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Management of Maize and Sunflower against the Depredations of Rose-ringed Parakeet (*Psittacula krameri*) using Mechanical Repellents in an Agro-ecosystem

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ABSTRACT

The use of some avian repellents against the depredations of rose-ringed parakeet (*Psittacula krameri*: Scopoli) on maize and sunflower was investigated in the cultivations of a selected agro-ecosystem in Central Punjab, Pakistan. In the crop guarded situation, the parakeet damage remained significantly lower for both crops. For maize, the reflecting ribbons provided a maximum protection, 0.47±0.13, while minimum 1.20±0.21, was recorded for acetylene exploders. For sunflower also, the reflecting ribbons yet again proved highly protective and the least furnished by the exploders. Incorporation of the environment friendly repellents might not only be useful against the rose-ringed parakeet, but may also inhibit the depredations by various other bird pests in croplands to reduce the damage and economic losses in the agro-ecosystems. © 2012 Friends Science Publishers

Key Words: Rose-ringed parakeet; Maize; Sunflower; Management

INTRODUCTION

Of a total cultivated area of 21.25 million hectares in Pakistan, only one third of its oil requirements are catering for the domestic use, while the remaining is achieved through from external sources (Shah *et al.*, 2005). There is therefore, a heavy burden of edible oil import on the national economy, which invariably demands increase in domestic oil production by growing more oil seed crops and improved technologies (Ahmad *et al*., 2002).

The rose-ringed parakeet (*Psittacula krameri*) is a serious vertebrate pest of agricultural and horticultural interests in Pakistan, which intensively feeds on maize and sunflower to cause substantial economic losses (Shafi *et al.*, 1986; Brooks & Hussain, 1990; Roberts, 1991; Gupta *et al*., 1998; Khan, 2002). In a multiple cropping system and unprotected conditions throughout Punjab, rightly regarded as hub of agriculture, extensive depredations have been reported (Khan & Ahmad, 1983; Beg *et al.*, 1995; Khan & Beg, 1998; Jassra & Rafi, 2003). Maize constitutes more than 5% of the cropping systems in Pakistan and is grown over 1.017 thousands hectares with in annual production of more than 3088 thousands tons. Different regions in Punjab and NWFP annually produce 95% of this crop, while Baluchistan and Sindh, only make a 5% contribution (Ariffin, 2006). Sunflower, another important oil seed crop in Pakistan, is cultivated on more than 256 thousand hectares. It has an annual production of more than 359 thousand (Haq *et al.*, 2006). It has been reported to suffer greatly due to bird damage and of these the rose-ringed parakeet is the most notable pest (Beg, 1978; Khan *et al*., 2006).

Situation in India regarding the damage incurred by the rose-ringed parakeet does not appear to be different (Reddy, 1998a, b; Mukherjee *et al.*, 2000). According to Reddy (1999), about 80% damage was recorded on mature maize cobs in Andhrapradesh, India, while a 40% loss occurred in Himachel Pradesh (Saini *et al.*, 1994). Losses to sunflower are also by some other birds as sparrows, crows and blackbirds in Asia, Africa, Europe and North and South America (Linz & Hanzel, 1997), while in Australia, cockatoos and monk parakeets are reported to bring about similar damage to sunflower (Colton & Coombs, 1994). In South Asia, prevalence of multiple cropping system seems to be a critical factor in agriculture and although they facilitate farmers in growing several crops over a relatively small area, a variety of avian pests, have always rendered serious economic losses and destroying the sustainable agriculture in the areas (Peacock & Jowett, 2004).

Repellents and chemosterilants provide with a better respite against the bird depredations on several significant crops. According to Avery *et al*. (2001), lethal control of winter visiting birds in Venezuela, with a repellent, dickissels, applied on the mature rice and sorghum

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substantially reduced damage to about 20%, while Stevens and Clarke (1998) suggested in spraying the bird repelling tear gas on crops to scatter birds. High frequency sonic devices proposed by (Bomford & O'Brien, 1990; Erickson *et al.*, 1992) to scatter birds efficiently from the crops using reflecting ribbons (luminous iridescent tapes) placed in a crisscross arrangement throughout the fields, prevented avian attacks on important crops (Parrott & Watola, 2008).

In present studies, it was hypothesized that impact of repellents on maize and sunflower in an agro-ecosystem in Faisalabad would reduce the rose-ringed parakeet depredations and resulting economic losses.

