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EFFECTIVENESS OF REFLECTIVE RIBBONS IN THE MANAGEMENT OF ROSE-RINGED PARAKEET (*Psittacula krameri*) IN GUAVA (*Psidium guajava* L.) ORCHARDS

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ABSTRACT

Fruit loss due to birds is a long-standing and costly problem affecting producers across the globe. The rose-ringed parakeet enjoys the status of worst avian pest in the Indian subcontinent. This study provides the information about the effectiveness of reflective ribbons in controlling the damage of rose-ringed parakeet (*Psittacula krameri*) to guava (*Psidium guajava* L.) fruit trees in central plain and sub-mountainous regions of Punjab (India). The damage caused by parakeet to the control fields ranged from 12.13 to 16.76% while the fields installed with reflective ribbons had damage between 5.67 and 8.51%. Ripened fruits were more preferred with top canopy most affected part of the trees. A remarkable reduction in bird damage was noticed in presence of reflective ribbons. Therefore, it seems plausible to use reflective ribbons as bird repellents to reduce bird depredatory attacks, improve economic losses and augment the crop quality and production.

Keywords: Avian pest, bird management canopy, guava, reflective ribbon, rose-ringed parakeet

INTRODUCTION

Recent studies have demonstrated a complex relationship between bird populations and agriculture (Ormerod and Watkinson, 2000). Fruit loss due to the birds is a long-standing costly problem (Simon, 2008) affecting producers across the globe (Somers and Morris, 2002; Ahmad, 2010; Ribot *et al.*, 2011). The worldwide damage to various food crops leads to the substantial economic losses (Tracey and Mary, 2007). The bird damage to fruit crops has received relatively little research attention as compared to the other agricultural pest problems (Gebhardt *et al.*, 2011). Yet for many producers the impacts can be severe and its management a costly affair. In addition to outright consumption, birds damage fruit leading to the increased fruit susceptibility to other pests and pathogens and reduced product quality (Pritts, 2001; Duffy and Schaffner, 2002; Holb and Scherm, 2008).

The rose-ringed parakeet (*Psittacula krameria*), popularly known as green or ringed parrot, belongs to the family 'Psittacidae' and order 'Psittaciformes'. The bird is widespread resident in the Indian subcontinent inhabiting forests, gardens, cultivations, towns and cities (Rasmussen and Anderton, 2005). Due to its wide feeding niche, it is regarded as one of the most destructive vertebrate pests in India. Parrots are often highly destructive birds damaging crops, private property and natural resources. It affects the farm crops and horticultural practices and sporadically the stored grains in good proportions (Khan *et al*., 2011; Ahmad *et al*., 2012). Rose-ringed parakeets are opportunistic granivores and frugivores and primarily consume dry and fleshy fruits and seeds (Clergeau and Vergnes, 2011). It is highly destructive to crops and orchards, gnawing and wasting far more food

than it actually eats (Ali, 2002). Many studies have documented the destructive feeding behaviour and quantified the extent of fruit and seed damage in agricultural landscapes (Maurice *et al.,* 2019).

Guava (*Psidium guajava* L.) belongs to family Myrtaceae which comprises of about 150 species of trees and shrubs, many of which have edible fruits. It is commonly called "the poor man's fruit" or "apple of tropics". It is a popular tree fruit of tropical and subtropical areas of the world and is native to tropical America stretching from Mexico to Peru. Guava is presently cultivated in most of the tropical and subtropical countries (NHB, Indian horticulture database, 2018). In terms of area and production, guava occupies 4th position after mango, banana, and citrus. In India, guava occupies 2.65 lakh ha land area leading to the total fruit production of 40.54 lakh tonnes. Guava cultivation in Punjab occupies the area of 9142 ha, while the production is 2.06 lakh tonnes (NHB, Indian horticulture database 2018). Being cheap and easily available guava is a popular fruit in India and is extensively grown and marketed in India. The factors that limit its production include bird pests especially parakeets (Iqbal *et al*., 2001). The time when fruit matures appears to influence the amount of damage. Bird damage tends to be worse on early-maturing cultivars. The early ripening fruits are often more damaged because it matures when other foods are less available (Brittingham, 2010). Many factors potentially influence the distribution and magnitude of bird damage. Understanding the ecology of agricultural systems, including the relationship between crop development and bird forging behaviour, is the first step towards developing effective management strategies (Tourenq *et al*., 2001). Agricultural pest species have particular foraging habits and because birds generally do not live on guava, the surrounding habitat features have been implicated as the most important factor in determining the amount of bird damage (Somers and Moris, 2002). The present study was aimed to assess parakeet damage in unprotected and protected guava orchards in Punjab (India).

