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PESTS ATTACKING POST-HARVEST SUGAR BEET ROOTS, AND THEIR ADVERSE EFFECTS ON SUGAR CONTENT

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ABSTRACT

Sugar beet is a main source of sugar, but the pest infestations reduce root quantity and sugar content. Post-harvest roots piled on the side roads before moving to the factories are being subjected to a variety of pests that may reduce root quality. So, the current study was carried out during 2012 and 2013 seasons at the Experimental Farm of Sakha Agricutlural Research Station for monitoring population size of major pests which attack roots of post-harvest sugar beet, and adverse effects on sugar content. Data indicated that the greatest population sizes in three plantations in both seasons were those of Diptera (mainly, Muscidae), *Rattus norvegicus* (Berkenhout, 1769) and *Corvus* spp. Moderate population sizes were those of *Liogryllus bimaculatus* L., while low populations were recorded for *Lixus junci* Boh.*, Scrobipalpa ocellatella* Boyd.*, Agrotis ipsilon* (Huf.) and *Gryllotalpa gryllotalpa* L. Also, the authors noticed that numbers of sheep were eating sugar beet roots greedily. Pest infestations resulted in highly significant losses in sugar percentage extracted from the damaged roots. It could be concluded that pests play an important role in reducing post-harvest sucrose.

INTRODUCTION

In the last decades, sugar beet crop has become a major source, in addition to sugar cane, of sugar supply in Egypt. The growers do their best to attain high root yield, quantitatively and qualitatively.

Unfortunately, sugar beet is liable to attack of several pests beginning from seeding up to harvest (Abo-Saied Ahmed, 1987; Shalaby, 2001; Saleh *et al*., 2009 and Bazazo *et al*., 2012). Sometimes, piles of sugar beet roots are late to move to sugar beet factories for sugar extraction, because of some complications of means of transportation. Thus, the root yield may stay for some days exposed to pests, and unfavourable weather conditions.

Pimental (1991) estimated the world wide losses (due to weeds, pathogens and insects) as 25-35% pre-harvest and 10-20% post-harvest. After the sugar beet plants are harvested, they undergo several operations that, if not properly done, reduce sucrose content in the root extraction. Rosenkranz *et al*. (2001) showed that wounding of sugar beet roots cause an induction of invertase activity, which contributes to post-harvest sucrose losses. Reymond *et al*. (2000) indicated that during the life span of higher plants, wounding is a common event. The open wound surface causes uncontrolled water loss and offers an entry point for pathogens. Lafta and Fugate (2009) indicated that some of the major factories influencing sucrose loss in sugar beet roots are temperature, root health at harvest, respiration,

excessive microbial growth, moisture loss, damage during harvest and transport, and the amount of mud, weeds, and debris going into piles.

In Egypt, little attention is available on the pests attacking post-harvest sugar beet roots and their adverse effects on sugar content. Therefore, the aim of this study was conducted to determine the pests attacking sugar beet roots few days post-harvest, and investigate their negative impact on sucrose percentage in sugar beet root extraction.

MATERIALS AND METHODS

The current investigation was carried out at the experimental of Sakha Agricultural Research Station during 2011/2012 and 2012/2013 seasons. The sugar beet roots of the three plantations were harvested at the recommended date, and kept piled close to the field five days to be transferred to the factory for sugar extraction. The heights of piles are about (1.00 to 1.50 meter). During these few days, the roots are being subjected to infestation of some insect pests as well as invasion of vertebrate animal pests.

1.Monitoring population size of pests on piles of sugar beet roots:

Pests attacking the piled sugar beet roots (three plantations) were surveyed one, three and five days after harvest. There were two sampling methods.

a)Sweep net:

Just before sweeping, a cotton piece saturated with chloroform was introduced into the net to anesthetize the trapped arthropods. Fifty double strokes were practiced at each sampling date. After collection, the catch was emptied into plastic bags and moved to the laboratory for sorting, identification and counting.

b)Visual examination:

Some pests, particularly vertebrate ones, i.e. rates and wild birds were recorded by visual examination.

2.Estimation of reduction in sugar content percentage:

To find out the effect of pest attacks to the sugar beet roots (Farida cultivar) on sugar percentage in the roots, samples of pest infested and uninfested roots were analyzed to determine the sugar percentage. This was achieved using sucrometer device, in laboratory of Sugar Crops Research Department (Sakha), by aid of Dr. B.M. Abou El-Magd (Physiology and Chemistry).

3.Statistical analysis:

The data were analyzed using the t-test.

