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Estimated damages due to the European starling *Sturnus vulgaris* in Béjaia's olives groves (North Algeria)

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ABSTRACT

Sturnus vulgaris was considered an invasive species in Algeria. Many farmers, notably olive growers and winegrowers, feared the arrival of this wintering migrant in northern Algeria. Aim of this study is to try to estimate the damage of this bird in an olive grove in order to know its degree of harmfulness. Experimentation was realised in olives mount on "little kabily" exactly in an olive grove of 10 hectares at Tazmalt (North-East of Algeria). Three trees are choose and considered as control trees. Another three trees are selected for observations. They are covered with threads. To identify trees we marked them with white paint. Olives and cores were collected manually under six sampled olives trees. It is performed every single week from October to January. The olives are picked manually and placed in paper bags. Finally the bags are transported to the laboratory where we proceed to the sorting. The calculations are then carried out from mathematical formulas proposed for the first time by my director of thesis. The results clearly show that the main pest in olive grove is the Starling (87.6 p.cent). The losses caused by this bird are quantitative. Insects coming in second position with 10.7 p.cent of the total losses. This does not preclude the fact that these insects cause other damages; those caused to the tree, meaning the olives attacked by insects remained on the tree. It seems important to note that beside the quantitative losses of olives generated by insects adds the qualitative losses, which are more important. Other species of birds (1 p.cent) are in third position. These results show that the European starling is a potential pest of olive groves. Preventive control should be considered before the arrival of starlings in winter. The anti-Starlings fight can not be positive unless a reasonable and rational combination of all the above methods are used.

KEYWORDS:*Sturnus vulgaris*, Olives grove, Damages, Tazmalt, European starling, Pest

INTRODUCTION

The Starling has always played with Mediterranean olives [1]. For this, we chose an olive grove to estimate the damage caused by this bird. Other authors have studied this species, including its damage. We can cite in an olive grove at Cap-Djinet [8,15], at Boumlih [18] and in Mitidja [19].

Algeria is a country with an agricultural vocation but encounters major problems, the harvest losses of which remain the most worrying problem. Madagh [17] estimated the damage of sparrows to cereal crops which is considered a basic crop in Algeria. Olive growing is also important and, throughout the country, this agricultural activity is of particular interest in recent years; 1,000,000 ha of new olive orchards have been programmed until 2015 [23]. According to the same authors, in the only wilaya of Batna 15,000 ha of new vegetation are planned between 2010 and 2015 of which more than 10,000 ha are already realized. The damage caused by the various pests (invertebrates and vertebrates), in particular those caused by starlings, are important

but hitherto very little estimated. These birds are now considered as invasive species because more and more of them are wintering in northern Algeria [5]. These pests are considered important in agriculture because of the damage caused during their wintering and also by their noise nuisance, their disturbances and the emotional impact caused by the spectacular aspect of the groupings of starlings.

The very first element necessary for the development of a coherent management of the winged predators is a perfect knowledge of the damage. This evidence is not so simple to pin down and few countries have so far managed to make a complete assessment [9]. This study is considered in Algeria, as a first attempt to quantify the damage of the European starling in olive growing.

Study Area:

The study of the estimated damage caused by Starling *Sturnus vulgaris* L. in the Bejaia region is made in the pilot farm Abderrahmène MIRA located east of the Daira of Tazmalt (237m of altitude, 4°25' E., 36°23'N.). It is framed by two chains, to the east by the chain of Bibans and west by the great chain Djurdjuran [2]. The soil of the study station has a silty-sandy texture. The maximum temperature for the year of study in Augustreached24.8° C. The lowest temperature recorded in February was 10.2° C. The total rainfall was 874.8mm at Tazmalt for 1996 [21]. Alight wind blows and dry in the region, makes the breath of the sirocco is felt during warm although it can occur even in winter but its effects are mitigated by cold.

Methodology:

We chose a plot of 10 hectares of olive trees. For this choice we relied on the homogeneity of the variety of olive that is Chemlal and accessibility to the orchard.

Three trees are selected in a random manner designated by T1, T2 and T3.These are considered as control trees. Three other trees A1, A2 and A3 are trees selected for observations. They are covered with threads. To identify trees we marked them with white paint.

