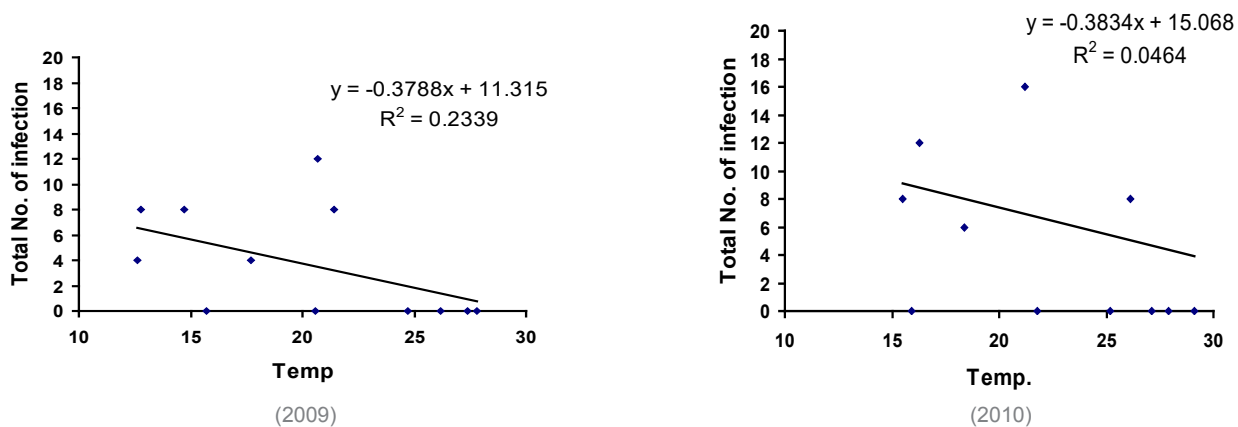


Figure (2,4). Relationship between infected RPW with fungus *B. bassiana* and mean temperature during seasons 2009 and 2010.

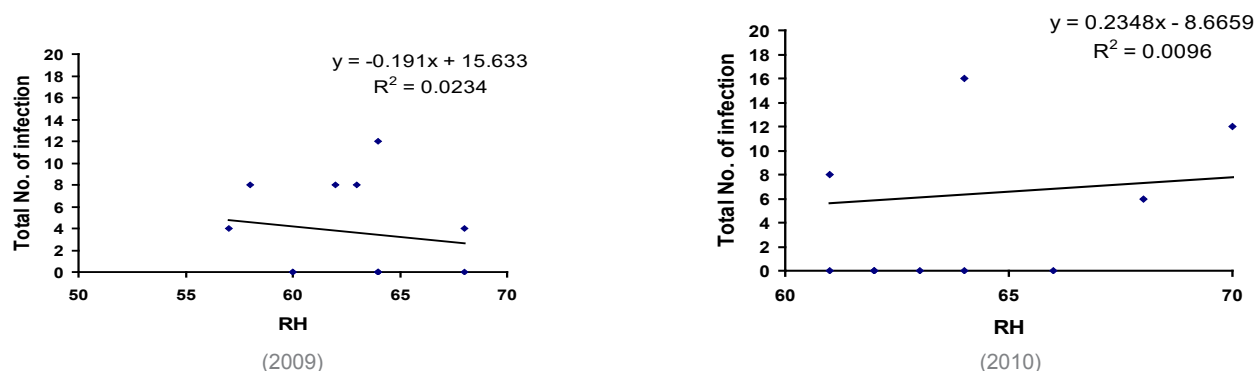


Figure (3,5). Relationship between infected RPW with fungus *B. bassiana* and relative humidity (RH) during seasons 2009 and 2010.

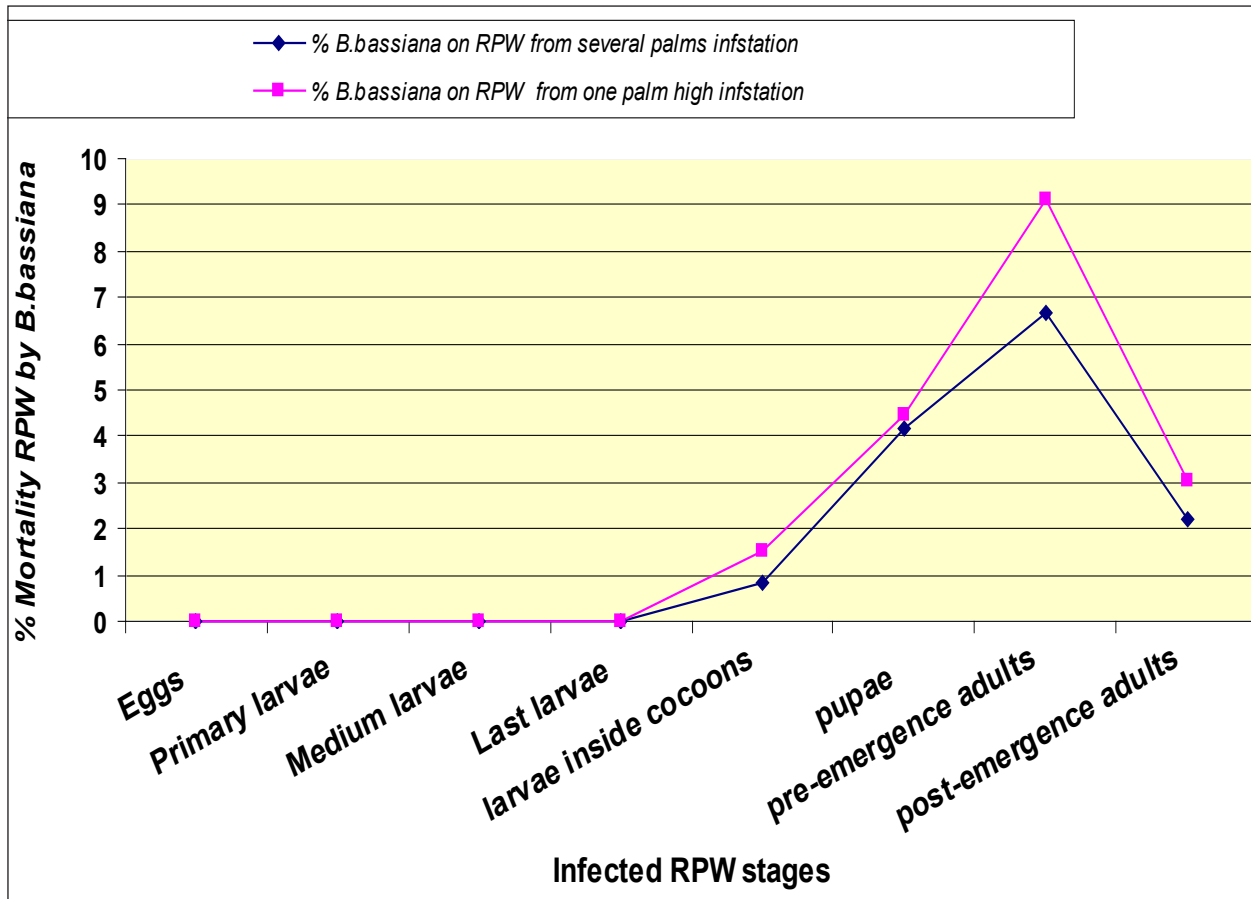


Figure (6). Comparing effect of the fungal pathogens *B. bassiana* on the different stages of (RPW) in one palm high infected (as comparison insect) and %several palms infested by (RPW) and infected it of the fungal in the field.

1-3- The comparing effect of the fungal pathogens *B. bassiana* on the different stages of (RPW) in one palm high infected (as comparison & spect) and % several palms infested by RPW and infected it of the fungal in the field.

The natural appearance of naturally fungal pathogens that associated with (RPW) on the different stages of (RPW) in one palm high infected (control) by it

fungal pathogens and % several palms infested by (RPW) and infected it by the fungal in the field. As showed the Figure (6). There were for the first and second year from study. However the % several date palms infested by (RPW) and infected it by the fungal, response of activity started inside the cocoon by *B. bassiana*, recorded the highest peak of activity on the pre emergence adult (6.67%).While, the second peak of activity was on

pupae (4.17%). While, the third peak of activity was recorded on post emergence adult (2.22%). Also recorded % one palm high infected by the *B. bassiana* (control), found that the response of activity started inside the cocoon recorded the highest peak of activity on the pre emergence adult (9.10%).While, the second peak of activity was on pupae (4.45%). While, the third peak of activity was recorded on post emergence adult (3.03%).

Generally pre emergence adult of (RPW) was recorded with relatively high numbers pupation was observed high numbers infested by *B. bassiana*.

1-3-1- Pathogenicity of fungal isolates *B. bassiana*:

All survey isolates especially, *B. bassiana* exhibited relatively high infection to the survey red palm weevil in cocoon stages specially pre adult emergence. While, the red palm weevil adult was low infection to the red palm weevil adult. On the other hand the larvae activity and eggs in

the trunk had less efficiency. These idea agree with (Ghazavi and Avand-Faghih , 2002) . Also (Shaiju et al., 2003). May be isolation of the pathogens from the native ecosystem with help in successful biological control program (Guerri-Agullo et al.,2011).

1-5-The comparing of the effect of the *B. bassiana* on different stages of (RPW) in field and laboratory.