MATERIALS AND METHODS

Present studies were undertaken in unprotected one acre each of maize and sunflower crops in October and November, 2009 and 2010. Mechanical repellents viz. reflecting ribbons, multi-mirror reflectors, distress sound players, the exploders (acetylene & gas) and bird scaring models were employed in both crops to inhibit parakeet damage. To assess plant losses, crops were checked at various growth stages. For maize, four such stages, that is the emerging, milky, dough and mature, were examined for parakeet damage. For sunflower, only two stages; milky and mature, were examined for the parakeet depredations. To ascertain a better crop damage, crops were equally divided in to three field blocks, the left, middle and right (Crabb *et al.*, 1994). In maize, comprising 110 rows, 37 existed on the left and right sides of the block, while rest 36 was in the middle of the field. Sample sizes of three divided blocks were represented by four randomly selected rows, wherein 240 plants were present per row. Of these, 80 were further randomized and studied for parakeet depredations. Thus, from all three field blocks, 960 maize plants were examined for the parakeet damage during four developmental stages. To determine kernel losses from mature maize cobs, random selection of two rows from the already four selected rows was made per three blocks of the field. From these, ten mature maize cobs were again randomized to measure the intensity of kernel losses. Kernels on cobs were visually counted and those inflicted with losses, were separated from the intact to assess damage percentage.

Sunflower plant loss was estimated on milky and mature stages, wherein 88 rows existed per row in one acre field. Of these, 29 each were randomly selected on both left and right sides of the field, while remaining 30 were in the middle. Moreover, four rows were randomly selected which comprised 270 plants, and of these, 70 plants each per row were randomly chosen to assess the impact of installed repellents regarding parakeet damage. Seed losses from mature sunflower heads, two rows were randomly selected from the pre-existing four rows in three field sections. Overall, five damaged sunflower heads per row were studied to adjudge the impact of rose-ringed parakeet depredations. Visual counts from the sunflower heads were made to ascertain percentage loss in terms of depredated sunflower seeds.

Data obtained was statistically analysed using Kolmogrov-Smirnov Test (KS-goodness of fit test), to assess its normality distribution and the one-way analysis of variance (Steel & Torrie, 1997; Sutradhar *et al*., 2010), was also applied to determine difference of means per three field blocks for the repellent efficiency on maize and sunflower.

RESULTS

Data of the present studies presents information on the depredations caused by the rose-ringed parakeet on maize and sunflower with installed repellents in and agro-ecosystem in Faisalabad. Results indicated that a comparison of means for maize damage showed that on left side, the damage recorded was 1.09%, while in the middle, it remained almost negligible, and on right, it was 1.02%. For sunflower, damage was relatively higher 2.71% on left corner of the field, while in middle it remained 1.28% and on right was 1.12% (Fig. 1). A comparison for three field blocks for parakeet damage showed that for maize on the right field corner, 1.09% occurred while for that of sunflower, 2.71% were recorded towards the left side, and the middle remained negligibly depredated (Fig. 2). Overall repellent efficiencies in maize show that reflecting ribbons provided maximum protection in maize with only 0.47% damage recorded, while the least 1.20% was achieved with simple exploders. For sunflower, yet again, highest protection was achieved with the reflecting ribbons, 1.04%, and minimum 2.66% was with simple exploders (Fig. 3).

Monthly device (repellent) efficiencies both crops were by the reflecting ribbons, followed by gas exploders, combined bird scaring devices, the multi-mirror reflectors and finally by acetylene exploders (Fig. 3).

Fig. 1: A comparison of percentage damage for maize and sunflower using different mechanical devices

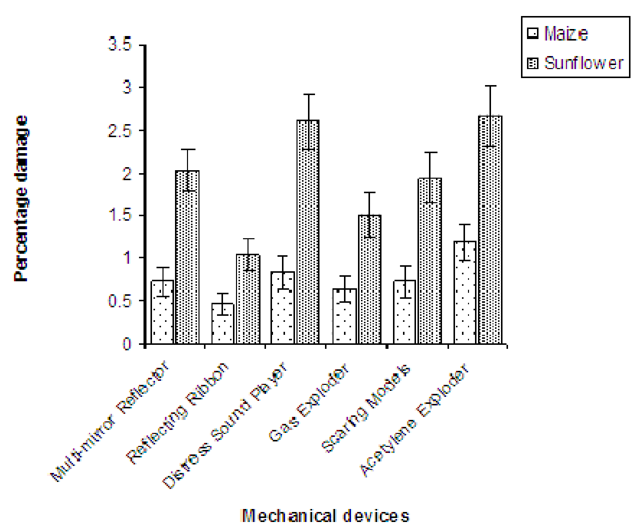


Table I: A row-wise damage comparison of means by the rose-ringed parakeet on randomly selected rows in three field blocks of maize and sunflower in study area