The collection of the olives is made in the circle projected by the leaf crown of the tree on the ground. It is performed every single week from October to January. At every visit, all possible observations concerning climate factors, farming practices such as plowing and checking the ripeness of the olives are recorded in an observation notebook. The olives are picked manually and placed in paper bags. Each bag bears the number of the tree A1, A2 and A3 or T1, T2 and T3. Finally the bags are transported to the laboratory where we proceed to the sorting.

RESULTS AND DISCUSSIONS

The variety of olives chosen for the present study is the Chemlal variety. It has been observed that the varieties of olives most consumed by starling are oleaster *Olea oleaster* and the variety Chemlal [23]. According to these authors, the fruits of the oleaster are the most consumed. 52 % of the fruits consumed in Batna by the starling are oleasters followed by the olives of the Chemlal variety with 45 %. The Starling, commonly called "Ezzerzour" in our country is considered as the most dreaded enemy of the olive tree. Although it is not settled in. It's winter visits often causes considerable losses to the growers. These losses fall into three categories: Olives are eaten by starlings and the cores are then discharged to the ground under the same trees; Healthy olives fall under these trees too. Unfortunately, under the weight of the numerous starlings on the tree; A portion of olives is not found under the trees. It is probably taken by the starlings and consumed elsewhere, probably at the dorms.

From these three categories we can assess the damage caused by starlings that summarized in three amounts:

The amount Qe cores rejected on the ground by the starling.

The amount Qse healthy olives fall to the ground because of this bird.

The amount Qpe olives collected by the starling.

Since the action of the starling is considered void under the observed trees set with nets, the last two quantities are calculated only on the uncovered witnesses trees.

The amount Qeis not zero considering that a negligible quantity of cores are collected under the trees; starlings that got through the nets are caught by the farmers.

The results are shown in the following table in quantities of lost olives due to the starling, for all six observed trees, throughout the experiment.

It's emerge from Table 1 that the total quantity of olives lost to the starling is less important or negligible in the observed trees with nets, comparing to the witness trees without net. This amount ranges from 0.00 kg to 0.02 kg for the covered trees A1, A2 and A3 while it is between 59 kg and 71.2 kg for the witness trees T1, T2 and T3.

Choubane [8]estimated about 11.2 kg of losses due to birds, throughout the olive orchard, specifically due to the starling. Unlike our results, this author points a greater quantity of 26.9 kg of fruits and kernels picked

under the trees with nets; against 15.6kg for the trees without nets. According to him, fallen fruit under a covered tree are the results of natural fall, while those fallen under a uncovered tree have dual origin, nature and avian.

In this event did we not neglect the effect of the weather and the insects?. Having observed much confusion in the work of Choubane [8] we believe that a reasonable discussion is not possible with these results.

Madagh [15] obtained a quantity of 0.5 kg per tree, that he thinks to be taken by birds or 1.8 cwt for the 329 Chemlal variety of trees in the station. This amount resulting from the difference between the quantities of olives and cores collected under a covered tree, and those collected under an uncovered tree.

The hypothesis used by this author is in contradiction with the following reasoning : The fruit carried by an uncovered tree are subject to the action of climate factors, the tree's physiological factors, and that of insects on one hand. And that of birds on the other hand. While the fruit on a covered tree are not affected by the action of the birds; So by a simple subtraction we obtain the amount of damaged fruit by birds.

This reasoning has allowed us to estimate the amount of healthy olives fallen because of starlings witch is 1.3 cwt / ha in total. This amount is not assessed by any of the authors above (Tab. 2).

The quantity of olives taken by the starling Q_{pe} is estimated by another hypothesis proposed by Pr. Doumandji. This amount is 30.5 cwt / ha (Tab. 2). This is the biggest amount among other amounts of olives lost to the starling. It alone represents 95.4 p.cent of the total of these quantities. The category of healthy olives Q_{se} represents only 4.2 p.cent of the same amount. The amount of cores rejected on the ground by the starling Q_e is even more negligible (0.1 qtx/ha) comparing to that taken by that bird. It represents only0.4 p.cent of total quantities of olives lost to that Sturnidae (Fig. 1).

The category of cores rejected by the starling can not be assigned to another bird, these cores are cleaned to a very specific way by this bird[12,10].

