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CASTOR BEAN, *RICINUS COMMUNIS*, A PROMISING SOURCE OF MITE'S PREDATORS

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Abstract

The Predators, *Stethorus gilvifrons* (Coleoptera), *Scolothrips longicorns* (Thysanoptera) *Orius spp.* (Heteroptera), and *Amblysieus spp.* (Parasitiformes), were surveyed on castor trees, (*Ricinus communis*) throughout 1997 and 1998 seasons in Ismailia Governorate. The predators were found over the two years, despite the temperature and relative humidity that affected their population density. The first two predators were more abundant than the other two. The four predators were found in each of the five surveyed districts (Fayed, Quantra Gharb, Ismailia, Quantra Shark and El-tall El-Kebeer) with no significant differences. *S.gilvifrons* and *Orius* spp. showed negative correlation with temperature and R.H. in 1997, however, positive correlation with temp. was evident in 98. *S.longicornis* and *Amblyseius* spp. showed positive and negative correlation with temperature and relative humidity, respectively during both seasons. Moreover, the effect of ten insecticides and acaricides varied in their action on the predators, while five fungicides; four herbicides and the nematicide Vydate did not prove to be harmful against the collected predators. It is recommended that castor bean plants can be planted in farms and as hidge or border where wind is blowing to serve as a source of predators owing to their existence throughout the whole season. The use of harmful pesticides to the predators against pest on economic crops must be avoided to preserve such predators.

INTRODUCTION

Castor bean, *Ricnus communis* is planted either to extract seed oil or to rear castor silk worms. Angelo (1996) mentioned that castor oil, expressed from the seeds of *Ricinus communis* is an effective laxative and also decrease the activity of circular smooth muscle which is believed to produce an increase in intestinal transmit. Janakiraman (1961) stated that eri-silk worm *Attacus ricin* Boisd feed on castor *Ricinus communis*. Ahmed (1974) mentioned the occurrence of castor plants on the banks of the water streams throughout the country, (Egypt). Moreover, farmers in Ismailia used to

plant castor that adapted to sandy soil and stand deficient water as a shelter from direct sun heat.

Castor is considered one of the main wild host for the two spotted spider mite *Tetranychus urticae* Kock. There is a natural balance between predators and preys; however, such a balance can be disturbed on economic crops as a result of circumstances usually created by the use of pesticides.

The aim of this work is to:

1. Survey and monitor mite's predators on castor plants .
2. Study the population fluctuation of these predators over two years.
3. Study the relationship between predators population densities and both of the prevailing temperature and humidity.
4. Determine the effect of certain pesticides which were used on economic crops on the collected predators.

MATERIALS AND METHODS

The current work was carried out during the period extending from January 1997 to December I998, at five districts of the Ismailia Governorate, (Ismailia region, Fayed, El-Tall El-Kebeer, Quantra Shark and Quantra Gharb). Three villages were selected in each district and four castor shrubs from each village were submitted to continuous surveillance. Each shrub was divided into 3 vertical levels, low, middle and high. One leaf from each of the four directions (east, west, north and south)were taken at every level . So, the size of each sample was 12 leaves / shrub and taken monthly. The collected samples were packed in paper bags and transported to the laboratory of the Agricultural Research Station in Ismailia. Each bag was provided with a small piece of cotton saturated with ether as an anaesthetic to allow examination and identification of the predators which were verified at the Plant Protection Research Institute, ARC. The monthly means of the predators were recorded and statistically analyzed. The correlation coefficient between the population of the predators and each of temperature and relative humidity was determined. Weather data of the districts were obtained from Meteorological Authorities.

Table 1. Monthly means of temperature and relative humidity in Ismailia Governorate from January 1997 to December 1998.

