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Vertebrate pests damage to agricultural holdings in Palestine

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Abstract
Humans and vertebrate pests have coexisted in different places including Palestine since thousands of years ago. Some vertebrate group populations compete with humans for resources, damage human's agricultural holdings either plantations or Animal production barns. This work is an attempt to prepare the first Checklist of vertebrate pests' damage to Agricultural holdings in Palestine. Our finding showed that twenty-five vertebrate species are reported to be of economic significance to the Palestinian agriculture sector, 17 of which are mammalian, 8 avian and 5 reptilian Species. The study showed that the most successful and applicable methods of control were the use of carbamate poisons like Temik, Lannate and Ro-Stop 90. and fences, where the percentages of using such methods were 47% and 34.3% for poisons and fences, respectively, while as using traps was much lower than other methods and their use did not exceed 2.8%.
Our finding showed that the damage parts or types were not only to orchard trees or field crops but also to other agricultural holdings, equipments; tools, such as irrigation pipes, plastic sheets etc. Our findings drove us to conclude that Vertebrate pests damage to agricultural holdings in Palestine, is due to a number of factors, ranging from natural habitat shrinking and urbanization encroachment, to Israeli segregation wall and the subsequent damage left behind its construction.

Keywords: Wildlife, vertebrate pests, damage, plant & animal productions, Palestine

1. Introduction
Palestine is a country with a diverse and large Vertebrate population [1]. Vertebrate damage in agriculture involves a variety of crops and species of animals, primarily birds, and rodents. Rodent's direct losses occur typically at planting and sprouting, during their milk or dough stages (for grains), just before harvest, or during postharvest storage conditions [2].
Estimation of prey and postharvest losses ranged from 30% and more in Africa and other developing countries. The losses or damages to agriculture are usually caused by a diverse set of agents/factors including animal species, pathogens, invasion weeds, and also by unfavorable climatic conditions.
Small mammals such as rodents are of considerable importance as agricultural pests [3], since they can cause considerable damage to the destruction of water pipes, furniture, agriculture plantation, and other amenities systems, this ability to do so is due to the fact that their front teeth continuously grow throughout their lifetime.
Agricultural losses to birds are not as well-documented as those to rodents. Various species of parrots, parakeets, blackbirds, weavers, doves, seed-eaters, pheasants, and waterfowl are among the types of birds known to cause damage to agriculture around the world [3].
In Palestine, the family Canidae, contains 6 species, which occur in the wild [4-6], of these, three wild species: wolves, golden jackals and red foxes, plus feral domestic dogs, occur in numbers large enough to pose an agricultural damage [7]. Jackals are responsible for a variety of agricultural problems in Palestine including damage to plastic drip irrigation pipes, damage to various fruits and vegetables, and depredation on poultry and mammalian livestock [7].
The fox has been implicated mainly in damage to plastic drip-irrigation pipes, various fruits, and vegetables, and depredation on poultry [7, 8].
Wolves are viewed as an enemy to growers raising livestock [9]. The Levant vole, *Microtus guentheri*, is a pest of most of the field crops in Palestine involved in mass depredation of field crops and orchards [7]. Serious economic damage is caused to cereals, fodder crops, and certain vegetables

2. Material & methods

We studied vertebrate pests of Palestine, the West Bank, and Gaza Strip governorates, an area of about 6,220 km² [10]. The scope of this study includes all land vertebrates of these governorates. We decided to include only those wild Birds, known to reproduce in nature. However, we excluded migrating birds that usually pass over Palestine or overwinter in it and have recently begun to nest here. These have been analyzed elsewhere [11, 12]. Several sources of information were used, for both local species and as worldwide references, regional experts' overview of this phenomenon.

3. Results & Discussion

The list of vertebrates presented in Table 1 consists of Species that are important regarding damage to Agriculture, plant and Animal productions in Palestine. Damage to agricultural tools; and or equipment also considered in our findings. Based on table 1, there are 25 vertebrate pests Species of which 17, (57%) are mammalian, 8, (27%) avian and 5, (17%), are reptilian as shown in Fig 1.

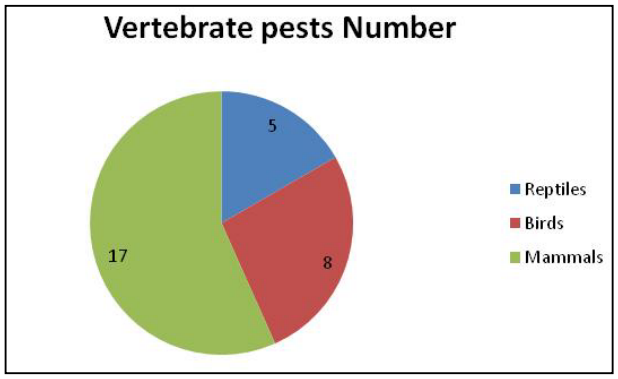

Fig 1: Distribution of different vertebrate pests in percentage

The damage quantity ranged from small negligible to complete loss of the crop, mainly like the case of Wild Boar. The study showed that the most successful and applicable methods of control were the use of carbamate poisons like Temik, Lannate and Ro-Stop 90. and fences, where the percentages of using such methods were 47% and 34.3% for poisons and fences, respectively, while as using traps was much lower than other methods and their use did not exceed 2.8%.

4. Conclusion

Vertebrate pests damage to Agricultural holdings in Palestine, is due to a number of vertebrate species inhibiting the Palestinian land, causing damage quantity ranged from small negligible to complete loss of the crops, and their ability to resist the success of applicable methods of control ranged from 97.8% to 53%.

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