RESULTS AND DISCUSSION

1.Population size of major pests attacking post-harvest sugar beet roots:

Tables (1 and 2) list the invertebrate and vertebrate pests attacking sugar beet roots piled for some days after harvest. Sugar beet roots of the three plantations were found infested with dipterous insect pests; *Gryllotalpa*

gryllotalpa, Agrotis ipsilon, Liogryllus bimaculatus, as well as *Rattus norvegicus* (Fig. 1) and *Corvus* spp. *Lixus junci* attacked the sugar beet roots of the third plantation only, while *Scrobipalpa ocellatella* infested the roots of both second and third plantations.

Data presented in Tables (1 and 2) showed the population sizes of major pests attacking sugar beet roots in 2012 and 2013 seasons. The greatest population sizes in the three plantations were those of dipterous insects (76.48, 80.26 and 74.07%) in 2012 season, and (75.44, 81.16 and 71.28%) in 2013 season, the second rank was that of *Rattus norvegicus* (13.23, 10.53 and 10.19%) in 2012 season, and (10.53, 5.80 and 7.92%) in 20013 season, and the third was that of *Corvus* spp. (4.41, 2.63 and 3.70%) in 2012 season, and (3.51, 5.80 and 5.94%) in 2013 season, for the first, second and third plantations, respectively.

Table(1):Population size of major pests attacking piles of sugar beet roots in three plantations, 2012 season, by using sweep net and visual examination methods.

Pest/ stage	First plantation		Second plantation		Third plantation		Total	
	No.*	%	No.*	%	No.*	%	No.	%
Diptera (adult)	52	76.48	61	80.26	80	74.07	193	76.59
Rodentia,*Rattus norvegicus*	9	13.23	8	10.53	11	10.19	28	11.11
Corvidae, *Corvus* spp.	3	4.41	2	2.63	4	3.70	9	3.57
Gryllotalpa gryllotalpa (adult)	2	2.94	1	1.32	1	0.93	4	1.59
Agrotis ipsilon (larva)	1	1.47	0	0.00	1	0.93	2	0.79
Liogryllus bimaculatus L. (adult)	1	1.47	2	2.63	4	3.70	7	2.78
Lixus junci, L. (adult-larva)	0	0.00	0	0.00	4	3.70	4	1.59
Scrobipalpa ocellatella (larva)	0	0.00	2	2.63	3	2.80	5	1.98
Total	68	-	76	-	108	-	252	-

*** Number of pests collected in 3 samples (50 double strokes, and visual record methods)**

Table (2):Population size of major pests attacking piles of sugar beet roots in three plantations, 2013 season, by using sweep net and visual record methods.

Pest/stage	First plantation		Second plantation		Third plantation		Total	
	No.*	%	No.*	%	No.*	%	No.	%
Diptera (adult)	43	75.44	56	81.16	72	71.28	171	75.33
Rodentia, *Rattus norvegicus*	6	10.53	4	5.80	8	7.92	18	7.93
Corvidae, *Corvus* spp.	2	3.51	4	5.80	6	5.94	12	5.29
Gryllotalpa gryllotalpa (adult)	1	1.75	1	1.45	1	1.00	3	1.32
Agrotis ipsilon (larva)	2	3.51	1	1.45	1	1.00	4	1.76
Liogryllus bimaculatus L. (adult)	3	5.26	2	2.90	5	4.95	10	4.41
Lixus junci, L. (adults-larva)	0	0.00	0	0.00	6	5.94	6	2.64
Scrobipalpa ocellatella (larva)	0	0.00	1	1.45	2	2.00	3	1.32
Total	57	-	69	-	101	-	227	-

*** Number of pests collected in 3 samples (50 double strokes, and visual record methods)**

Moderate population sizes were those of *Liogryllus bimaculatus* (1.47, 2.63, and 3.70%) in 2012 season, and (5.26, 2.90 and 4.95%) in 2013 season. Low population sizes were recorded for *Lixus junci*, *Scrobipalpa ocellatella, Agrotis ipsilon* and *Gryllotalpa gryllotalpa* in both seasons. Regardless of plantations, the same trend was obtained in both seasons, with dipterous insects being the most common, followed by Norway rat, while *Agrotis ipsilon, Lixus junci* and *Scrobipalpa ocellatella* were the least encountered. Andrea (2009) showed that harvesting of sugar beet may result in wounding of roots, that leads to induction of invertase and, consequently, to sucrose loss. Boetel (2014) indicated that the sugar beet root aphid is capable of causing up to 75% reductions in sucrose concentration per ton in post-harvest stored sugar beet roots. It was also determined that harvesting aphid-damaged field two weeks earlier can significantly reduce the amount of loss that occurs in stored roots. Strausbaugh *et al*. (2010) reported that the insecticide seed treatments not only have the potential to limit yield losses and increase profits in the field, but also improve sucrose recovery in storage.

