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Roost Composition and Damage Assessment of Rose-Ringed Parakeet (*Psittacula krameri*) on Maize and Sunflower in Agro-Ecosystem of Central Punjab, Pakistan

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ABSTRACT

Present studies provide information on the occurrence of dominant and co-dominant trees, as their probable roosts and the damage assessment on maize and sunflower, by the rose-ringed parakeet (*Psittacula krmaeri*) in the cultivations in Central Punjab, Pakistan. Unquestionably, being the cash crops of Pakistan, their relentless damage in the unguarded situations, leads to serious economic losses. Of total 30 roosts, maximum nests 446 occurred in variable trees of University Campus, followed by 239 in the PARS, Faisalabad, while for an overall total of 1187 nests in the study area, average 39.57 nests per roost were recorded. Damage at various growth stages of maize and sunflower, was highest at the mature stage, 23.8% and was minimum, 7.60%, on the emerging stage. Correspondingly, equal intensive damage came about on the growth stage of sunflower, highest (33.2%) being on the mature stage. Likewise, significant parakeet depredations were also inflicted on the kernels of both crops. Seemingly, in the diversified agro-ecosystems throughout Central Punjab, the parakeets, not only obliterate these crops but also prove harmful to the other sustainable crops, causing substantial damage and serious economic losses in agro-ecosystems. © 2011 Friends Science Publishers

Key words: Rose-ringed parakeet; Roost; Depredations; Maize; Sunflower

INTRODUCTION

The rose-ringed parakeet (*Psittacula krameri* Scopoli Linn., Psittacidae: Psittaciformes) belongs to the order 'Psittacformes' and family 'Psittacidae'. It inhabits lightly timbered areas throughout Pakistan, Bangladesh, India, Nepal, Sri Lanka and some areas in Europe, North America and rarely in Africa (Butler, 2003). Several birds such as the parakeets have expressed an increased trend in their roosting for the last several decades, depending upon the suitability of feeding in a given environment of California. According to Harms and Eberhard (2003), the four sub-species of brown throated parakeet (*Aratinga pertinax*) considered be endemic to the Southern Caribbean Island, develop the several dozen to several hundred birds in the distinct Islands. Localities of the roosts seemed to be stable for at least few weeks on one of the Islands, while on the others, although their population did not seem to be steady, but occurred regularly. It might be important to protect the roosts for these Islands. The rose-ringed parakeet is a communal bird and as such roosts in fairly large numbers in the tall and old trees. Mostly the trees include those of *Salmalia malabarica*, *Dalbergia sissoo*, *Cedrella toona*, *Ficus bengalensis* and *Teminalia arjuna*. The roosts are predominantly stable and retain their effectiveness for several years, incorporating many of the diurnal movement patterns from and to the roosts in varying parakeet flocks (Roberts, 1991). Sarwar *et al.* (1989) reported the information on the use of the grooves of tall trees by the rose-ringed parakeets in the rural and urban situations in Punjab, Pakistan. Mostly extensive studies on roosts suggest any possibility of a correlation between the roosts and maximized feeding behaviour of several birds, the beneficial effects from the predators, exploitation of tree species and also the overall impact on the cropping patterns in a particular habitat (Yu, 2010).

The parakeet has a wide feeding niche, and as such, not only brings about the damage to the cultivated plantations, but also, those of the orchards and stored houses (Dvir, 1985). The infestations of the rose-ringed parakeet on maize and sunflower have a serious predicament as they not only inflict a serious damage to them, but also result in significant economic losses to economically important cash crops in Pakistan, particularly in the unguarded habitats (Khan & Ahmad, 1983; Shafi *et al.*, 1986; Brooks *et al.*, 1990; Roberts, 1991; Beg *et al.*, 1995; Khan & Beg, 1998; Jassra & Rafi, 2003).

Maize (*Zea mays* L.) occupies more than 5% of the

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total cropped area of Pakistan with an annual production more than 3000 tonnes, while that of sunflower (*Helianthus annuss* L.), economically important oil-seed crop, is also cultivated over thousands of hectares in the country, with an overall production 359 tonnes (Haq *et al.*, 2006). Damage to maize by the rose-ringed parakeets in the unguarded situation, are fairly abundant, to be more than 50%, as reported by (Bashir, 1978; Khan & Ahmad, 1983; Iqbal *et al.*, 2001). Situation is also of a comparable tenacity in India on standing maize crop (Parwin, 1988; Gupta *et al.*, 1998).

Losses to sunflower by the birds' viz. parakeets, sparrows, crows and blackbirds in the Northern territory have been reported to be prevalent. Damage to sunflower was apparent during summer against depredations of blackbirds, while in fall, it was obliterated by parakeets, in winter by crows, and in spring by the sparrows (Linz & Hanzel, 1997). As such, the destruction by the blackbirds proved to be a major constraint in the profitable production of sunflower in plains of California (Linz *et a.*, 1984; Hotham *et al.*, 1988). Comparable damage by the cockattoos and monk parakeets in the Australian territory has also been reported by Bomford (1992) and Colton and Coombs (1994), while Fleming *et al.* (2002) discussed the damage on sunflower by cockattoos in the New South Wales, Australia to be intensive at the harvesting stages, with the mature heads nearly annihilated.