The natural appearance of naturally the fungal pathogenic *B. bassiana* isolated from (RPW)

on the different stages of (RPW) in the field palms in response to RPW population was illustrated in Figure (7), for the first and second years and the treatment of the laboratory. The % several palms infested by (RPW) stages it infected by the *B. bassiana* and (control) was one palm infested by (RPW) stages it high infected by the *B. bassiana*. Found that the response of fungal activity started inside the cocoons and recorded the highest peak of fungal activity on the pre-emergence adults from cocoons and second peak of activity was on pupae and third



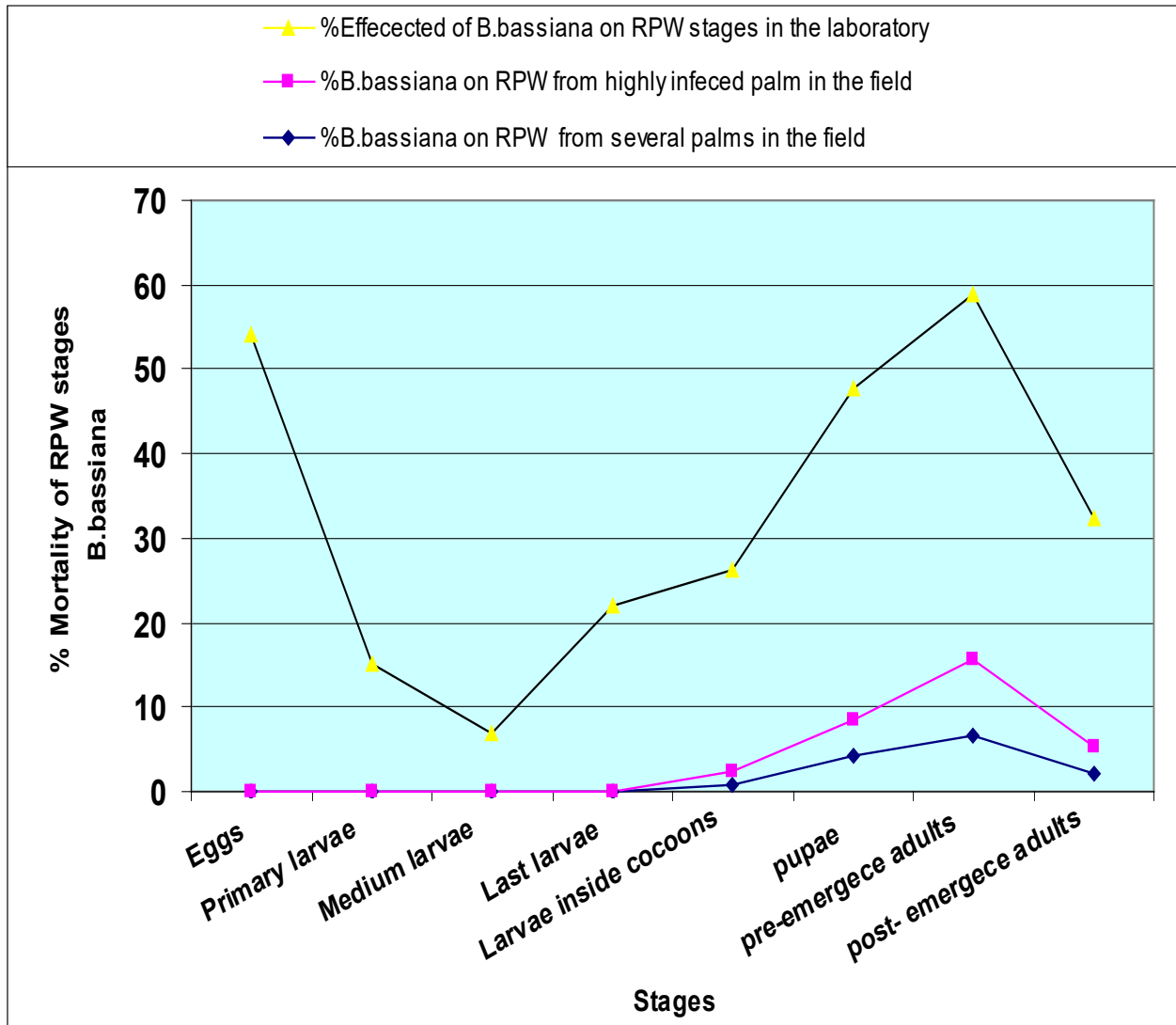


Figure (7). The comparing effect of the *B. bassiana* on different stages of (RPW) in field and laboratory

peak of activity was recorded on post- emergence adult from cocoons. While recorded % of the treatment on the different stages of (RPW) in the laboratory infected by the *B. bassiana*, found that the response of fungal activity started on the eggs of (RPW) recorded the highest peak of activity (54%).While,

the second peak of fungal activity was on pre emergence adult (43%). While, the third peak of activity was recorded on pupae (39%).Results in the same Figure, cleared that (RPW) eggs were recorded with relatively high number infected by *B. bassiana* also pupation was observed in the field and in the

laboratory. May be development (RPW) stages inside cocoons from chitins formed, effected of the hormones and not found ooze, these increased of the infection by *B. bassiana*. (Ghazavi and Avand-Faghih, 2002) investigated *B. bassiana* was isolated from *R. ferrugineus* pupae and adults.The malformed adults did

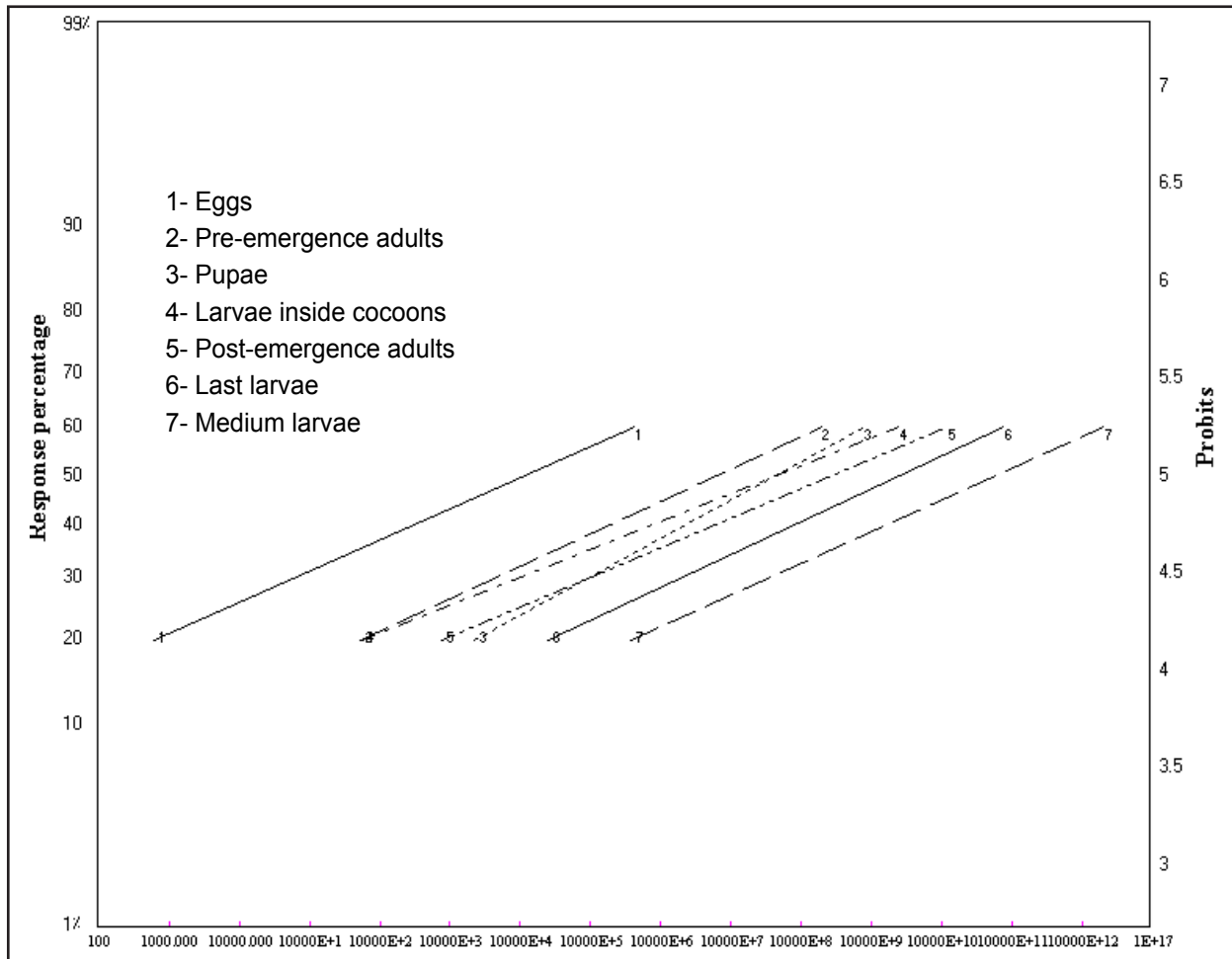


Figure (7). Log concentration

not survive. (El-Sufty et al.,2007) indicated that the biological control of the (RPW), was studied using the local strain, the entomopathogenic fungus *B. bassiana*. Dusting a date palm tree with 40 g of a powder formulation containing 5% conidia killed 8.9% of adult population during the three weeks after application and caused monthly delayed mortality of 4-5.9% in the following three months.