Month	Monthly Means			
	1997		1998	
	Temperture°C	R.H. %	Temperture°C	R.H. %
January	15.1	61.0	14.6	66.0
February	13.5	64.0	15.0	69.5
March	15.7	60.3	16.3	61.3
April	19.2	52.0	22.1	54.3
May	24.3	56.3	24.3	56.3
June	27.4	55.3	26.7	57.6
July	29.1	58.3	29.0	59.3
August	28	61.0	29.8	64.7
September	26	64.7	27.9	60.3
October	23.1	68.0	24.2	64.0
November	19.7	69.3	20.7	69.3
December	16.9	67.7	15.7	64.7

R.H: Relative Humidity.

The susceptibility of the surveyed predators to the recommended concentrations of certain pesticides used in Egypt, was determined according to Hassan *et al.* (1993) depending on the percent kill. The tested pesticides were diluted with tap water to correspond to those recommended doses for field use. Tap water was used as the control. Leaf disc method was used to determine the susceptibilities of the adult stage of predators to the pesticides. Sweet potatoe leaves were dipped in toxicant solution for five seconds, then left to dry. Fifty moving individuals of mite and twenty of adult of each predator were transferred onto every treated leaf placed in glass tubes (5cm) and covered with muslin. Each treatment, four replicates were used.

The treatments were kept under laboratory conditions at 25°C±2 and to 65±5% relative humidity. The criterion for mortality was the failure to respond positively by leg movement following light prodding with a fine brush. Percent kill was calculated as normal method and Abbot's formula (1925) was used to correct percent kill.

Table 2. The tested pesticides were as follows:

No.	Formulations	Recommended Concentration g or ml/ liter water
	Insecticides	
1	Selection 72 Ec (Profenofos)	3.75
2	Actellic 50 Ec (Primifos methyl)	3.75
3	Sumithion 50 Ec (Fenitrathion)	2.5
4	Lannate 90 WP (Methyomyl)	1.50
5	Reldan 50 Ec (Chlorpirifos.methyl)	10.0
6	Marshal 25wp (Carbosulfan)	1.50
7	Pirimor 50wp (Pirimicarb)	0.75
8	Malathion 57 Ec (Metathion)	2.5
9	M-Peed 49 Ec	1.5
10	Natural oil 95 Ec	10.0
	Fungicides	
1	Ridomel Plus 50 wp (Metaloxyltcopper)	15
2	Preficore-N72.2 (Promacarb)	2.5
3	Robigan 12 Ec (Finarimal)	0.25
4	Sumi-eight 5 Ec (Diniconazol)	0.35
5	Score 25 Ec (Difinconazole)	0.5
	Herbicides	
1	Sencor 70 wp (Metribuzin)	1.75
2	Gallant 12.5 Ec (Haloxyfop-EE)	7.5
3	Fusilade 12.5 Ec (Fluazifop-butyl)	7.5
4	Nabu 20 Ec (Sethoxydim)	10.0
	Nematicides	
1	Vydate 24 Ec (Oxamyl)	5.00

RESULTS

Results of the two-years monitoring and surveying study revealed the presence of about four predators: *Stethorus gilvifrons* (Coleoptera), *Orius* spp. (Heteroptera), *Scolothrips longicorns* (Thysanoptera) and *Amblyseius spp* (Parasitiformes), on castor shrubs *Ricinus communis* in the five districts of Ismailia Governorate .

Data in Table 3 show that *S.longicorns* and *S.gilvifrons* were the most dominant species in the two years of study. The overall means of population densities were 1.0 and 0.8 individuals / leaf, respectively; whereas *Orius* spp and *Amblyseius* spp. were low in their population (0.2 individuals/leaf) for each. It can be noted that the population of each of *Orius* spp. and *Amblyseius* spp. was stable to a great extent through the two years.

Table 3. Mean numbers of predators collected from castor shrubs (*Ricinus communis)* of five districts in Ismailia Governorate during 1997and 1998.

Predators	Mean number of predator (individuals/leaf)										Mean		
	Fayed		Quantara [a] Gharb		Ismailia		Quantra Shark		El-Tall El-Keeber				
Season	97	98	97	98	97	98	97	98	97	98	97	98	avarage
S.gilvifrons	0.8	0.7	1.1	0.6	1.4	06	0.7	0.6	1.2	0.7	1.5	0.6	0.8
Orius spp	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
S.longicornis	1.7	0.8	0.8	0.7	1.0	0.7	1.1	0.9	1.2	0.8	1.2	0.8	1
Amblyseius spp	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
L.S.D.											0.31	0.09	0.52

Results reported in Table 4 indicate that the four predators were found in each of the five surveyed districts with no significant differences at 5% level.

