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Comparative studies on the effect of camphor leaves and green algal extracts against house sparrow bird *Passer domesticus niloticus* (Passeriformes:Passeridae) under laboratory conditions

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Abstract

The avicidal repellent effects of camphor plant leaves and green algal extracts were studied under laboratory conditions, crude plant and algal extract when solved by ethanol and hexane. For the free and one-choice feeding test, the ethanol and hexane extracts were coated with sorghum seeds to introduce them as bait to target birds in different concentrations and were tested to clarify their repellent activity against house sparrow bird *Passer domesticus niloticus* (Passeriformes: Passeridae). The results proved that ethanol extract was more effective than hexane. The assessment of phytochemicals of camphor extract indicated that sterol and triterpenes, phenols, anthraquinone, saponin flavonoid, alkaloid carbohydrates, and glycosides were found in high amounts, and they may be responsible for the avicidal repellent effect observed in the present study. Therefore, camphor could be used as an avicide repellent more than algal extract.

Introduction

Agronomic crops provide food, feed grain, oil, and fiber for domestic consumption and are a major component of U.S. export trade. Crop damage caused by birds, particularly cereal grains, is a serious problem worldwide. In African countries, like Egypt, with a limited cultivated area, food insufficiency is the major problem that faces the overgrowing human population. The Egyptian government started to find a solution to this problem by reclaiming desert areas. Recently in Egypt, the house sparrow, *passer domestics niloticus*, and crested lark, *Galerida cristata*, are considered the most economic vertebrate pests in agricultural land, particularly in the newly reclaimed areas. Currently, these pests are mostly controlled chemically by using insecticides and synthetic avicides such as repellent compounds such as Methiocarb (Rachana and Mukesh, 2020 El-Deeb, 1990 and Khidr, 2001). The house sparrow bird *Passer domesticus niloticus* (Passeriformes: Passeridae) is considered to be one of the most important agricultural pests in cultivated areas. Bird damage to cereal crops represents economic losses of 5-10% of production, Omar (2019). Birds consume many crops, especially cereal grains such as wheat and sorghum (El-Deeb, 1991) reported that birds damage the ripening stages of wheat and sorghum. However, bird control is more difficult because many birds are protected by international laws. Bird-repellent methods are safe for the environment because they are based on the physical and chemical sense of target pests. The work aims to introduce some suitable, economical, and safe techniques to control house sparrow *P. domesticus niloticus* bird.

Materials and methods

Tested species:

English name: Camphor
Latin name: *Eucalptus glbulus*
Family name: Myrtaceae
Part tested: Leaves
Source: Giza

Camphor leaves

English name: Sea lettuce
Latin name: *Ulva Lactuca*
Family name: Ulvaceae
Division: Chlorophyta
Source: Abouquri in Alexandria

Green algae

1. **Preparation of camphor leaf plant extract:**

The activity of the extract depends on the solvent used and the parts of the plant (Muhamad *et al.*, 2019). The tested plants were extracted according to Freedman *et al.* (1979) with minor modifications. Leaves of the camphor plant were dried at room temperature, and then ground into powder; afterward, 150 grams of the powder were extracted three times successively with two solvents varied in their polarity. Hexane and ethanol. The ground plant parts were macerated, and the homogenate was allowed to stand for 72 hrs. The extracts were filtered through anhydrous sodium sulphate, and then the filtrates were combined and rotary evaporated at temperatures 50 °C maximum. The crude extracts were weighed and kept in a deep freezer until use.

2. Preparation of algal extract:

The tested macroalgae was extracted according to Michalak and Chojnacka (2014) as follows: One hundred and fifty grams of air-dried samples were extracted with ethanol and hexane. It dried well, grounded into powder, then extracted three times successively with the two solvents, hexane and ethanol. The solvent was removed by a rotary evaporator, and the residue was dried, weighed, and kept in a deep freezer until use.

3. The bird species:

Acclimatization and adaptation procedure

Laboratory trials were conducted against the house sparrow bird passer *domesticus niloticus*. Birds were trapped by "Paratrap," adapted from the MAC trap. Birds were transferred directly from the aviary (2.4 x 2.4 x 3.6) to the laboratory. All birds had access to water, grit, and whole grain sorghum. Birds were housed in a communal wire mesh hiding cage (53 x 25 x 36 cm) with no more than two birds/cage for two weeks at room temperature before testing and allowed free access to the same diet and water for acclimatization (Koehler *et al.*, 1987).