Sewify (2007) in Egypt found that the fungus *B. bassiana* was isolated from cadaver of adult stage of *R. ferrugineus*. Field application of this fungal strain in large scale proved highly control to (RPW). Also (Dembilio and Jacas,2012). So (Dembilio et al.,2010) evaluated the potential of a strain of *B. bassiana* obtained from a naturally infected *R. ferrugineus* pupa as a biological control agent against

this weevil was evaluated both in the laboratory and in semi-field assays. Laboratory results indicate that this strain of *B. bassiana* can infect eggs, larvae and adults of *R. ferrugineus* (LC50 from 6.3×10^7 to 3.0×10^9 conidia per ml). In addition, treatment with *B. bassiana* significantly reduced fecundity (up to 62.6%) and egg hatching (32.8%) in pairing combinations with fungus-challenged

males, females or both sexes. Likewise, 30–35% increase in larval mortality was observed in larvae obtained from eggs from fungus-challenged females or from untreated females coupled with inoculated males.

Data presented in Figure (6). Showed the fungus (*B. bassiana*) on RPW is existed mortality percentages with different concentration of *B. bassiana* against different age stages of RPW. The toxic effect of different inoculums densities of the fungus on (RPW) stages revealed that all of *B. bassiana* treatments significantly recorded high percentages of (RPW) eggs and pre-emergence adults followed it pupa, larvae inside cocoons, post-emergence adults, Last larva and Medium larva.

1-3- Effect of infested palm trees ooze by larvae stages of the RPW, on fungi isolates.

The results shows that ooze highly effect on the tested entomopathogens *B. bassiana*. While, entomopathogens no affected on the artificial diet with out ooze. However was recorded relatively higher inhibition percentage at the ooze on *B. bassiana*. They recorded effect ooze only, on germination of spores (*B. bassiana*), ooze covered half PDA and PDA only

The results shows that ooze highly effect on the tested entomopathogens B. bassiana. While, entomopathogens no affected on the artificial diet with out ooze.

(artificial diet) were 100%, 50% and 0.00% *B. bassiana* inhibition respectively.

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Attempts For Reducing Microbial Contaminations On Zaghloul Date Fruits By Using Safe Treatments

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Our study aimed to describe the dynamic changes of units of colony forming microorganisms of dates during storage period.

Abstract:

Dates, the fruits of date palm (*Phoenix dactylifera* L.) are a vital element of the daily diet in the Arabian world. This study was carried out on palm date fruit Zaghloul from Egypt. Spathes were sprayed three times at growth start, after fruit setting and at one month later with four substances namely Amino acids, Sugar alcohol, Algae extract in concentration of 2% and Licorice root extraction (*Glycyrrhiza Glabra* L.) in concentration of 7%. Sprayed fruits were harvested at khalal stage and immersion in 1% chitosan as postharvest application and then fruits stored up to 3 months at 0°C and relative humidity (RH) 90-95% in order to study the effect of all treatments on fruit quality and storability of Zaghloul date palm. Our study aimed to describe the dynamic changes of units of colony forming microorganisms of dates during storage period. Samples were collected from different treatments and storage periods. The obtained results indicated that the bacterial load was the highest in sampling amino acids + chitosan and licorice root extract + chitosan gave the lowest number of bacteria in the two studied seasons, respectively. Sampling control treatment



recorded higher for total fungi counts and licorice root extract + chitosan recorded lower for total fungi counts in the two studied seasons, respectively.

Key words: Zaghloul Date Palm, *Phoenix dactylifera* L., Spraying, Amino Acids, Sugar Alcohol, Algae extract, Licorice root extraction, *Glycyrrhiza Glabra* L., Nutrients, Chitosan, Cold Storage and Quality.

Date palm *Phoenix dactylifera* L., is one of the oldest fruit trees in the world. It is known as “tree of life” because of its resilience, its need for limited water inputs, its long term productivity and its multiple purpose qualities. In Egypt, dates are important traditional crops (FAO, 2009).

Egypt is considered as the first country of the top ten date producers (1,130,000 tones). Economically Zaghloul date is the most important soft cultivar grown in Egypt. It is usually harvested and consumed at Khalal stage when fruits reach full maturity and are crunchy and red in color.

Every part of the date palm is useful. Dates offer useful prospects for fighting hunger and diseases. The importance of the date in human nutrition comes from its rich composition of carbohydrates, salts and minerals, dietary fiber, vitamins, fatty acids, amino acids

and protein.

Amino acids as organic nitrogenous compounds are the building blocks in the synthesis of proteins, which are formed by a process in which ribosomes catalyze the polymerization of amino acids (Davies, 1982).

The marine ecosystem is the treasure place for many natural resources (Anandhan and Sorana 2011).

Algae extract is a new generation of natural organic fertilizers containing highly effective nutritious source and promotes faster germination of seeds, increase in yield and resistant ability of many crops. Unlike, chemical fertilizers, extracts derived from seaweeds are biodegradable, non-toxic, non-polluting and non-hazardous to humans, animal and birds (Ganapathy and Sivakumar, 2013).

Sugar alcohols are carbohydrates whose chemical structure partially resembles a sugar and partially resembles an alcohol (Canadian Diabetes Association, 2005).

Licorice, the root of *Glycyrrhiza glabra* L. has been used medically for over 2000 years (Gibson, 1978).

Licorice has been reported to have antioxidant anti-inflammatory, anti-arthritic, anti-diabetic, anti-arrhythmic, anti-bacterial, antiviral and anticancer

activities. A recent animal study indicates that licorice may be useful in treating lupus (Der-Marderosian, 2001).

The Chitosan coating is safe (Hirano *et al.*, 1990) and shows antifungal activity against several species (Yu *et al.*, 2007).

Chitosan (poly-B - (1-4) N-acetyl-d-glucosamine), is a natural antimicrobial compound. It can be obtained from crustacean shells (crabs, shrimp and crayfishes) either by chemical or microbiological processes and other hand it can be produced by some fungi (Devlieghere *et al.*, 2004).

Date fruit undergoes number of physical and chemical changes during ripening and storage. The most important ones are the changes in its color and firmness. Zaghloul date lost color at rutab stage at higher temperature which influence on fruit quality and marketability. Therefore, the fruits were stored at 0°C.

The microbial load of the date palm fruits was a mixture of bacteria, yeasts and molds. Temperature and moisture were found to be important in the development of date palm fruit rot caused by associated fungi. The low relative humidity (RH) and temperature aren't conducive for disease development. Thus, date fruits with low moisture content may be pre-

served at room temperature, while those with high moisture content require lower temperatures (Omamor and Hamza, 2004).

Christensen *et al.* (2007) reported that the Agricultural industries sustained huge crop losses as a result of fungal diseases of fruits and plants.

The microbial load of the date palm fruits was a mixture of bacteria, yeasts and molds. Temperature and moisture were found to be important in the development of date palm fruit rot caused by associated fungi. The low relative humidity (RH) and temperature aren't conducive for disease development. Thus, date fruits with low moisture content may be preserved at room temperature, while those with high moisture content require lower temperatures (Omamor and Hamza, 2004).

Microbial contaminants isolated from date fruits include yeasts, molds, lactic acid bacteria and some potential pathogens like *Staphylococcus aureus*, *E. coli*, and *A. flavus* (Hamad, 2008).

Rygg (1956) found that temperature, oxygen and moisture content are the most important factors that influence the type of microbial growth and spoilage of foods. High sugar tolerant microorganisms, tem-

perature of storage and water content are the major factors which affect the shelf life of dates. Enumeration of microorganisms causing spoilage of fresh dates could lead to storage process that prevents date deterioration.

Ahmed *et al.* (1997) reported that *Aspergilli* could proliferate on any date fruits that suffered from mechanical damage in the field or during harvesting and hence, such fruits should be considered as likely to be unfit for human or animal consumption. Most abundant genus on date was *Aspergillus* spp., *Cladosporium* spp., *Penicillium* spp., *Rhizopus* spp. In addition, *A. flavus* and *A. parasiticus* were able to support the production of different forms of aflatoxin.

Shenasi *et al.* (2002) found that, aflatoxins were detected in 12% of the samples although aflatoxigenic *Aspergillus* spp. were detected in 40% of the varieties examined, at Kimri stage only.

Moore *et al.* (2002) reviewed that the analysis of edible dates identified *Cladosporium cladosporioides* and *Sporobolomyces roseus*, both fungi have been previously reported in opportunistic infections involving skin or in immune-compromised patients.

Fresh fruits are prone to fungal contamination in the field;

during harvest, transport, and marketing; and with the consumer. Fungi play a substantial role in spoilage of fruits and vegetables, because of their pathogenicity to the harvested products. Fungi (*Aspergillus*, *Alternaria*, and *Penicillium* spp.) may grow on high-moisture dates, especially when harvested following rain or high humidity periods (Kader, 2007). It was observed that the date palm fruits are mostly loaded with mixture of microbes; bacteria, molds and yeast but people consume the fruits after clearing the inner environment, while some eat it whole irrespective of the state of the internal environment of the fruits (Atia, 2011).

Some potential pathogens and mycotoxin producing microbes isolated from date fruits include *Staphylococcus aureus*, *Escherichia coli*, species of *Aspergillus*, *Penicillium*, *Alternaria* and *Fusarium* (Hayrettin *et al.*, 2012)

The objectives of this study were to evaluate the effectiveness of chitosan on sprayed fruit with amino acids, sugar alcohol, algae extract and licorice root extract for reducing postharvest decay and the effect on quality properties during cold storage for 90 days of Zaghloul date palm.