This insignificance may be attributed to the similarly croppings and environmental conditions in all surveyed sites. El-Adawy *et al.* (1996) indicated that pests under study exist in both old and new land and that Suez Canal didn't act as a barrier for their movement from one location to another.

Table 4. Total mean numbers of predators (individuals/leaf) of leaf surface of castor shrubs *(Ricinus Communis)* in five districts of Ismailia Governorate during 1997- 1998.

Location	Total Mean number of predators (individuals/leaf)				
	S.gilvifrons	*Orius spp*	*S.longicornis*	*Amblysieius spp*	Mean
Fayed	0.8	0.2	1.3	0.2	0.6
Quantra Gharb	0.9	0.2	0.4	0.3	0.5
Ismailia	1.0	0.2	0.9	0.2	0.6
Quantra Shark	0.7	0.2	1.0	0.2	0.5
El-Tall-El-Kebeer	1.0	0.2	1.0	0.2	0.6

The differences between location are not significant at 5% level.

The population density of the collected predators, Tables 5&6 show that the predators existed throughout the two years and the population density fluctuated during the period. The greatest number was in April 1997 (5 individuals/leaf), while the lowest in November 98 (0.4 individuals /leaf). The numbers of *S.gilvifrons*, increased gradually to reach its peak (3 and 1.1 individuals/leaf) in April 97 and 98, respectively, then decreased to record the minimum (0.1 individuals /leaf) in November 97 and 98 and also, in December 97. The number of *S.longicornis* peaked in May 97 and 98 (2.5 and 1.1 individuals /leaf, respectively) and reached the minimum manifested in October

Table 5. Mean numbers of predators (indivdual/inch) collected from caster shrubs *(Ricinus communis)* at five districts in Ismaillia Governorate during 1997.

Month	Monthly mean number of predators (individuals/leaf)																								Average
	Stethorus gilvifrons						*Orius spp.*						*Scolothrips longicornis*						*Amblyseius spp.*						
	F	QG	Is	Q.S	El-T	M	F	QG	Is	Q.S	El-T	M	F	QG	Is	Q.S	El-T	M	F	QG	Is	Q.S	El-T	M	
January	1.5	0.9	1.4	0.3	1.4	1.1	0.2	0.1	0.4	0.1	0.4	0.2	0.9	0.7	1.1	0.4	3.1	1.2	0.2	0.2	0.2	0.2	0.3	0.2	0.7
Febuary	1.0	0.9	7.6	0.8	1.1	2.3	0.4	0.3	0.7	0.2	0.3	0.4	0.5	1.8	1.0	0.9	1.8	1.2	0.4	0.3	0.2	0.2	0.2	0.3	1.1
March	1.2	2.0	2.0	1.7	2.5	1.9	0.2	0.4	0.2	0.2	0.3	0.3	0.7	1.2	0.7	1.5	2.6	1.3	0.3	0.2	0.2	0.2	0.2	0.3	1.0
April	3.3	2.8	3.9	1.7	3.2	3.0	0.3	0.2	0.3	0.2	0.1	0.2	1.6	2.2	1.8	0.8	1.1	1.5	0.2	0.2	0.3	03	0.3	0.3	1.3
May	1.3	2	0.2	1.9	3.8	1.8	0.1	0.1	0.1	0.6	0.5	0.2	7.5	0.1	1.3	3.3	0.3	2.5	0.1	0.2	0.2	0.2	0.1	0.1	1.2
June	0.3	2.8	1.3	0.5	1.2	1.2	0.1	0.1	0.2	0.1	0.4	0.2	5.0	0.7	1.9	1.9	2.6	2.4	0.2	0.2	0.2	0.2	0.2	0.2	1.0
July	0.1	1.3	0.2	0.2	0.7	0.5	0.1	0.2	0.1	0.1	0.1	0.1	1.0	1.7	1.2	1.2	1.0	1.2	0.2	0.3	0.2	0.2	0.1	0.2	0.5
August	1.6	0.2	0.1	0.1	0.1	0.4	0.1	0.1	0.1	0.1	0.1	0.1	1.7	1.5	0.8	0.8	0.7	1.1	0.1	0.3	0.2	0.3	0.2	0.2	0.5
September	0.1	0.1	0.1	0.6	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.7	0.9	0.4	0.2	0.4	0.5	0.5	0.5	0.2	0.5	0.1	0.4	0.3
October	0.1	0.1	0.1	0.6	0.3	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.3	0.5	0.4	0.3	0.3	0.1	0.2	0.1	0.2	0.1	0.1	0.2
November	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.8	0.7	1.0	0.4	0.7	0.2	0.2	0.1	0.1	0.1	0.1	0.3
December	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.7	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.2
L.S.D						1.35						0.15						1.43						0.14	0.771