The other two categories are attributed to the starling too, neglecting the contribution of other bird species. This is explained by the fact that this contribution is very small, especially as the number of species that visit the olive orchard to consume its fruits are low in number compared to the starling during the period we estimated the damage in the study site, such as Robins *Eritacus rubecula*, the Blackcap *Sylvia atricapila* and the Sparrow *Passer* sp.. So, the healthy olives fallen to the ground from the uncovered trees are under the effect of the weight of the numerous starlings.

The category of olives taken is also attributed to the starling only. Other species may also remove and take whole fruits. These include *Sylvia atricapila*, *Turdus merula*, *Pycnonotus barbatus* and *Turdus philomelos*. Naturally, the impact of these species is very low compared to the action of *Sturnus vulgaris* [6,12,10].

Indeed, according to Pagnol [22] and De La Blanchère [10], when the sunset, starlings down as a big cloud in the olive orchards. They rapidly take some fruit, usually two or three, in each leg and one in the spout. They then fly to a base of rocks to store their goods. They then return rushed for at least three or four trips yet. The other avifauna species are not known for this kind of behavior. For this reason this olive grove damage category is assigned to the starling only. Finally, in the light of these results, the starling appears more redoubtable than the other bird species for the olives. But before we hurry to conclusions, it seems important to ask the question: Is the other avian species as responsible as the starling to the losses generated in the this olive grove?.To answer this question we assessed the damage category caused by birds. It is also important to know if these species are interested in olives or if it is the insects that attract them. For this we estimated the insect damage. We have found fruits attacked by both insects and birds. This enabled us to evaluate another damage category (Fig. 2).

It is clear that Starling is the main responsible for losses the olive grove (87.6 p.cent), followed by insects with 10.7 p.cent of the total losses. Other species of birds (1 p.cent) are in third position.

These results show that the main pest in olive grove is the Starling. The losses caused by this bird are quantitative. Insects came in second position. This does not preclude the fact that these insects cause other damages; those caused to the tree, meaning the olives attacked by insects remained on the tree. It seems important to note that beside the quantitative losses of olives generated by insects adds the qualitative losses, which are more important. Insects such as the Olive fly *Dacus oleae* which is most common in the orchard and also throughout the region do not cause as much quantitative losses as it causes qualitative ones. They deteriorate the taste of the oil extracted from olives by making it more acid than the oil extracted from healthy olives subjected to storage [14].

This storage aim mainly to the phenomenon of alternation in the production, which is one of the features of the olive tree. Olive growers keeps the olive oil during low production years, maintaining olive oil for periods that can reach up to seven to ten years. Therefore, it is interesting to assess the overall losses on an economic point of view.

A quantity of 21kg olives can produce 1 liter of oil. This varies depending on the olives quality. The olives are not all the same. Some are rich in olive oil and other poor (Haddad, pers. com.). Variety Chemlal is considered a variety moderately rich in oil. So the amount of 21kg does not apply to all varieties but only to the variety studied.

The average harvest on one hectare of olive trees is 8640 kg at the station during this study. This gives an

average production of 411 liters of oil per hectare.

The total quantity of olives lost per hectare is 3643 kg, a loss of 173 liters of oil per hectare.

The starling causes alone an average loss of 151.5 liters of oil, while insects cause only 3.2 liters. The other birds cause a smaller loss of 0.3 liters of oil.

Therefore, it is important to first prevent the arrival of the Starling by installing nets on trees. However, this method is a very expensive in one hand, and on the other hand, not feasible in mountains, while 80 p.cent of Algerian olive grove is located in mountains.

It is interesting to prevent the arrival of these pests by conducting an early harvest. This procedure is currently practiced by the growers (fellahs), but only for olive trees producing preserved olive. Another method of control can be considered. It is that of the optical or sound scaring.

These two methods are on the one hand, more convenient for small groves than for large olive orchards that we must protect. In the other hand a habituation phenomenon appears. According to De La Grange et Reille [11]the Starlings are famous for their hability to quickly learn to thwart traps, set for them, or get used to the scarecrow, firecrackers and other systems used to frighten them. Rifle shooting is another method of struggle[12,16,9]. This method of hunting is also very little used during recent years.