Materials and Methods

This investigation was carried out during two successive seasons in 2012 and 2013 on Zaghloul date palms (as soft cultivar). It is grown on the experimental farm at the Central laboratory for Research and Development of Date palm, Agriculture Research Center (ARC), Giza, Egypt. The experiment was designed as a completely randomized block design each treatment was replicated three times, one palm per each. Therefore, fifteen uniforms in vigor Zaghloul date palms of 20 years old received normal cultural practices were selected for achieving of this study consisted of Pre and Post-harvest treatments divided into two experiments.

The first experiment

It was done in field to study the effect of spraying of various substances (amino acid, sugar alcohol, algae extract and licorice root extract) on rate of yield and quality of Zaghloul date palm fruits.

The second experiment divided into two sections (A&B)

A. It was done in laboratory to study the effect of pre-harvest treatments on quality of Zaghloul date palm fruits during cold storage and microbiological analysis on fruits after storage period.

B. It was done in laboratory to

study the effect of pre-harvest treatment and immersing each treatment in 1% chitosan as postharvest treatments on fruit quality of Zaghloul dates during cold storage method and microbiological analysis on fruits after storage period.

Experiment (1) Pre-harvest treatments

All the selected Zaghloul date palms received common horticultural practices that already applied in the orchard.

The present experiment included the following five treatments:

- 1- Spraying of amino acid enriched with micronutrients (Fe, Zn, B, Mo and Mn) at (2.0 cm/l)
- 2- Spraying of sugar alcohol enriched with micronutrients (B, Fe, Mn, Zn and N) at (2.0 cm/l)
- 3- Spraying of green algae enriched with (potassium oxide, phosphorus oxide, N, Zn, Fe and Mn) at (2.0 cm/l)
- 4- Spraying of licorice root extraction (*Glycyrrhiza Glabra* L.) at (7.0 g/l)
- 5- Control (untreated fruits).

Amino acids

The amino acid solution having the following composition: Free amino acid (7.4%), soluble iron (1.2%), soluble zinc (0.8%), soluble manganese (1%), soluble boron (0.1%) and soluble molybdenum (0.1%) W/ V.

Sugar alcohol

The sugar alcohol solution having the following composition: (Mannitol, Sorbitol, Glycerol) and minerals (zinc 2.4%, manganese 3%, iron 1.2% and boron 0.3%).

Algae extract formulation

Algae extract having the following composition: Oligo-x a mixture of green algae and minerals (potassium oxide 12%, phosphorus oxide 0.5%, N 1%, Zn 0.3%, Fe 0.2% and Mn, 0.1%).

Preparation and extraction of licorice root extract (*Glycyrrhiza Glabra* L.)

The licorice powder (7g) was mixed with 1000 ml distilled water. Mixtures were heated to 60°C under stirring for 4 hours and after cooling down, the solution was filtered with a fluted filter and the licorice extract stored in the refrigerator at 4°C until the absorptive bubble separation then on the next day spraying fruits (Short *et al.*, 2005).

All treatments were sprayed three times at growth start (1st week of Mar.), after fruit setting (last week of April) and at one month later (last week of May) in both seasons and were harvested randomly at khalal stage in the first September during 2012 and 2013 seasons. The fruits were harvested when attained full color (bright red).

Fruits were transported to the laboratory of Agriculture Development Systems (ADS) project in the Faculty of Agriculture, Cairo University without signs of mechanical damage and deterioration were selected and standardized showing homogeneous size, color and form, The selected fruits from each treatment, washed, air dried and placed into plastic baskets then randomly distributed into 5 groups.

Experiment (2) Post-harvest treatment

A. The effect of safe pre-harvest treatments on quality of Zaghloul date palm fruits during cold storage and microbiological analysis on fruits after storage period.

Storage studies on spraying fruits

In the laboratory, the defected fruits were discarded the sound fruits were washed with tap water, dried and packed gently in perforated carton boxes and stored at cold temperature (0°C with 90-95% RH). Sprayed Fruits from each treatment were placed in in performing carton boxes for each treatment, one box to determine decay, the second to determine weight loss and the third for determining fruit quality parameters, each box contained of (2 kg of fruits/ replicate) was replicated

three times, and the experiment was repeated twice (2012 and 2013 seasons). During the storage period all the physical and chemical characteristics will be determined in fruits sample every 18 days until the end of storage period up to 3 months or 50% discarded.

B. The effect of safe pre-harvest treatments and immersing each treatment in 1% Chitosan as postharvest treatments on quality of Zaghloul dates during cold storage and microbiological analysis on fruits after a storage period.

Fruits of all previous treatments treated by dipping for 10 min in Chitosan 1 % (w/ v) and dried after dipping by drying equipment.

Storage studies

Sprayed Fruits from each treatment immersion with Chitosan and placed on performing cartoon boxes for each treatment, as box to determine decay, the second to determine weight loss and the third for determining fruit quality parameters, each box contained of (2 kg of fruits/replicate) was replicated three times, and the experiment was repeated twice (2012 and 2013 seasons). During the storage period all the physical and chemical characteristics will be determined in fruits sample every 18 days during 3 months period at different sampling time

(i.e. 18,36,54,72 and 90) days. All treated and untreated fruits stored at 0°C and relative humidity (RH) 90-95 % up to 90 days.

Microbiological studies

Date palm fruits from 5 different treatments after a storage period were collected in a clean sterile polyethylene bag. The labeled samples were transported to the microbiology laboratory, Central laboratory for Research and Development of Date palm, Agriculture Research Center (ARC), Giza, Egypt.

Microbiological analysis in the two sections Experiment (2) (A&B)

A total of 15g of the date fruits were collected of five different treatments from pre harvest and 18g of the date fruits were collected six different treatments from postharvest, each sample was replicated three times 1g per each. 1g from each Samples and 9 ml sterile peptone water was added and homogenized for 2 minutes, then the serial dilution was prepared. (1 ml) of the stock solution was transferred into a test tube containing nine milliliter (9 ml) sterile distilled water and the tube was shaken and labeled 1 to 6. From the tube containing one milliliter (1 ml) was then transferred into another tube containing 9 ml of

sterile distilled water. This was also agitated and the procedure was repeated up to 10^{-6} using sterile syringes. The results were then reported as colony forming units (CFU) per gram (APHA, 1992).

One Milliliter (1ml) from the dilution factors of each labeled sample was transferred into appropriately labeled triplicate sterile petri dishes. This was followed by pouring a cooled molten prepared nutrient agar into appropriately labeled separate triplicate petri dishes. The dishes were gently rocked, plates showing less than 100 colonies were counted.

Statistical analysis

The current study followed a complete randomized block design with factorial analysis, with three replicates for each treatment. The obtained data were subjected to analysis of variance (ANOVA) according to Snedecor and Cochran (1980) using SAS software (2006) and significant between means were differentiated and tested by multiple range test of Duncan (1955) at significance level of 5%.

Results and Discussion

Microbial load

Units of colony forming microorganisms developed from samples taken after storage as shown in Plate (1 and 2)

were identified. Figs (1 and 2), showed the total number of bacteria and fungi isolated from samples of the treatments of preserved dates at 10^{-6} dilution in 2012 and 2013 seasons.

The obtained results indicated that the bacterial load in (Fig. 1) was the highest in sampling amino acids followed by control treatment followed by sugar alcohol followed by algae extract then licorice root extract in the two studied seasons, respectively.

Sampling control treatment recorded higher for total fungi counts followed by algae extract followed by sugar alcohol followed by amino acids then licorice root extract in the two studied seasons, respectively (Fig. 2). This could

be due to nutritional (sugar) content of the analyzed date palm fruits which may serve as good source of carbon to bacteria present. This observation is has agreed with the one reported by (Hamad *et al.*, 2008). Licorice has been reported to have anti-bacterial and antiviral (DerMarderosian, 2001). Postharvest conditions like storage temperature could be considered as the major factors affecting the microbial load and as consequence the shelf life of dates (Rygg *et al.*, 1956; Hasnaoui *et al.*, 2010; Al Jasser, 2010). Furthermore, Couey (1982) noted that post-harvest fungus diseases could be controlled by low temperature.



Plate. 1: General view of damaged fruit surface after storage period. (AA) = Amino acids; (SK) = Sugar alcohol; (T7) = Algae extract; (3R) = Licorice; (Con) = Control.

Postharvest conditions like storage temperature could be considered as the major factors affecting the microbial load and as consequence the shelf life of dates

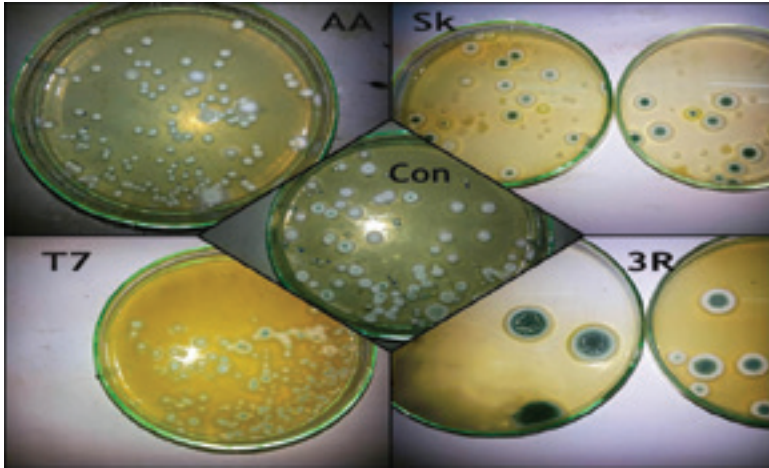


Plate. 2: Total number of bacteria and fungi isolated from samples of the treatments of preserved dates at 10^{-6} dilution in 2012 and 2013 seasons. (AA) = Amino acids; (SK) = Sugar alcohol; (T7) = Algae extract; (3R) = Licorice; (Con) = Control.