F.= Fayed Q.S.= Quantra Shark Q.G.= Quantra Gharb Is.= Ismailia El-T.=El-Tall El-kebeer M.=mean

Table 6. Mean numbers of predators (indivdual/inch) collected from caster shrubs *(Ricinus communis)* at five districts in Ismaillia Governorate during 1998.

Month	Monthly mean number of predators (individuals/leaf)																								Average
	Stethorus gilvifrons						*Orius spp.*						*Scolothrips longicornis*						*Amblyseius spp.*						
	F	Q.G	Is	Q.S	El-T	M	F	Q.G	Is	Q.S	El-T	M	F	Q.G	Is	Q.S	El-T	M	F	Q.G	Is	Q.S	El-T	M	
January	0.7	0.6	0.2	0.6	0.2	0.5	0.1	0.1	0.1	0.1	0.2	0.1	0.5	0.1	1.0	0.5	0.2	0.4	0.2	0.1	0.1	0.2	0.2	0.2	0.3
Febuary	0.6	0.5	1.1	0.1	0.3	0.5	0.1	0.2	0.4	0.1	0.4	0.2	1.0	0.6	0.8	0.8	0.8	0.8	0.3	0.1	0.4	0.2	0.3	0.3	0.5
March	0.7	0.8	1.6	1.5	1.5	1.2	0.2	0.3	0.5	0.2	0.4	0.3	1.2	0.6	0.6	0.6	0.5	0.7	0.2	0.3	0.1	0.3	0.4	0.3	0.6
April	0.7	1.6	0.7	1.1	1.3	1.1	0.3	0.4	0.2	0.5	0.3	0.3	0.7	0.8	0.9	1.8	0.8	1.0	0.3	0.3	0.5	0.1	0.2	0.3	0.7
May	0.5	0.8	0.6	1.2	1.2	0.9	0.1	0.2	0.3	0.2	0.5	0.3	0.9	0.9	0.9	1.2	1.8	1.1	0.2	0.2	0.1	0.1	0.1	0.1	0.6
June	1.4	0.6	1.3	1.3	1.6	1.2	0.1	0.1	0.1	0.1	0.1	0.1	0.8	0.7	0.6	1.9	1.0	0.8	0.1	0.1	0.1	0.1	0.1	0.1	0.6
July	2.0	0.9	0.7	0.1	1.2	1.0	0.2	0.1	0.1	0.1	0.1	0.1	0.9	1.2	0.5	0.5	0.5	0.8	0.4	0.3	0.1	0.2	0.2	0.2	0.5
August	0.6	0.4	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	1.4	1.0	0.7	0.7	0.6	0.9	0.3	0.2	0.2	0.3	0.1	0.2	0.4
September	0.1	0.1	0.4	0.4	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.7	0.5	0.5	0.3	0.5	0.5	0.3	0.8	0.3	0.4	0.2	0.4	0.3
October	0.7	0.4	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.8	0.2	0.2	0.3	0.2	0.3	0.1	0.2	0.2	0.3	0.1	0.2	0.2
November	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.9	0.5	2.5	1.4	1.1	0.1	0.1	0.1	0.2	0.1	0.1	0.4
December	0.2	0.1	0.1	0.2	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.6	0.9	1.1	0.9	0.7	0.8	0.1	0.3	0.1	0.3	0.1	0.2	0.3
L.S.D						0.45						0.1						0.52						0.14	0.352