According to Gramet [12], the destruction of the dorms is a good way to fight against these birds. But starlings often use *Ficus* and even less *Eucalyptus* as dorms[20]. If the destruction of these sites reduced their number, it does not prevent it to settle on new sites. This leads us to proceed again to the destruction of their dorms. But these repeated destruction reduces the number of trees used as dorms or as perches by beneficial species such as raptors.

The use of natural enemies such as starlings prey can contribute to reduce their number. Among these species we can mention the Barn owl *Tyto alba*. Baziz *et al*. [3] found 31 individuals of starlings among its prey in the dam Boughzoul. Khemici *et al*. [13]highlights 10 individuals starlings among the prey of Owl at Biskra. In sub-urban environment, such as the National Institute of Agronomy at El Harrach, 10 starlings individuals are among the prey of Tawny Owl *Strix aluco* and 27 individuals among the prey of the Barn Owl *Tyto alba* [24]. Bendjaballah *et al*. [4]reported one single individual of Starling among the prey of the Little Owl *Athene noctua* in the region of the dam Boughzoul. We can also consider the Kestrel *Falco tinnunculus* as a starlings eater, since 13 individuals were found in the study of his diet [7]. It would be interesting to protect these predatory species, installing their nesting boxes, using pesticides rationally and promoting perches tree planting nearby olive groves.

Finally, we can say that the anti - Starlings fight can not be positive unless a reasonable and rational combination of all the above methods are used.

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Table 1: Quantities of olives lost due to the starling on the trees

Trees	Covered tree A_1	Covered tree A_2	Covered tree A_3	Witness tree T_1	Witness tree T_2	Witness tree T_3
Dates	q_{et1} (kg)	q_{et2} (kg)	Q_{et3} (kg)	q_{et4}(kg)	q_{et5}(kg)	Q_{et6} (kg)
19 X 1996	0.00	0.00	0.00	80.97	83.96	69.97
26 X 1996	0.00	0.00	0.00	80.99	83.97	69.97
2 XI 1996	0.00	0.00	0.00	80.97	83.97	69.93
9 XI 1996	0.01	0.00	0.00	80.76	83.85	69.82
16 XI 1996	0.00	0.00	0.00	80.78	83.74	69.80
23 XI 1996	0.00	0.00	0.00	80.69	83.72	69.80
30 XI 1996	0.00	0.00	0.00	80.98	84.00	69.99
7 XII 1996	0.00	0.00	0.00	80.60	83.30	69.41
14 XII 1996	0.00	0.00	0.00	79.93	82.52	68.90
21 XII 1996	0.00	0.00	0.00	78.97	81.86	68.70
28 XII 1996	0.00	0.00	0.00	78.72	81.60	67.77
4 I 1997	0.01	0.00	0.00	78.57	81.37	67.51
11 I 1997	0.00	0.00	0.00	78.35	81.31	67.45
Total	0.02	0.00	0.00	69.27	71.16	59.02

q_{et1}, q_{et2}, q_{et3}, q_{et4}, q_{et5}, q_{et6} are the quantities of lost olives due to the starling under the trees A_1, A_2 , A_3 , T_1, T_2 and T_3.

Table 2: Quantities of lost olives to the Starling in quintals per hectare

Release dates	*Categories of damage*			
	Q_e (qtx)	Q_{se} (qtx)	Q_{pe} (qtx)	Total (qtx)
19 X 1996	0.00	0.01	37.57	37.58
26 X 1996	0.00	0.00	37.59	37.59
2 XI 1996	0.00	0.00	37.58	37.58
9 XI 1996	0.00	0.00	37.50	37.51
16 XI 1996	0.01	0.06	37.43	37.49
23 XI 1996	0.01	0.04	37.42	37.47
30 XI 1996	0.00	0.00	37.59	37.60
7 XII 1996	0.01	0.15	37.17	37.33
14 XII 1996	0.02	0.13	36.87	37.02
21 XII 1996	0.02	0.16	36.54	36.73
28 XII 1996	0.02	0.26	36.22	36.49
4 I 1997	0.02	0.26	36.11	36.39
11 I 1997	0.02	0.26	36.05	36.34
Total	0.13	1.33	30.45	31.91

(Qe, Qse and Qpe are respectively the quantities of cores rejected on the ground by the starling, healthy olives fallen because of starlings and finally the quantity of olives collected by this bird).