4. Repellency studies

4.1. Repellency of *Eucalptus glbulus* leaves and *Ulva lactuca* extracts to house sparrow *Passer domesticus niloticus*:

4.1.1. The non-choice method under laboratory conditions:

The non-choice method described by Bullard and Shumake (1979), modified by Shefte *et al.* (1982), and by El-Danasory and Abouamer (2012) was adopted. These methods are based on the original method of Starr *et al.* (1964) and Schafer and Brunton (1971). Five individually caged birds were used for each of the crude extractions of extract. Each bird was offered 120 grains untreated, and the consumed diet was assessed daily. Then the same pretested birds were offered 120 grains of coated sorghum with one of the tested extracts for another four successive days. The consumed diet was calculated daily during the pretreatment and post-treatment periods. Khidr and Abo-Hashem (2019). The repellency potential was calculated by using the following equation according to Mason *et al.* (1989).

$$\text{\% acceptance} = \frac{\text{Averaged consumed treated grains}}{\text{Averaged consumed treated grains} + \text{Averaged consumed untreated}} \times 100$$

Birds with food acceptance less than 40% are considered repelled.

4.1.2. Free-choice method:

L. l the two-choice method test described by Russell *et al.* (1989) was followed. Five birds were individually caged and used for one crude of the tested camphor Leaves plant and green algae extracts.120 grains from treated and untreated sorghum grains were separately exposed to each bird daily in two small Petri dishes for four successive days. The position of the two dishes was alternated and changed daily to prevent any bias to location. Consumed treated and untreated sorghum grains were recorded every day. The repellency potential was calculated according to the previous equation.

5. R_{50} determination:

R_{50} value means that 50% of the population of birds consumed less than half of the offered treat food. Laboratory trials were conducted to determine R_{50} for extracts that were found to have a repellent effect on birds, such as camphor and green algae extract. R_{50} values are calculated for four tested extracts using the Engeman *et al.* (1989) method. Five caged birds of the house sparrow, *p*. domestics, were used individually using untreated sorghum grains for successive four days for acclimatization, then offered treated grains with the extract to each one for 24 hrs. Birds that consume less than 50% are considered repellent. The percentage of consumed food by repelled birds that had treated grains was determined. Estimated R_{50} values were determined according to Weil (1952), Gabr (2005), and Khidr and Abo-Hashem (2019).

6. Toxicity study:

6.1. LD_{50} determination:

LD_{50} values were calculated according to Thompson and Weil (1952). The term LD_{50} refers to the estimation of the amount of poison that, under control conditions, will be a lethal dose to 50% of large, tested birds of a particular species; it is expressed in milligrams of substance being tested per kilogram of animal body weight (mg/kg). Laboratory trials and serial doses of each tested extract were done to determine LD_{50} values which showed a repellent effect on house sparrows. *P. domesticus* niloticus camphor and *Ulva* extracts the bird was exposed to a dose 0.5% of its weight, then individually caged, then provided with water and food, and observed for 6 hrs. to observe the sign of toxicity and 24 hrs. for mortality.

6.2. Bioactive component screening of the camphor and green algal extracts:

The studied camphor L. and green algae were extracted for phytochemical analyses and showed the following constituents:Carbohydrates test and glycosides according to Karawya and Abd El-Wahab (1975); Velavan. (2015) and Ramalingam *et al.* (2021), phenolic glycosides and anthraquinone tests according to Balbaa (1981). Cardic glycosides according to Baljet *et al*. (1918) and saponin glycosides according to Wall *et al*. (1964).

Sterol and triterpenes test: Sterol and triterpenes were determined. Tannin was estimated by Clause (1961). Flavonoids were estimated by *Venkatarmann* (1962) Alkaloid was estimated according to Romo (1966).

Results and discussion

1. Repellency screening test:

The effects of camphor leaves and green algal extracts as house sparrow bird repellents were determined under laboratory conditions using one and two-choice feeding methods. They were extracted with hexane and ethanol solvents.

-Extracts repellency using one and two-choice methods:

Data in Table (1) and Figure (1) show the repellency potential of camphor and green algae extracts to the house sparrow, *P. domesticus*, using the one-choice method. Using hexane and ethanol extracts of each revealed that camphor leaves have repellent effects more than algal extract. The sorghum seeds treated with camphor extract were accepted by the bird at 7.1 with 37% acceptance in the case of hexane and ethanol extracts, respectively. The algal extracts showed a repellent effect against the house sparrow, *P. domesticus* birds, with 48.1 and 47.50% acceptance in the case of hexane and ethanol extracts, respectively. The same trend was observed when these extracts were tested using a two-choice feeding method. Repellent compounds that, when added to a food source, act through the taste system to produce a marked decrease in the utilization of that food by the target species, Roger (1985) separated repellents into two classes primary, where the animai reacts to the taste of the repellent alone, and secondary (conditional aversion), where the animal uses the taste of the repellent as a cue later adverse effect. Many investigators have reported the phenomenon of repellency action of some tested compounds against bird species (Rachana and Mukesh, 2020). Finally, it is needless to say that natural repellents are preferred over synthetic ones for their safety, selectivity, degradability, applicability, and cost-effectiveness. They were repelled from feeding on a crop without killing them. This bird-repellent technology is very simple and easy to transfer to farmers. However, the physiological and biochemical mechanisms responsible for their repellency are still to be thoroughly investigated (Khidr and Abo-Hashem, 2019 and Khidr, 2006).