MATERIALS AND METHODS

The study was conducted in two districts of Punjab (Ludhiana and Shaheed Bhaghat Singh (SBS) Nagar). In Ludhiana area, rose-ringed parakeet damage was assessed in a guava orchard at the University Seed Farm (USF), Ladhowal, Ludhiana (75. 49° E, 30.59° N, 189 m masl) and in SBS Nagar at Dr D R Bhumbla Regional Research Station (RRS), PAU, Ballowal Saunkhri, SBS Nagar, Punjab, India (76.38° E, 31.09° N, 295 m masl). Well-maintained guava orchards were selected at both the locations during the study period. The observations were taken for 45 consecutive days during the summer 2018 and winter 2017. The locations were visited weekly during morning and evening hours. The trees almost 8 years of age from all the four corners and the one in the centre were selected for sampling purpose. Reflective ribbons were installed 30 cm above the top canopy of the guava trees in the north to south direction Reflective ribbons used were polyester strips (1.5 cm wide) having a metallic coating of silver colour on one side and red colour on the other side.

An approximate number (five) of guava per tree was assessed by counting the number of guava per tree by the naked eye. In total five trees on four corners and centre were taken in consideration. The fruit damaged by rose-ringed parakeet and dropped were collected and buried underground. Damage by parakeets was, in general, very conspicuous and unmistakable because of the triangular marks they typically exert on the fruits (Senar *et al.,* 2016). The damaged fruits were graded on the basis of the amount of losses inflicted on them such as nearly full damaged, ¾th part damaged, ½ damaged & ¼th damaged.

Control **Reflective ribbons**

Fig. 1: The study site showing control and reflective ribbons

$$\text{Damage (\%)} = \frac{\text{Number of damaged fruits}}{\text{Total fruits}} \times 100$$

The data was statistically analyzed using t-test for significance by using SAS software, version 9.4 (SAS Institute, Inc., Cary, NC, USA).

RESULTS AND DISCUSSION

Flocks of rose-ringed parakeets were observed to attack the guava fruits in the morning and evening hours. The damage to the fruit was also carried by the crows but they would often detach the fruit from the tree and carry them to the nearest trees for eating. The damage to the guava at the University Seed Farm, Ladhowal, Ludhiana and Dr D.R. Bhumbla, Regional Research Station, Ballowal Saunkhri, SBS Nagar is presented in Table 1 and 2, respectively, for summer and winter seasons. The guava damaged by the Rose-ringed Parakeet in control fields having fruit damage of upto 25% was between 5.16 to 6.10, upto 50% damage between 4.11 to 5.67, upto 75% damage was between 1.81 to 2.90% and the fully damaged guava fruit was between 1.05 to 1.84%. In the fields installed with the reflective ribbons fruit damage of 25 % was in between 3.16 to 4.36%, upto 50 % damage between 1.81 to 2.39%, upto 75% damage in between 0.93 to 1.31% and the fully damaged fruit was in between 0.29 to 0.87%. The damage to the guava was more in the ripened stage as compared to the unripened stage in both control as well as in the fields having reflective ribbons.

The damage to the guava at the different canopy levels was studied at both the locations and it was found that that the heaviest damage on the top branches with a range of 7.11-11.46% in the control fields, while as on the treated fields the damage range was 3.95-5.06%. The middle branches have the damage in the range of 2.99-4.46% in control fields and 1.29-2.46%, while as the lower canopy got the damage in the range of 1.26-1.78% in control and the treated fields got the damage of the range 0.43-1.54% (Table 3). It can be concluded that the higher tree canopy got the maximum damage percentage whereas the lower canopy gets less damaged. The findings of our study are in line with those of Khan *et al*. (2013), where they got 8.01% damage to the unprotected guava fields due to rose-ringed parakeet. Khan *et al.* (2006) have reported a damage of the range 20.1-40.0%.

Birds are a known cause of crop damage and loss. Guava producers often resort to using multiple bird management methods, increasing their costs while still losing crop to bird damage. However, without bird management producers expect substantially crop loss. The extent of damage caused to different crops varied between the study plots and also within plants and trees. Shafi *et al.* (1986)

Table 1: Extent of damage (%) to guava fruits at University Seed Farm, Ladhowal, Ludhiana during winter 2017-18 and summer 2018

Treatments	Seasons	Extent of damage (%)				Growth stage	
		¼	½	¾	Full	Ripened	Unripened
Control	Summer	6.03^{A}	4.96^{B}	2.33^{C}	1.37^{DE}	12.60	2.09
Reflective ribbons		3.24^{B}	1.81^{CD}	1.31^{DE}	0.87^{E}	5.67	1.56
Control	Winter	5.53^{a}	5.41^{a}	2.55^{bc}	1.84^{cd}	12.77	2.55
Reflective ribbons		3.33^{b}	1.91^{cd}	1.30^{de}	0.74^{e}	6.29	2.04

The values with similar superscript do not differ significantly ($p<0.05$) from each other.