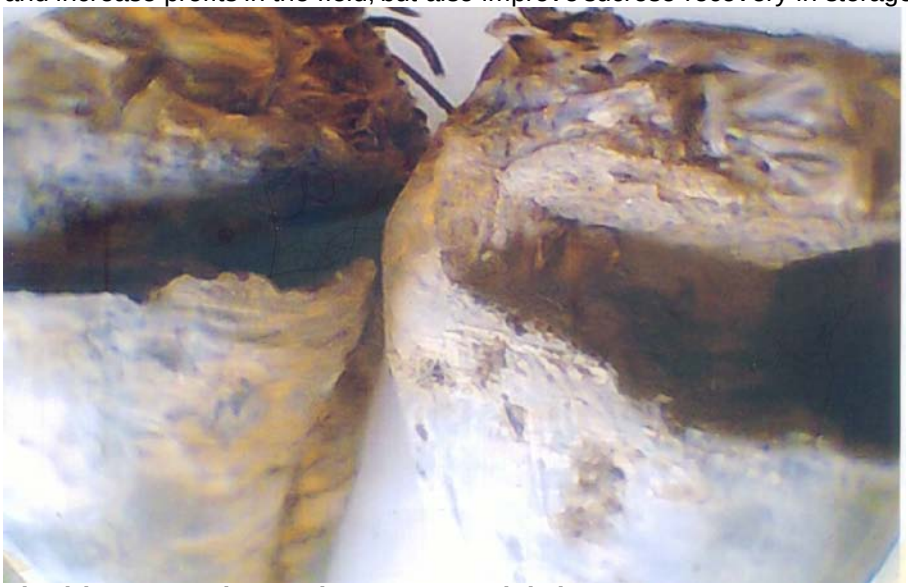

Fig. (1): Damaged sugar beet roots, mainly by rats.

2.Adverse effect of pests on sugar content:

Data presented in Table (3) showed the difference in the sugar content percentage of infested (14.43%) and uninfested (18.86%) sugar beet roots. Highly significant reduction in sugar percentage was recorded in the infested roots as compared to uninfested ones. This means that the pest infestation have reduced the sugar content percentage in the post-harvest of sugar beet roots. Rosenkranz *et al*. (2001) showed that wounding of sugar beet roots cause an induction of invertase activity, which contributes to post-harvest sucrose losses.

Table (3):Sugar content (%) as affected by pest infestation, 2013 season.

Sample No.	Sugar content (%)		"t" test	
	Uninfested	Infested	Calculated	Tabulated
1	18	14	7.91**	0.05=2.447
2	20	15		0.01=3.707
3	19	14		
4	20	16		
5	19	17		
6	18	13		
7	18	12		
Average	18.86	14.43		

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الآفات التى تهاجم جذور بنجر السكر بعد الحصاد وتأثيرها على نسبة السكر

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****قسم وقاية النبات ، كلية الزراعة ، جامعة طنطا**

يعد محصول بنجر السكر من المصادر الرئيسية للسكر ، ولكن إصابته بالآفات المختلفة تقلل من جودة المحصول كماً ونوعاً. تتعرض جذور بنجر السكر بعد حصاده وقبل نقله للمصانع للعديد من الآفات والتى تؤثر على جودة هذه الجذور. لذلك أجريت هذه الدراسة فى المزرعة البحثية لمحطة بحوث سخا لحصر ومراقبة تعداد أهم الآفات التى تهاجم جذور البنجر وكذلك معرفة تأثير هذه الآفات على نسبة استخلاص السكر.

أوضحت النتائج أن أكبر تعداد بعد الحصاد ولمدة خمسة أيام فى الثلاث عروات فى الموسمين 2012 ،2013 كانت أعداد الذباب ، الفأر النرويجى والغراب ، وسجلت أعداد صرصور الغيط قيما متوسطة ، بينما كانت أعداد سوسة جذور البنجر ، وفراشة البنجر ، والدودة القارضة والحفار هى الأقل. كما لاحظ الباحثان أعداداً من الأغنام وهى تأكل جذور البنجر بشراهة. كانت الفروق فى نسبة السكر عالية المعنوية بين الجذور المصابة بهذه الآفات والجذور السليمة.