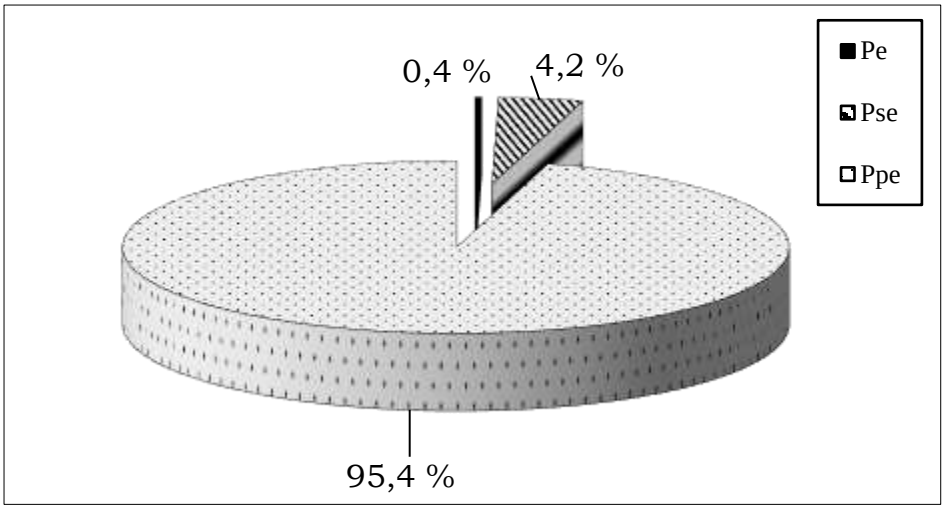

Fig. 1: Percentage of damage categories due to the starling in a hectare of olive trees

(Pe, Pse and Ppe are respectively the percentages of cores rejected on the ground by the starling, healthy olives fallen because of starlings and finally the percentage of olives collected by this bird).

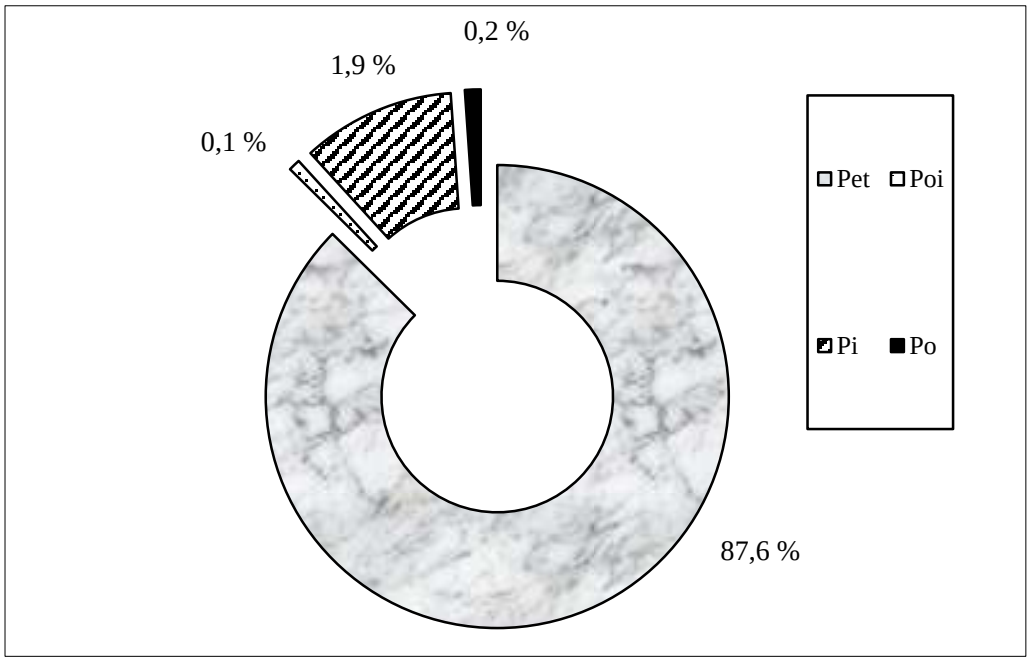

Fig. 2: Percentage of damage categories in a hectare of olive trees

(Pet, Poi, Pi and Po are the percentages of damage due respectively to Starling, to both birds and insects, to insects only and finally to birds only).

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