Maize				Sunflower			
Months	Section	Rows	Means ± SE	Months	Section	Rows	Means ± SE
October	Middle	28	0.00±0.00A	December	Middle	10	0.83±0.42A
October	Left	20	0.21±0.21AB	November	Middle	10	1.04±0.38AB
November	Left	20	0.21±0.21AB	December	Middle	27	1.04±0.38AB
October	Middle	6	0.21±0.21AB	November	Middle	23	1.04±0.21AB
November	Middle	28	0.21±0.21AB	November	Right	14	1.04±0.38AB
November	Left	8	0.42±0.42ABC	December	Right	21	1.04±0.21AB
October	Middle	1	0.42±0.26ABC	November	Left	21	1.25±0.32ABC
November	Middle	6	0.42±0.26ABC	November	Right	21	1.25±0.32ABC
October	Left	8	0.62±0.43ABCD	December	Left	21	1.46±0.38ABCD
November	Middle	1	0.625±0.280ABCD	December	Middle	11	1.46±0.50ABCD
November	Middle	15	0.62±0.28ABCD	December	Middle	23	1.46±0.20ABCD
November	Right	32	0.62±0.28ABCD	November	Middle	11	1.67±0.42ABCDE
November	Left	7	0.83±0.42ABCD	November	Middle	27	1.67±0.26ABCDE
October	Right	12	0.83±0.42ABCD	December	Right	14	1.67±0.53ABCDE
November	Right	12	0.833±0.264ABCD	December	Left	17	1.88±0.70ABCDE
October	Left	7	1.04±0.60ABCD	November	Right	5	1.88±0.53ABCDE
October	Middle	15	1.04±0.21ABCD	December	Right	5	2.29±0.50BCDEF
October	Right	32	1.042±0.384ABCD	November	Left	17	2.50±0.55CDEF
October	Left	2	1.25±0.32BCD	December	Right	2	2.50±0.32CDEF
November	Right	3	1.25±0.46BCD	November	Left	9	2.71±0.60DEF
October	Right	3	1.25±0.32BCD	December	Left	9	2.92±0.77EF
November	Right	5	1.25±0.00BCD	November	Right	2	3.54±0.60FG
November	Left	2	1.46±0.21CD	December	Left	3	4.17±0.62GH
October	Right	5	1.67±0.53D	November	Left	3	4.79±0.75H

Fig. 2: A Comparison of percentage damage per three sides of the maize and sunflower fields by the rose-ringed parakeet

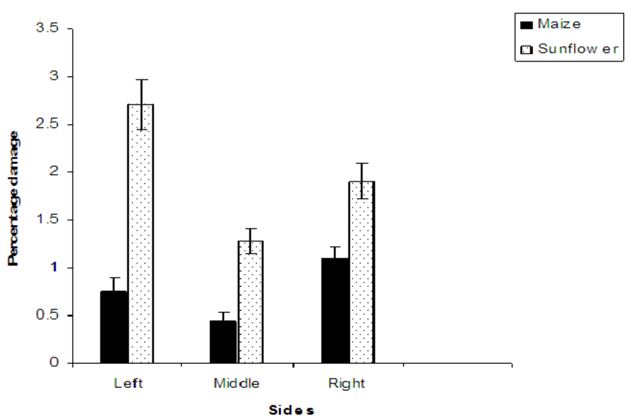
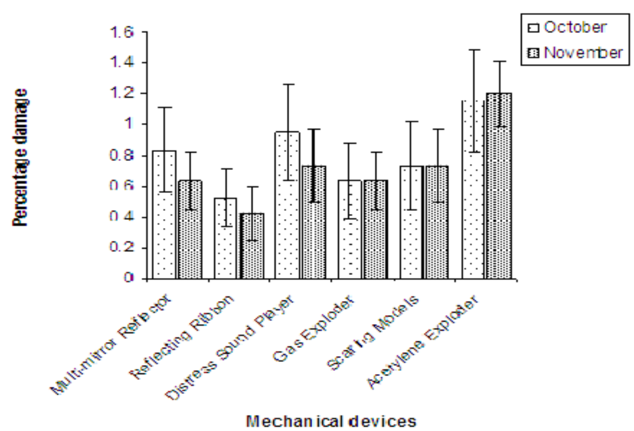