F.= Fayed Q.S.= Quantra Shark Q.G.= Quantra Gharb Is.= Ismailia El-T.=El-Tall El-kebeer M.=mean

and December 97 and also, in October 98 (0.3 individuals/leaf).

The greatest number of *Orius* spp. was found in February 1997 (0.4 individual/ leaf) and in March, April and May 98, while the highest number of *Amblyseius* spp. was in September 97 and 98(0.4 individual/leaf). The results also indicate that the number of collected predators vary in their response to temperature and humidity.

Data in Table 7 reveal that both temperature and relative humidity exerted varied effects on the collected predators *S. gilvifrons* and *Orius* spp. showed negative correlation to each of temperature and R.H. throughout the two years; however, *S.gilvifrons*, which showed positive correlation in 98. While, *S. longicornis* and *Amblyseius* spp. showed positive and negative correlation to temperature and relative humidity, respectively throughout the two years .

Table 7. Correlation coefficient of predators and both temperature and relative humidity in Ismailia Governorate during 1997 and 1998.

Predator	Year	Temperature	R.H.
S.gilvifrons	97	-0.279	-0.489
	98	+ 0.6	-0.28
Orius spp	97	- 0.368	-0.227
	98	+ 0.264	-0.133
S.longicornis	97	+ 0.124	-0.464
	98	+ 0.052	-0.060
Amblyseius spp	97	+ 0.28	-0.227
	98	+ 0.088	-0.021

The effect of certain pesticides on the collected predators was tested to reveal their side effects on such non-target organisms

Data in Table 8 show that the tested insecticides and acaricides varied in their toxicity to the predators. Natural oil., M.peed and Chlorpirifos- methyl have a slight harmful effect, whereas Profenofos has an obvious harmful effect to *S.longicornis* and *Amblyseius* spp and moderate effect on *S.gilvifrons* and *Orius* spp. Methomyl and Pirimicarb have harmful effect on *S.gilvifrons* and *Orius* spp, moderate on Orius spp. and *S.longicornis* and slight effect on *Amblyseius* spp. Fenitrathion and metathion have moderate harmful effect on *S. gilvifrons*, slight effect on each of *Orius* spp and *S.longicornis* and moderate harmful effect on *Amblyseius* spp. Carbosulfan has moderate harmful effect on all the collected predators, except *Amblysieius* spp. that are slightly effected. Fungicides, herbicides and the nematicide are harmless to the predators except Promacarb and Diniconazol on *Amblysieus* spp. Oxyamyl show slight effect on *S.gilvifrons*.

Table 8. Side effect of certain recommended pesticides and concentrations against four predators collected from castor shrubs, *Ricinus communis* in Ismailia Governorate during 1997-1998.

Pesticide		Intitial toxicity				
		Conc. g or ml/l.water	*S. gilvifrons*	*Orius spp.*	*S. longicornis*	*Ambylsieus spp.*
Insecticides & Acaricides	Profenofos	3.75	3	3	4	4
	Primifos	3.75	4	4	4	2
	Fenitrathion	2.5	3	2	2	3
	Methyl	1.5	4	3	3	2
	Chlorpirifos methyl	10.0	2	2	2	2
	Carbosulfan	1.5	3	3	3	2
	Pirimicarb	0.75	4	3	3	2
	Metathion	2.50	3	2	2	4
	M-peed	1.5	2	2	2	2
	Natural oil	10.0	2	2	2	2
Fungicides	Metaloxyltcopper	15.0	1	1	1	1
	Promacarb	2.5	1	1	1	2
	Finarims	0.25	1	1	1	1
	Diniconazol	0.35	1	1	1	2
	Difinconazol	0.5	1	1	1	1
Herbicides	Metribuzin	1.75	1	1	1	1
	Haloxyfop-EE	7.5	1	1	1	1
	Fluazifop-butyl	7.5	1	1	1	1
	Sethoxydim	10.0	1	1	1	1
Nematicide	Oxamyl	5.0	2	1	1	1