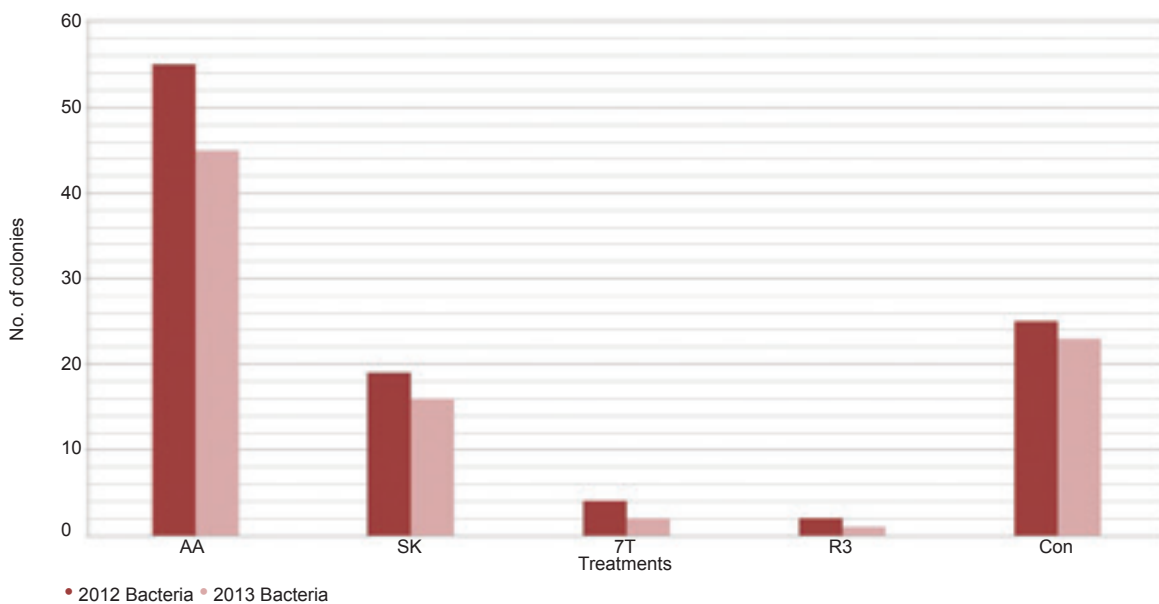


Fig. 1: Total number of bacteria isolated from samples of the treatments of preserved dates at 10^{-6} dilution in 2012 and 2013 seasons. (AA) = Amino acids; (SK) = Sugar alcohol; (T7) = Algae extract; (3R) = Licorice; (Con) = Control.

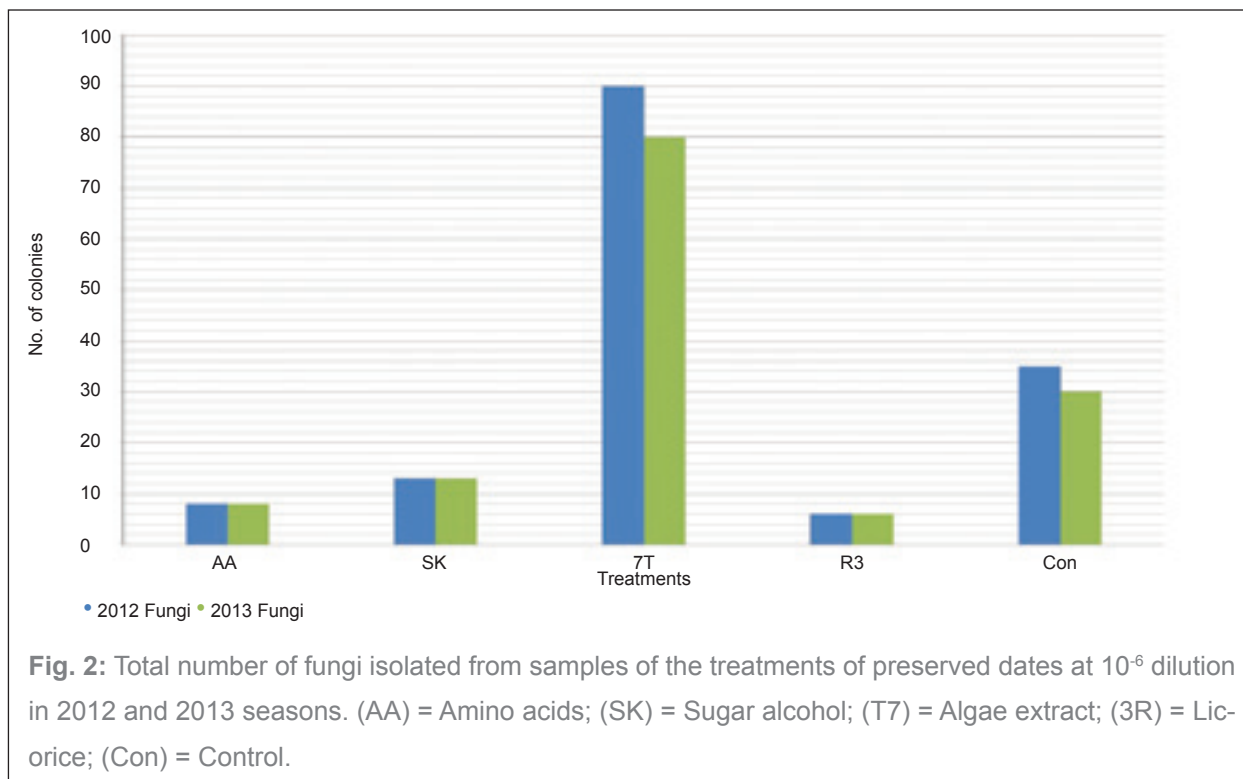


Fig. 2: Total number of fungi isolated from samples of the treatments of preserved dates at 10^{-6} dilution in 2012 and 2013 seasons. (AA) = Amino acids; (SK) = Sugar alcohol; (T7) = Algae extract; (3R) = Licorice; (Con) = Control.

Microbial load

Units of colony forming microorganisms developed from samples taken after storage as shown in Plate (3 and 4) were identified. Figs (3 and 4), showed the total number of bacteria and fungi isolated from samples of the treatments of preserved dates at 10^{-6} dilution in 2012 and 2013 seasons.

The obtained results indicated that the bacterial load (Fig. 3) was the highest in sampling amino acids + chitosan followed by control treatment followed by chitosan only 1% followed by sugar alcohol +

chitosan followed by algae extract + chitosan then licorice root extract + chitosan gave the lowest number of bacteria in the two studied seasons, respectively.

Sampling control treatment recorded higher for total fungi counts followed by algae extract + chitosan followed by chitosan only 1% followed by sugar alcohol + chitosan followed by amino acids + chitosan then licorice root extract + chitosan recorded lower for total fungi counts (Fig. 4) in the two studied seasons, respectively. (DerMarderosian, 2001) cleared that licorice has been

reported to have anti-bacterial and antiviral. Gupta *et al.* (2008) found that antimicrobial potential of *Glycyrrhiza glabra* L. roots was exhibited as antimicrobial activity against both Gram-positive and Gram-negative bacteria.

Postharvest conditions like storage temperature could be considered as the major factors affecting the microbial load and as consequence the shelf life of dates (Rygg *et al.*, 1956; Hasnaoui *et al.*, 2010; Al Jasser, 2010).

Chitosan exhibits a variety of antimicrobial activities (Kulikova *et al.*, 2006). Chitosan

inhibits the growth of a wide range of bacteria (Muzzarelli *et al.*, 1990). Similarly, several derivatives of chitin and chitosan were shown to inhibit *E. coli*, *Staphylococcus aureus* (Kim *et al.*, 1997). Some *Bacillus* species, and several bacteria infecting fish. Fungicidal activity of chitosan has been documented against various species of fungi (Muzzarelli *et al.*, 1990). Chitosan, applied at a rate of 1 mg/mL, is able to reduce the in vitro growth of a number of fungi and oomycetes except *Zygomycetes*, which have chitosan as a component of their cell walls (Allan and Hadwiger, 1979).

Chitosan inhibits the growth of a wide range of bacteria. Similarly, several derivatives of chitin and chitosan were shown to inhibit E. coli.