Table (1): Repellency potential of camphor plant and green algal (*Ulva lactuca*) extracts against *Passer domestics nilotticus* under laboratory conditions using one-choice feeding methods.

Extracts	Hexane extracts			Ethanol extracts		
	Daily average no. of consumed sorghum grains/ bird		% Acceptance	Daily average no. of consumed sorghum grains/ bird		% Acceptance
	Pre-treatment	Treated		Pre-treatment	Treated	
Camphor	96.0	3.7	7.1	94.8	56.5	37.3
green algal (*Ulva lactuca*)	91.0	84.2	48.1	82.11	74.30	47.50

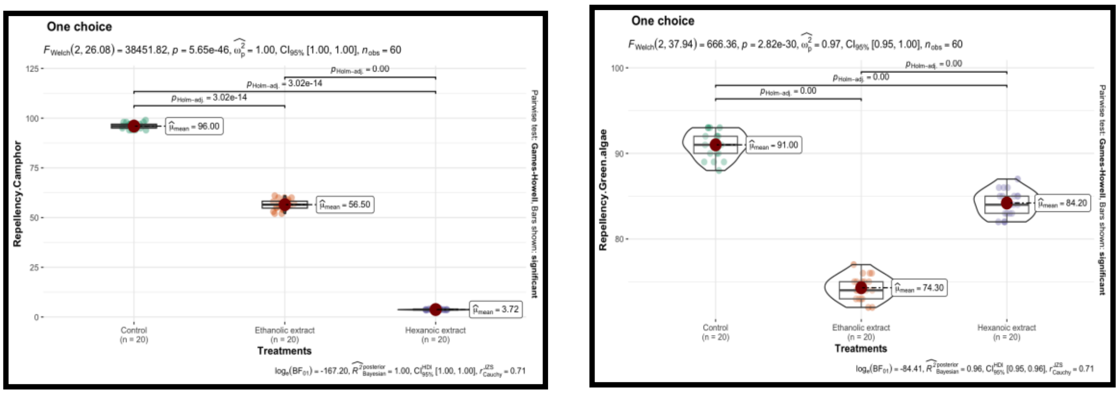
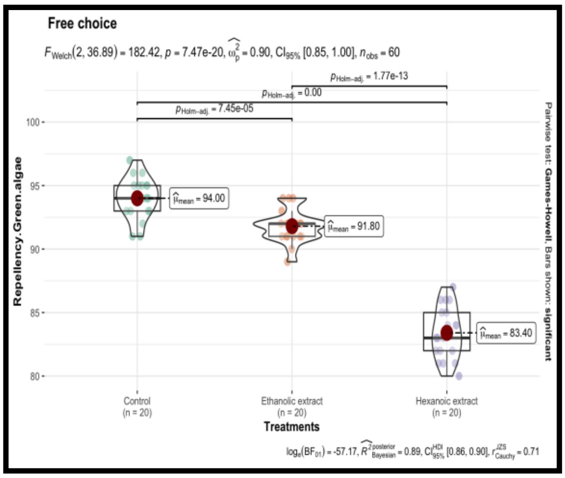


Figure (1): Repellency potential of camphor plant and green algal (*Ulva lactuca*) extracts against *Passer domestics nilotticus* under laboratory conditions using one-choice feeding methods.

Table (2) and Figure (2) illustrate the efficiency of the camphor plant and algal extracts using free choice feeding methods with hexane and ethanol. Hexane extract of camphor results in 9.8 and 53.0%, respectively, while ethanol extract was 11.7 and 48.9%, respectively.

Table (2): Repellency potential of camphor leaves and green algal extracts against house sparrow, *Passer domesticuus nilotticus* under laboratory conditions using free choice feeding methods.