Table 2: Extent of damage to the guava fruits at the Dr D.R. Bhumbla, Regional Research Station, Ballowal Saunkhri, SBS Nagar during winter 2017-18 and summer 2018

Treatments	Seasons	Extent of damage (%)				Growth stage	
		¼	½	3/4	Full	Ripened	Unripened
Control	Summer	5.16^{A}	4.11^{B}	1.81^{D}	1.05^{DE}	10.53	1.60
Reflective ribbons		3.16^{C}	1.29^{DE}	0.93^{EF}	0.29^{F}	5.10	0.57
Control	Winter	6.10^{a}	5.67^{a}	2.90^{c}	2.09^{de}	15.28	1.48
Reflective ribbons		4.36^{b}	2.39^{cd}	1.27^{ef}	0.49^{f}	7.45	1.05

The values with similar superscript do not differ significantly ($p<0.05$) from each other.

Table 3: Canopy-wise damage to the guava during winter 2017-18 and summer 2018

Treatments	Months	Locations	Damage in canopy (%)			Fruits damaged (No.)	
			Top	Middle	Lower	Undamaged	Damaged
Control	August	USF	8.95	2.99	1.55	1429	246
Reflective ribbons			4.36	2.18	0.68	1490	116
Control	December		9.09	4.46	1.78	1425	258
Reflective ribbons			4.44	2.34	1.54	1486	135
Control	August	RRS	7.11	3.77	1.26	1260	174
Reflective ribbons			3.95	1.29	0.43	1314	79
Control	December		11.46	4.00	1.29	1351	272
Reflective ribbons			5.06	2.46	0.98	1301	121

USF = University Seed Farm, Ladhowal Ludhiana; RRS = Dr. D.R. Bhumbla Regional Research Station Ballowal Saunkhri

reported that the damage to citrus trees was high in top canopy, almost 4 times greater than the damage to middle and lower branches of trees. Khan *et al.* (2006) reported a similar pattern of damage in guava, with most damage occurring in the upper central core of tree. Better visibility limits predators. The edges of fields have more damage, especially where the perching and refuging sites are available near to the crops, and away from the human disturbances (Kler, 2003).

Guava fruit was extensively damaged by rose-ringed parakeet in unprotected fields. However, a considerable decline in guava damage was observed in the fields having reflective ribbons and proved highly effective in repelling the birds from cropped areas. The shine of reflective ribbons and the sound produced due to wind fear some animals and keep the attacking parakeets at bay from guava. This not only protected the orchards from parakeet depredations, but also considerably averted economic losses. Unquestionably, the wide feeding niche of rose-ringed parakeet is mainly due to suitable ecological conditions in the Indian subcontinent. The damage imposed by rose-ringed parakeet and some allied birds on cultivated and non-cultivated crops, including orchard fruits remains unparalleled causing substantial economic losses (Butler, 2003). The use of traditional methods for crop management against bird damage has failed to deliver the required dividends to the farmers and stakeholders. Present studies also report on the ecologically effective management measures like the use of reflective ribbons to inhibit their depredations.

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REFERENCES

Ahmad, S. 2010. *Sustainable Control Measures for Rose-Ringed Parakeet (Psittacula krameri) on Maize, Sunflower, Citrus, Guava and Mango Damage in Some Selected Agro-ecosystems in Central Punjab, Pakistan*. University of Agriculture, Faisalabad, Pakistan.

Ahmad, S., Khan, H.A., Javed, M. and Khalil-Ur-Rehman. 2012. An estimation of rose-ringed parakeet (*Psittacula krameri*) depredations on citrus, guava and mango in orchard fruit farm. *International Journal of Agriculture and Biology*. **14**: 149-152.

Ali, S. 2002. *The Book of Indian Birds* (13th edn.). Bombay Natural History Society & Oxford University Press, Mumbai, India.

Brittingham, M.C. and Falker, S.T. 2010. *Controlling Birds on Fruit Crops.* College of Agricultural Sciences, Agricultural Research and Cooperative Extension. Pennsylvania State University. Pennsylvania, USA.

Butler, C.J. 2003. *Population Biology of the Introduced Rose-Ringed Parakeet Psittacula Krameri in the UK*. Ph.D. thesis, Department of Zoology, Edward Grey Institute of Field Ornithol. Zoology, University of Oxford, Oxford, UK.