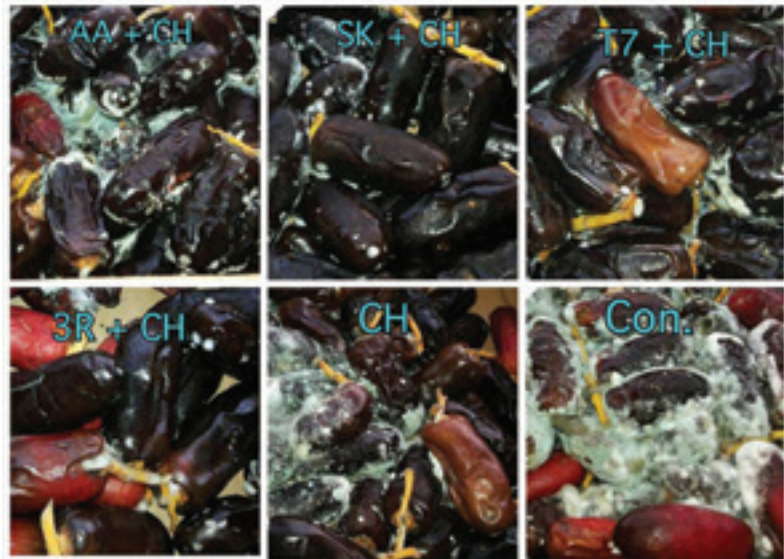


Plate . 3: General view of damaged fruit surface after storage period. (AA) = Amino acids; (SK) = Sugar alcohol; (T7) = Algae extract; (3R) = Licorice; (Con) = Control.

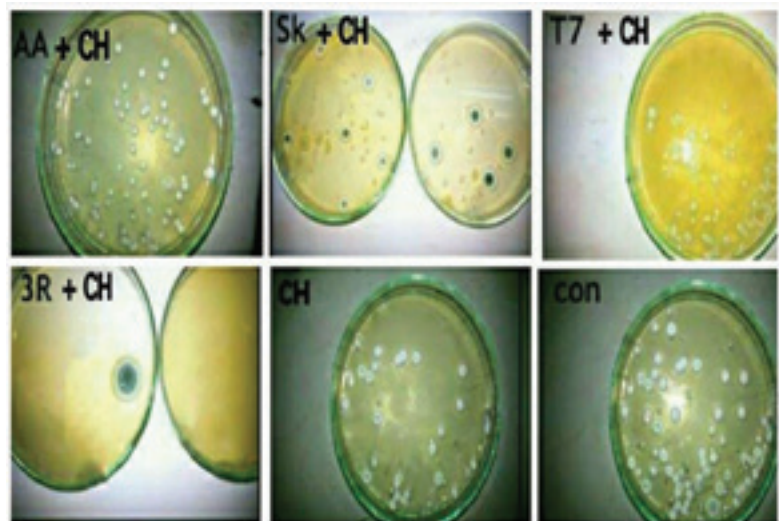


Plate . 4: Total number of bacteria and fungi isolated from samples of the treatments of preserved dates at 10^{-6} dilution. (AA) = Amino acids; (SK) = Sugar alcohol; (T7) = Algae extract; (3R) = Licorice; CH = chitosan; (Con) = Control.

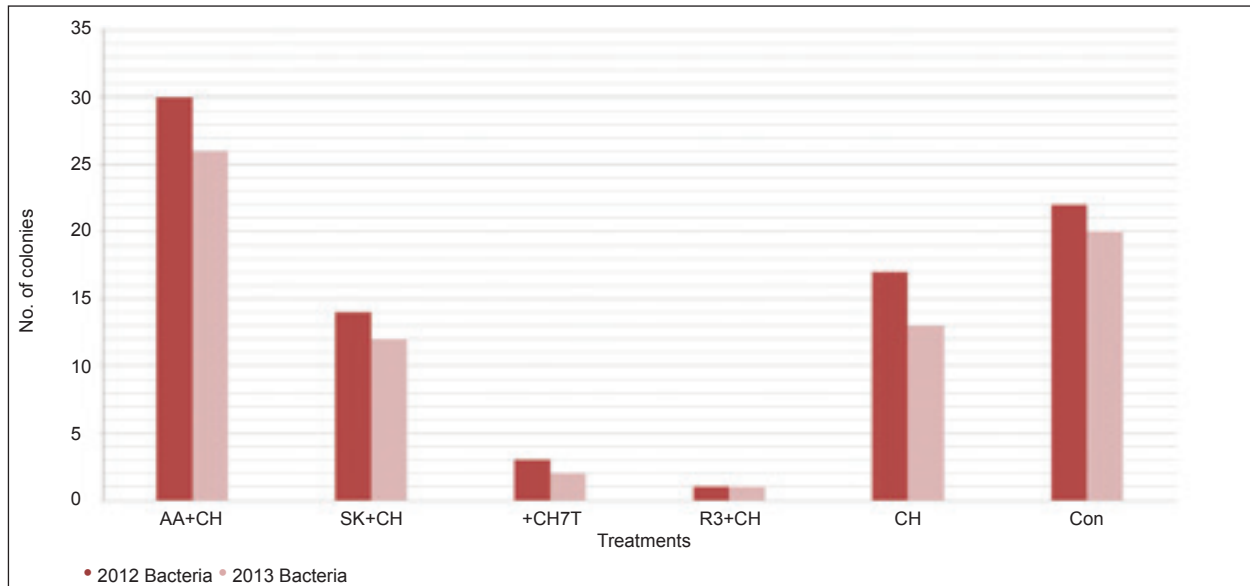


Fig. 3: Total number of bacteria isolated from samples of the treatments of preserved dates at 10^{-6} dilution in 2012 and 2013 seasons. (AA) = Amino acids; (SK) = Sugar alcohol; (T7) = Algae extract; (3R) = Licorice; CH = chitosan; (Con) = Control.

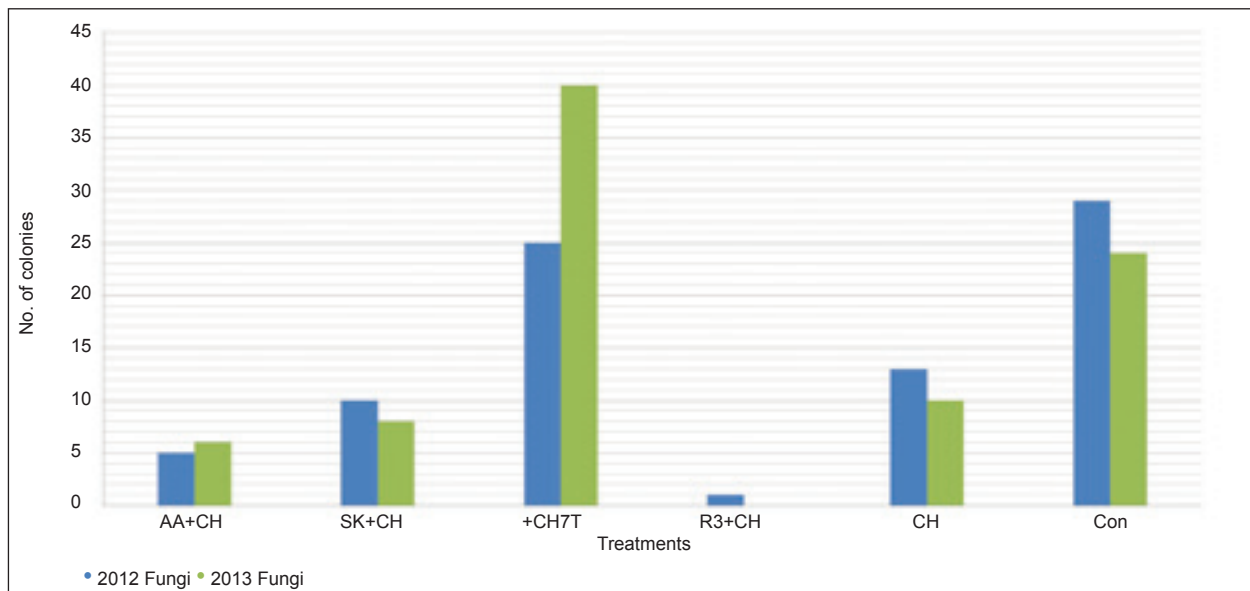


Fig. 4: Total number of fungi isolated from samples of the treatments of preserved dates at 10^{-6} dilution in 2012 and 2013 seasons. (AA) = Amino acids; (SK) = Sugar alcohol; (T7) = Algae extract; (3R) = Licorice; CH = chitosan; (Con) = Control.

Reasons of dates decay during storage

Yeasts (most important), molds and bacteria. Yeast species of *Zygosaccharomyces* are more tolerant of high sugar content than others found in dates. Yeast infected dates develop an alcoholic odor (become fermented). *Acetobacter* bacteria may convert the alcohol into acetic acid (vinegar). Fungi (*Aspergillus*, *Alternaria* and *Penicillium* spp.) may grow on high moisture dates, especially when treating and storage soft cultivar.

How to maintain quality and reduce losses of dates

- During harvesting of fruits avoid temperature fluctuations to avoid moisture condensation dates, which may encourage growth of decay causing microorganisms.
- Protect fruits from insect infestation.
- Reduced in temperature to prolong the storage period.
- Keep storage relative humidity in equilibrium with moisture content of the fruits.
- Proper cleaning for fruits before storage to minimize microbial contamination during storage period.

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Assessing the Efficiency of Sponge and Traditional Methods of Pollination in Date Palm

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Often, the availability of male flowers becomes scarce due to the high demand to take up pollination during the short period of time when the female flowers are receptive.