Fig. 3: Month wise efficiencies for the rose-ringed parakeet by various bird management devices in maize field



A row-wise comparison for the mean damage for four randomly selected rows per three field blocks for rose-ringed parakeet with the repellents showed that for maize, no damage was recorded in row 28 in the middle section, while comparable damage were recorded on the next four and three randomly selected rows. Consequently, a higher damage was recorded in the rows located on the corners of both crops, while in middle; the damage remained fairly low, except in that of the fifth row and middle sections, such that, highest damage percentage 1.67% was in the fifth row (Table I).

DISCUSSION

Present studies indicated that the rose-ringed parakeet assumes to be a worst bird pest in agriculture of Pakistan, and much more in Central Punjab. Important ecological favouring factors to its population owe due to an extensive canal irrigation system and also multiple cropping practices spread over a relatively small area of 12.5 acres. Both maize and sunflower happen to be highly preferred crops by the parakeet in both rural and urban areas (Beg *et al*., 1995; Khan *et al*., 2011). As such, in the unprotected areas, damage is intensive (Anonymous, 2004b). Management measures using mechanical devices, mainly repellents seemingly are important to inhibit rose-ringed parakeet and other birds damage to croplands (Avery & Cummings, 2003).

It was apparent that, reflecting ribbons due to their glossy image provided maximum protection against the rose-ringed parakeet attacks on both crops in the study area. Ribbons installed consecutively for seven days effectively inhibited the parakeets entering the fields, before they were rotated with other devices to do away with the possibility of birds getting used to them, as for longer duration they sneak in the field and feed on crops (Roberts, 1991; Crabb *et al.*, 1997). Besides the ribbons, a considerable protection also came through multi-mirror reflectors, bird hawk eye rotator, distress sound players and fearsome avian models. Present findings also were comparable to those made by Bruggers *et al*. (1986); Dolbeer *et al.* (1986) and Beg *et al.* (1995) with respect to sunflower, corn and blueberry plots using various repellents. However, work done by Canover and Dolbeer (1989) suggested that, ribbons failed to effectively protect the damage by blackbirds on maize and sunflower which continued without any inhibition.

Both maize and sunflower are cash crops not fulfilling domestic cereal and oil requirements of Pakistan. Dearth of oil in the country demands more concerted efforts. Continuous depredations by the rose-ringed parakeets serve as a major ecological constraint for the cereals and oil production in various habitats of Punjab and other parts of the country (Hamid *et al*., 1999; Khan *et al*., 2006). It was also apparent that higher damage took place on the sides of the three field blocks, possibly the parakeets preferring to feed on in relatively undistracted conditions and to make good their escape in danger, than in the middle section of crops.

Reflecting ribbons, mostly cost effective and readily available, their application not only is useful to maize, but also to that of sunflower to inhibit parakeet and other birds as crows, sparrows and starling; to some more economically important croplands in enriched agricultural landscape. Protection with simple exploders remained almost negligible, as possibly these were old and traditional (Fiedler *et al*., 1991; Glahn & Wilson, 1992). Losses to sunflower in unprotected situations were recorded to be more than 50% (Anon, 2008), which were reduced significantly to 12.18%, following applications of repellents. Other measures as wrapping of leaves around the cobs (Dhindsa *et al*., 1992) have also provided 50% protection from the bird depredations, and their implications in the multiple cropping systems, should also serve as a useful inhibitory agent against damage by birds.

Accordingly, following a non-chemical approach for management various studies (Fiedler *et al.,* 1991; Glahn & Wilson, 1992; Beg *et al.,* 1995; Vogt, 1997; Tastad *et al.,* 2011; Khan *et al*., 2011), have provided dividends on important crops, more significantly without altering the sustainability of productive agro-ecosystems.

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