Initial toxicity 1=harmless <50% 2=silghty harmful (50-79)

3= moderately harmful (80-99) 4= harmful > 99

DISCUSSION

The obtained results clearly indicate that castor shrubs can be considered a dominant and renewed source of the effective predators *S. gilvifrons*, *Orius* spp. *S.longicornis* and *Amblysieus* spp., which exist all over year, despite, their population density being affected by prevailing temperature and humidity.

Wilson *et al.* (1991) showed that natural enemies are able to suppress spider mite population and in May cases are effective in delaying the population build up. Salas- Aguiliar and Ethler (1977) confirmed that *Orius* spp can feed on a wide range of small arthropods, although it shows some preference to thrips.

Oatman *et al.* (1981) noticed that *Scolothrips* sp. is an important predator among 11 predators reported for *Tetranychus urticae* that causes severe damage on strawberry.

McMurtry (1982) reviewed that phytoseiidae are considered to be the most efficient and widely used natural enemy against the two spotted spider mite.

In view of the previous reports by other workers on the spectrum of activity and efficiency of such different predators locally found on castor plants; it was important to test the effect of the most used pesticides on their population. Different insecticides existed undesired effect on the predators, therefore, their use should be rationalized or avoided and the wind direction should also be observed when applied if the presence of such predators is to be secured. Such adverse effect, could explain the absence of these predators on the economic crops as different types of insecticides are usually applied. Moreover, castor plants can be recommended as a hidge or border from where wind is blowing. They can harbour host mites and predators as well, which can affect such mites in the neighboring fields.

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نباتات الخروع مصدر واعد لمفترسات الأكاروس

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تم حصر أربع مفترسات على أشجار الخروع *Ricinus communis* هي:
Stethorus gilvifrons (Coleoptera), *Scolothrips longicorns* (Thysanoptera)
Orius spp. (Heteroptera) and *Amblysieus* spp. (Parasitiformes)
خلال موسمى ١٩٩٧ و ١٩٩٨ في محافظة الإسماعيلية، وقد وجدت الأنواع الأربع طوال فترة الدراسة رغم تأثر تعداد هذه المفترسات بالحرارة والرطوبة النسبية.

لم توجد أي فروق معنوية في تعداد المفترسات *Stethorus gilvifrons*، *Scolothrips longicorns*, *Orius* spp and *Amblysieus* spp في مناطق المحافظة الخمس (فايد والقنطرة غرب والإسماعيلية والقنطرة شرق والتل الكبير) والتي أجريت فيها الدراسة، غير أن كل من *Orius* spp and *Stethorus gilvifrons* أظهر علاقة سالبة بكل من درجتى الحرارة والرطوبة في موسم ١٩٩٧، وعلاقة موجبة للحرارة في موسم ١٩٩٨، وأظهرت المفترسات *Amblysieus spp, Scolothrips longicorn* علاقة موجبة وسالبة لكل من الحرارة والرطوبة على الترتيب خلال موسمى الدراسة.

ولقد اختلفت تأثير المبيدات الحشرية والاكاروسية المختبرة على هذه المفترسات، في حين لم تظهر (٥ مبيدات فطرية، ٤ مبيدات حشائش ، ومبيد نيماتودي (فايديت) أى تأثير ضار على هذه المفترسات.

نوصى بزراعة أشجار الخروع كمحددات للمزارع ومصدات رياح كمصدر دائم للمفترسات التي تتواجد على مدار الموسم، كذلك يفضل عدم استخدام المبيدات التي تسبب ضرراً لهذه المفترسات في مكافحة الآفات على المحاصيل الاقتصادية لحمايتها ولإكثار أعدادها.