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Abstract:

In date palm *Phoenix dactylifera* L. male (pollen bearing) and female (fruit bearing) inflorescences are on separate palms. To ensure good fertilization and better yield, artificial pollination is carried out in date plantations, where pollen harvested from male flowers are used for artificial pollination which is usually done manually. Often, the availability of male flowers becomes scarce due to the high demand to take up pollination during the short period of time when the female flowers are receptive. We assessed the comparative efficiency of using pollen to manually pollinate female date palm flowers in the field

using sponge pieces charged with harvested pollen as compared to the traditional practice of the farmers using male inflorescences. Results revealed that fruit set (%), fructification (%), yield per bunch (kg) besides fruit weight, length and breadth were statistically similar in the two pollination methods evaluated. The sponge method of manual pollination can therefore serve as a viable alternative to the traditional method of pollination with the possibility of using stored pollen especially where male palms are scarce and pollen is difficult to obtain.

Key words: Date palm, manual pollination, sponge technique, fruit set, fructification.

Introduction

Date palm *Phoenix dactylifera* L. is the most important fruit crop in the Arabian Peninsula, closely associated with the life of the people in the region since ancient times. The date industry is rapidly growing at the Arabian Peninsula. According to the Food and Agriculture Organization (FAO) of the United Nations, the global date production has increased from just 1.8 million tons in 1962 to 7 million tons in 2010. The Kingdom of Saudi Arabia is among the world's leading producer of dates producing 1.3 million tones of dates annually, accounting for 17% of the global date production [1].



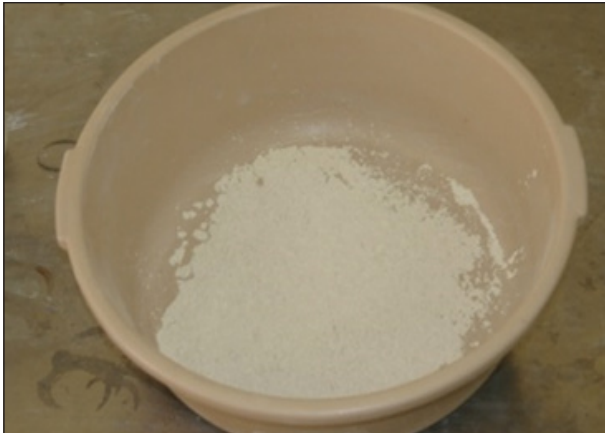
**Drying
the male
bunches**



Date palm is a dioecious crop where male (pollen bearing) and female (fruit bearing) inflorescences are on separate palms [2]. To ensure good fertilization, traditionally female inflorescence is usually manually pollinated by inserting male flowers between female flower clusters during the first few days of its opening when the female flowers are receptive [3]. This overcomes disadvantages of dichogamy besides enhancing fruit set

and sustaining yield levels. The most common manual technique of pollination in date palm is to cut the strands of male flowers from a freshly opened male spathe and place two to three of these strands, lengthwise and in an inverted position, between the strands of the female inflorescence [4]. Mechanical pollination in date palm using pollen dusters is also known since late 1960s [5] but not common among farmers.

Often the availability of male flowers becomes scarce due to the high demand to take up pollination during the short period of time when the female flowers are receptive. Pollen can therefore be stored and used to pollinate female flowers [5] when required without depending on the availability of strands of male flowers during the season. Efficiency of pollen is also known to increase when mixed with wheat flour [5]. Al-



Manual extraction of Pollen

though sponge pieces charged with date pollen have been used to manually pollinate female inflorescences in date palm [6], there is no data to quantify its impact in terms of fruit set and subsequent yield. During 2013, studies were carried out in the date palm oasis of Al-Hassa (25°19'60" N latitude and 49°37'60" E longitude) in Saudi Arabia to assess the efficiency of the sponge and traditional techniques of manual pollination in date palm.

Materials and Methods

Field studies were conducted by the Date Palm Research Centre, Al-Hassa during 2013 to test the efficiency of two pollination techniques (sponge and traditional). The trial was carried out in Wuziah village in the Al-Hassa oasis. Two blocks (Table 1) of date palms (Khalas cultivar) were pollinated using the sponge technique

Table 1 Number of palms per block in the two methods of pollination evaluated.

Treatment	Total palms/block
T1 (sponge method)	116
	119
T2 (traditional method)	89
	122

(T1) where in strips of sponge (25 cm long, 1.5 cm thick and 3 cm wide) charged with freshly extracted date pollen mixed with wheat flour in the ratio of 1:4 were used to pollinate the female inflorescence by inserting 1-3 pollen charged sponge pieces between female inflorescences. In another two blocks of the same plantation, pollination was carried out using the traditional method (T2) of pollination practiced by farmers where in 2-3 male flower strands (staminate inflorescences) harvested from male date palms were placed between female flow-

er clusters. The number of pollen charged sponge pieces and male flower strands used for pollination depended on the size of the female inflorescences. To ensure fertilization and good fruit set, in both T1 and T2 the female inflorescences were loosely tied with twine to secure the pollen charged sponge pieces and male flower strands within the female flowers. Pollination was carried out during February 2013 by using pollen (T1) and male flowers (T2) from the same male date palms. Five palms were marked in each experimental block (10 palms/



Mechanical extraction

treatment) to record observations on fruit set and fructification. Observations on fruit set in each of the five sample palms were recorded at the khalal fruit stage in three bunches (five strands/bunch). As regards fructification, observations in each of the five sample palms were recorded at the tamar stage in four bunches (five strands/bunch) on the following parameters: (1) fructification (%) and (2) yield per bunch (kg).

The physical characters of fruits (weight and size: length & width) were also recorded at the tamar stage in 100 fruits per palm. Data on all the above parameters were subjected to two sample T test ($P = 0.05$). Results on the above parameters with respect to the sponge and traditional methods of pollination are presented and discussed below.

Results and Discussion

Results revealed that fruit set (%) at the khalal fruit stage in both T1 (sponge) and T2 (traditional) were 67.03 and 69.10, respectively and statistically similar (Fig. 1). Results on fructification (%) (56.95 and 54.48, respectively) and yield per bunch (7.32 kg and 6.31 kg, respectively) at the tamar stage were also statistically similar (Figs. 2 and 3).

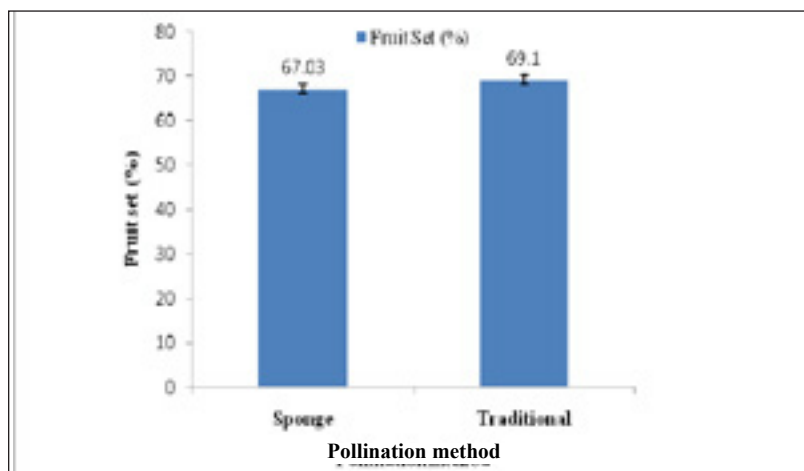


Fig. 1 Effect of pollination method on fruit set in date palm (Khalas cv).

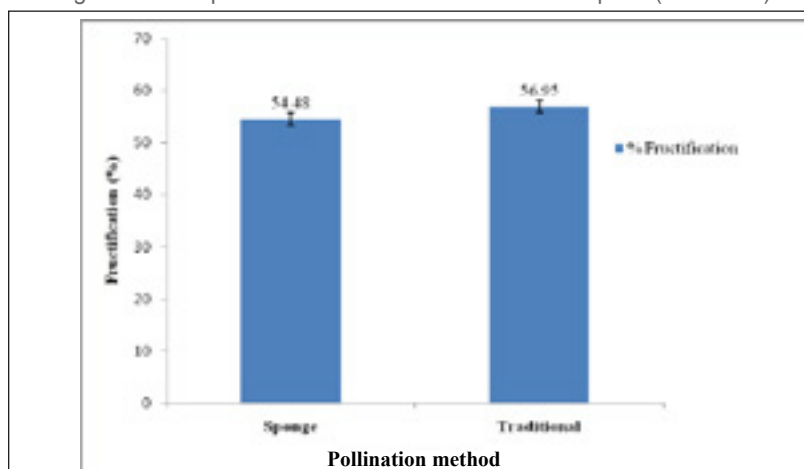


Fig. 2 Effect of pollination method on fructification in date palm (Khalas cv).

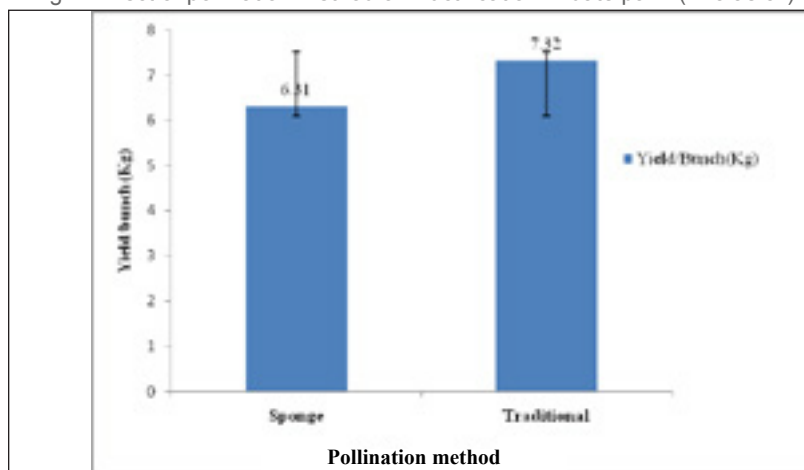


Fig. 3 Effect of pollination method on yield/bunch in date palm (Khalas cv).