Extract	Hexane extracts			Ethanol extracts		
	Daily average no. of consumed sorghum grains/ Bird		% Acceptance	Daily average no. of consumed sorghum grains/ bird		% Acceptance
	Untreated	Treated		Untreated	Treated	
Camphor	82.3	9.0	9.8	80.5	10.7	11.7
Green algae	74.0	83.4	53.0	95.9	91.8	48.9



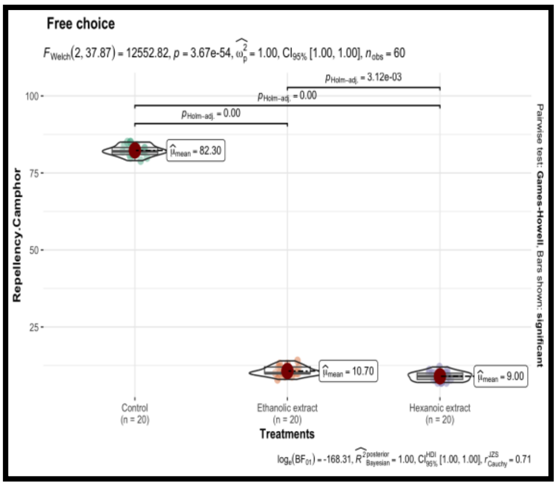


Figure (2): Repellency potential of camphor leaves and green algal extracts against house sparrow Passer *domesticuus nilotticus* under laboratory conditions using free choice feeding methods.

2. R_{50} and LD_{50} determination for camphor and green algae extracts:

From studying, it is obvious that both extracts have a repellent effect against house sparrows, while camphor plant extract is more repellent than *Ulva lactuca* therefore, R_{50} and LD_{50} were determined.

2.1. R_{50} determination:

The data in Table (3) illustrates the camphor plant extract effect values; the results show the difference that hexane is greater than ethanol, and the R_{50} of ethanolic and hexanoic in camphor leaves are between 0.271 and 0.128 mg/kg, respectively. While in the ethanolic green algae extract was 2.16 mg/kg seeds.

Table (3): Repellency of bioactive camphor plant extracts to house sparrow *Passer domestics niloticus* R_{50} (mg/kg seed) and Lethal effect mg/kg.b.w

Plant	Solvent	R50(mg/kg seed)	LD_{50}mg/kg.b.w .
Camphor leaves	Ethanol	0.271	0.920
Camphor leaves	Hexane	0.128	1.260
Ulva lactuca	Ethanol	2.16	5.14
Ulva lactuca	Hexane	-	-

2.2. LD_{50} determination:

The toxic effects represented as LD_{50} of bioactive plant extracts against house sparrows in Table (3). LD_{50} of camphor ethanol and hexane extract were 0.920 and 1.260 mg/kg b. wt., respectively, and the LD_{50} for ethanolic green algae extract was 5.14 mg/kg b. w. Laboratory trials and serial doses of each tested extract were done to determine LD_{50} values, which showed a repellent effect on the house sparrow, *P. domesticus niloticus.* Camphor and Ulva extract the bird exposed to a dose 0.5% of its weight, then individually caged, then provided with water and food, and observed for 6 hrs. to observe the sign of toxicity and 24 hrs. for mortality.

3. Phytochemical screening for camphor plant and algal extracts:

By testing the four camphor plants and green algae extracts, their phytochemical constituents were determined. The following constituents are present in Table (4) sterol and triterpene, phenolic glycosides, tannins, anthraquinone glycoside, saponin, flavonoid, cardic glycosides, alkaloid, and carbohydrates and glycosides in the extracts.

Data indicated that the following groups were detected in camphor, Sterol, and triterpenes, phenolic, anthraquinone, saponin flavonoid, alkaloid carbohydrates, and glycosides in high amounts in the ethanolic and hexanoic extract. While phenolic glycoside, cardic glycoside, and saponin are traces, and it is free of tannins, glycoside, and flavonoids. On the other hand, *Ulva lactuca* extract has sterol and triterpene, phenolic glycosides, carbohydrates, and glycosides. It is free of anthraquinone glycosides, saponin cardic glycosides, and alkaloids. This was pronounced with both camphor leaves and green algae, as well as both solvents used (Hexane and ethanol) for extraction. These data indicate that sterol and triterpenes, anthraquinone, flavonoids, alkaloids, and carbohydrate and glycoside may be responsible for bioactivity on the studied bird's avicides. Numerous bioactive compounds were found in various extracts that were examined in this study. Based on these findings, variations in the toxicity and repellency of green algae and camphor plant extracts may result in different types and amounts of bioactive compounds in these extracts, which is consistent with Khidr (2001), Hadear (2019), Abo-Hashem (2013), and Karuppannan *et al.* (2022).

Table (4): Phytochemical screening (Qualitive analyses) for camphor and green algae extracts.

Phytochemical parameter	Extract with hexane		Extract with ethanol	
	Camphor L	Ulva extract with hexane	Camphor L	Ulva extract with ethanol
Sterol and triterpene	+++	++	+++	+
Phenolic glycosides	±	+	±	+
Tannins	++	+	++	-
Anthraquinone glycoside	+++	-	++	+
Saponin	±	-	+++	+
Flavonoid	±	+	±	+
Cardic glycosides	±	-	±	+
Alkaloid	+++	-	+++	++
Carbohydrates and glycosides	+	++	+	++

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