Clergeau, P. and Vergnes, A. 2011. Bird feeders may sustain feral Rose-ringed parakeets *Psittacula krameri* in temperate Europe. *Wildlife Biology*. **17**: 248–252.

Duffy, S. and Schaffner, D.W., 2002 Monte Carlo simulation of the risk of contamination of apples with *Escherichia coli* O157:H7. *International Journal of Food Microbiology.* **78**: 245-255.

Gebhardt, K., Anderson, A.M., Kirkpatrick, K.N. and Shwiff, S.A. 2011. A review and synthesis of bird and rodent damage estimates to select California crops. *Crop Protection*. **30**(9): 1109-1116.

Holb, I.J. and Scherm, H. 2008. Quantitative relationships between different injury factors and development of brown rot caused by *Monilinia fructigena* in integrated and organic apple orchards. *Phytopathology.* **98**: 79-86.

Iqbal, M.T., Khan, H.A. and Ahmad, M.H. 2001. Feeding regimens of the rose-ringed parakeet on a brassica and sunflower in an agroecosystems in Central Punjab, Pakistan. *Pakistan Veterinary Journal.* **4**: 111–115.

Khan, H.A., Ahmad, S., Javed, M., Ahmad, K. and Ishaque, M. 2011. Comparative effectiveness of some mechanical repellents for management of rose ringed parakeet (*Psittacula krameri*) in citrus, guava and mango orchards. *International Journal of Agriculture and Biology.* **13**: 396-400.

Khan, H.A., Hassa, B. and Mehmood, I. 2006. A comparison of population abundance of the rose-ringed parakeet, *Psittacula krameri*, in the two roosts of Central Punjab, Pakistan. *Journal of Agriculture and Social Sciences*. **2**: 136-141.

Khan, H.A., Javed, M., Tahir, A. and Kanwal, M. 2013. Limiting the rose-ringed parakeet (*Psittacula krameri*) damage on guava (*Psidium guajava*) and mango (*Mangifera indica*) with an ultrasonic sound player in a farmland of Faislabad, Pakistan. *African Journal of Agricuture and Research*, **8**: 6608-6614.

Kler, T.K. 2003. Eco-friendly management of rose-ringed parakeet (*Psittacula krameri*) in winter maize crop. *Tiger paper*, **8**: 23-26.

Maurice, M.E., Fuashi, N.A., Mengwi, N.H., Ebong, E.L., Awa, P.D. and Daizy, N.F. 2019. The control methods used by the local farmers to reduce weaver-bird raids in Tiko farming area, Southwest region, Cameroon. *Madridge Journal of Agriculture and Environmental Science*, **1**(1): 31-39.

NHB. 2019. National Horticulture Board Statistical Database 2018-19. New Delhi, India.

Ormerod, S.J. and Watkinson, A.R. 2000. Birds and agriculture - Editor's introduction. *Journal of Applied Ecology*, **37**: 699-705.

Pritts, M.P. 2001. Fruit plantings. *New York Hortic. Society*, **9**: 5-7.

Rasmussen, P.C. and Anderton, J.C. 2005. *Birds of South Asia : The Ripley Guide.* (1st edn.). Smithsonian Institution/ Lynx Edicions, Washington, USA/Barcelona, Spain.

Ribot, R.F.H., Berg, M.L., Buchanan, K.L. and Bennett, A.T.D. 2011. Fruitful use of bioacoustic alarm stimuli as a deterrent for crimson rosellas (*Platycercus elegans*). *Australian Ornithology*, **111**: 360-367.

Senar, J.C., Domènech, J., Arroyo, L., Torre, I. and Gordo, O. 2016. An evaluation of monk parakeet damage to crops in the metropolitan area of Barcelona. *Animal Biodiversity and Conservation*, **39**: 141-145.

Simon, G. 2008. A short overview of bird control in sweet and sour cherry orchards - Possibilities of protection of bird damage and its effectiveness. *International Journal of Horticulture Science*, **14**: 107-111.

Somers, C.M. and Morris, R.D. 2002. Birds and wine grapes: Foraging activity causes small-scale damage patterns in single vineyards. *Journal of Applied Ecology*, **39**: 511-523.

Tourenq, C., Aulagnier, S., Durieux, L., Lek, S., Mesléard, F., Johnson, A. and Martin, J.L. 2001. Identifying rice fields at risk from damage by the greater flamingo. *Journal of Applied Ecology*, **1**: 170-179.

Tracey, J.B. and Mary, B. 2006. *Managing Bird Damage to Fruit and other Horticultural Crops*. Commonwealth Government, Department of Agriculture, Fisheries and Forestry, Bureau of Rural Sciences, Canberra, Australia.