The sponge method of manual pollination can serve as a viable alternative to the traditional method of pollination with the possibility of using stored pollen.

Further, fruit weight (9.54 g and 9.05 g, respectively), width (20.51 mm and 20.70 mm, respectively) and length (39.91 mm and 36.85 mm, respectively) were also similar in the two pollination methods (Figs. 4-6). Timely pollination when the female flowers are most receptive is crucial to sustain yield levels in date palm. Delaying pollination beyond the seventh day of spathe cracking in Egypt resulted in significant reduction in initial fruit set and bunch weight [7]. It is recommended [8] that the stored pollen first be tested for viability then mixed with filler (e.g., wheat flower, industrialized-non perfumed talc, etc.). The mixture must be prepared immediately before pollination. In Pakistan a comparison between

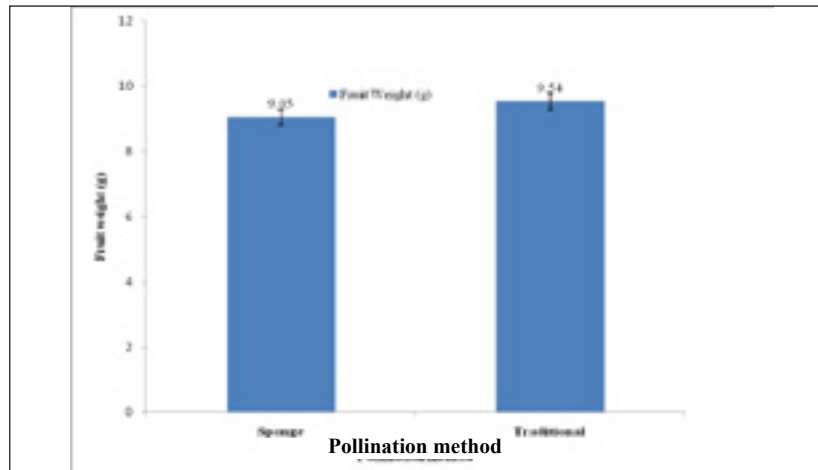


Fig. 4 Effect of pollination method on fruit weight in date palm.

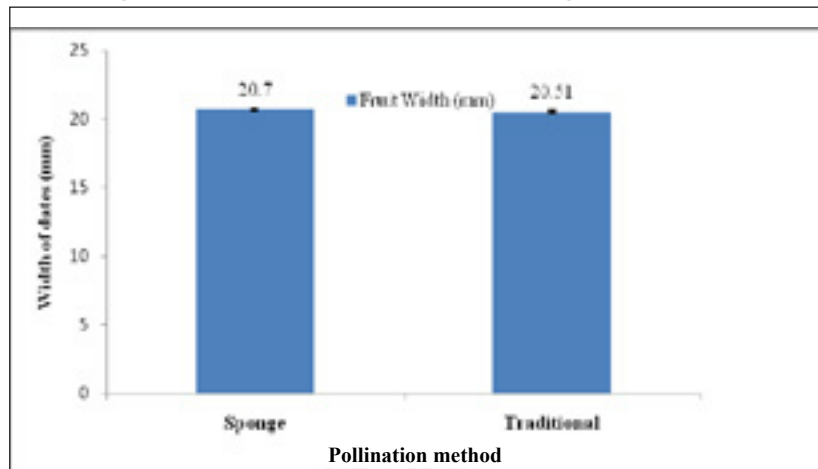


Fig. 5 Effect of pollination method on fruit width in date palm.

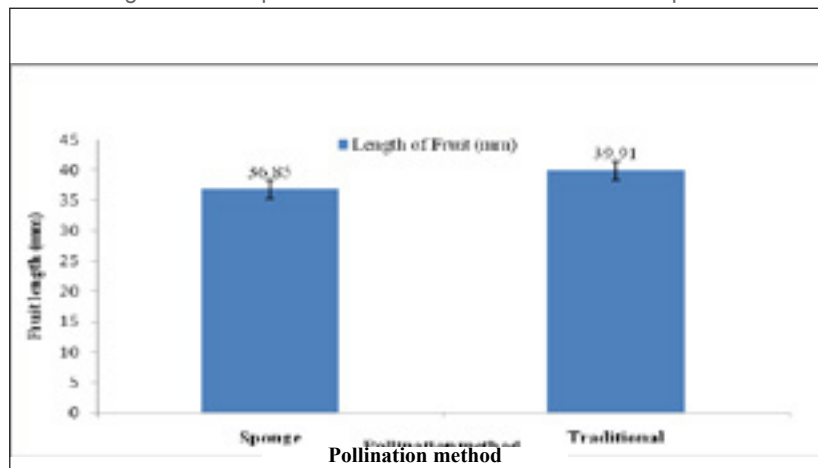


Fig. 6 Effect of pollination method on fruit length in date palm.



strips of sponge (25 cm long, 1.5 cm thick and 3 cm wide) charged with freshly extracted date pollen mixed with wheat flour in the ratio of 1:4 were used to pollinate the female inflorescence by inserting 1-3 pollen charged sponge pieces



the female inflorescences were loosely tied with twine to secure the pollen charged sponge pieces and male flower strands within the female flowers

different methods of pollinating date palm viz. dusting of pollens, placement of male spathe, liquid spraying of pollens as well as natural process of pollination (control), revealed that highest fruit set was recorded in the placement method [9] which corresponds to the traditional method in this study. Reports from Saudi Arabia reveal that manual method of pollina-

tion resulted in better fruit set as compared to mechanical pollination in the cultivar Khalas [10]. Our results showed that with regard to fruit set, fructification and other parameters evaluated placing male flower strands in female inflorescences (traditional method) did not significantly differ from the sponge technique in these manual two methods of pollination.

Conclusions

Based on the results presented above, it is concluded that there is no difference between the sponge and traditional methods of pollination in terms of fruit set, yield and fruit attributes tested in date palm. Therefore, the sponge method of pollination can serve as a viable alternative to the traditional method of pollination especially



the sponge method of pollination can serve as a viable alternative to the traditional method of pollination especially where male palms are scarce and pollen is difficult to obtain.

where male palms are scarce and pollen is difficult to obtain.

Acknowledgments

Support provided by the Date Palm Research Centre, Al Hassa, Saudi Arabia to carry out this study through the FAO project UTFN/SAU/043/SAU is acknowledged.

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Parthenocarpic fruits



Failure of Pollination



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Good fruits



Successful Pollination





خدمة رأس النخلة



بقلم الشاعر
عثمان أحمد عثمان النقيب
مهندس زراعي.

جمعية فلاحية ورعاية النخيل السودانية

بالري والتسميد لا يلقي به ثمرا
دون الثلاث ورم التي هي أكثرا
لاتقطعن إلا اليبيس الأغبرا
أو قل ثمان، وأفضل تكون العاشرة
واحذر لقاحا أن يكون مبكرا
لا تأخذن من المواسم أخرا
في الاخضرار قبل أن تتصفرا
تعطي الأمان إذا قد أمطرا
تربي العوائد للزراعي التاجرا
يكفيك شر العنكبوت الأحمرا
توجد على خوص الجريد منتشرا
فاعمل بجد يا صديقي وحاذرا
بالمعدني من الزيوت محررا
نخشي من الحشرات أن تتحشرا
في تساقط التمر الجديد الباكر
واللون فيها أن تكون محمرا
تنال في التلقيح من بعض القرى
خسر الذي للنخل كان يؤيرا
أو بعض ماتوصي البحوث ومن درى
ما كان هذا من حديث يفترى
رأي لشخصه لاتكن متأثرا
وأعمل بضده لاتكن متأثرا
صحب النخيل حتى يموت ويقبرا
تلقي النجاح فلا تكون مقصرا

ومن له النخل إن يترك تعهده
أما الرواكب والخلف لآترمها
إن الجريد مصدر غذاء النخلة
وزع جريدك للسبيط مسبعا
لقح ثلاثا أو رباعا يا فتى
وتخير الفحل الكثير دقيقه
دل وقوس للسبيط عل عجل
خف الثمار على العذوق لأنها
تربو الثمار على الجميل وثق بها
رش الأكاروس بعد قطع ثمارنا
احذر من القشرية فورا إذ هي
فالركب المقلوبة تشبه ش كلها
فالكونفيدور عدوها إن قد خلط
اهجم على الكروك قطعنا إننا
وخصوصا الخميرة فهي تخصصت
شعيرية دودية في شكلها
تلقاها في الطلع النضيد تخبأت
من أين جئت إلى الحقول شقية
فعليك بالساير مبيدا قاتلة
إن البحوث إلى الزراعة زادنا
لكن من باب النصيحة قرابة ياب
لا تأخذن بفعله لك قدوة
هذه وصية حاذق متمرس
هذا من قول (النقيب) فخذ به