Curtis *et al.* (2004) reported that the depredations on sweet corns (*Zea mays* L.) by red-winged blackbirds were apparent highly in summer. In an experiment performed between September and October 1997, with no choice feed tests, to ascertain their feeding efficiency, after the installation of polymer fibers (ethylene vinyl acetate) on the entire crop, damage reduced to about 10-12%, but was sufficient to cause economic losses. Present investigations were therefore, aimed to know the roost composition of the rose-ringed in terms its numerical proportions throughout Central Punjab, and to evaluate the damage profile on maize and sunflower, and finally, to suggest a few environmentally sustainable management devices to inhibit crop and resultant economic losses.

MATERIALS AND METHODS

Studies to assess thirty probable roosts throughout Central Punjab, Pakistan for the estimation of rose-ringed parakeet populations, in terms of availability of nests per roost per dominant and co-dominant trees were surveyed in 2008. A variety of cultivated and orchard fruits remained available here in rural and urban habitats, in co-existence with tall and old trees, throughout the year. Therefore, there was almost no dearth of food throughout the sampled habitats in Central Punjab, as a sufficiently large fauna, comprising few amphibians, reptiles, birds; small and large mammals, occurred in substantial numbers (Taber *et al.*, 1967). Predominantly, such trees have attained prevailing height and harbour with several depressions, frequently refined by many cavity nesting birds including the rose-ringed parakeet. By and large, the fields comprise one acre in a multiple cropping system, favoring the farmers in terms of unified agricultural plantations, but also augmenting in ruthless depredations by many birds (Roberts, 1991). Present investigations were therefore, conducted in five districts viz. Faisalabad, Toba Tek Singh, Jhang, Hafizabad and Shiekupura with suitable parakeet roosting of Central Punjab, Pakistan.

To assess the parakeet depredations on maize and sunflower, observations were made from August through November, 2008 in experimental research farms, University of Agriculture, Faisalabad, Pakistan. Damage was ascertained on the basis of percentage losses (plants & kernels) at various growth stages for both crops. For maize, plant damage was recorded at four i.e., emerging, milky, dough and mature stages, while kernel damage was only estimated on mature cobs. For sunflower, plant depredations occurred only at the milky and mature stages, with sunflower heads were examined, for the parakeet pillage.

For accuracy, one acre field each of maize and sunflower, were split into three stations, that is, left, middle and right. A total of 110 rows occurred for maize, which were further differentiated into 37 each on left and right and 36 were present in the middle of the field (Crabb *et al.*, 1997). From each of the three sections, four rows were randomly selected to represent sample size of each section. Numbers of plants per maize section were 240. Of these, 80 were again randomly selected from each row and were paper tagged. In all, from each of the four rows in station, 320 plants were paper tagged and from the entire field, 960 plants were randomly selected and tagged to estimate rose-ringed parakeet depredations. To determine kernel losses per three sides of the field, two rows from the pre existing four selected rows, were randomly chosen in each three field stations. Of these, five mature (damaged) cobs were again randomly selected to assess the kernel damage by parakeets. Numbers of kernels present on each cob were visually counted and were separated out from those inflicted with parakeet damage.

Concurrently, damage to one acre sunflower was assessed on milky and mature stages only with 88 rows. The entire field was also divided in three field corners (stations), with 29 each on the left and right, and 30 in the middle (Crabb *et al.*, 1997). Of the three sunflower sides, four rows were randomly selected through simple random selection. A total of 270 plants existed per sunflower row, and from each of the four rows, 70 plants, after being randomly selected, were paper tagged. Accordingly, 280 plants were arbitrarily selected and were paper tagged to assess the parakeet depredations. To assess damage to seeds through mature crop (heads), two rows were selected randomly from the earlier four rows. Of these, five damaged sunflower heads were carefully observed for the seed loss by the parakeets. Damage seeds were separated from the intact and overall

sunflower seed loss was analysed.

Statistical analysis of the data was made through Kolmogrov-Smirnov goodness of fit test, indicating the data normality distribution. Analysis of Variance (Steel & Torrie, 1990) was also used to determine the test of significance of means for the three field sections, and monthly parakeet crop visitations.

RESULTS

Roosting habits: Availability of cultivated crops harboured with sufficiently large number of trees in the five study sites of Central Punjab support well established rose-ringed parakeet roosts. Of these, the University Campus, due to large experimental crops, includes a rich fauna. For present studies, of a total 780 trees examined, highest numbers of nests (142) occurred in *Salmalia malabarica*, and a maximum nests (1.54) per tree, followed by the *Ficus bengalensis* (1.17), Terminalia arjuna (1.12), Dalbergia sissoo (1.05) and Cedrella toona (0.97). A yet another substantial parakeet roost, the PARS, about 20 km away, wherein, 288 trees checked, had the *S. malabarica* had maximum nests (2.53) per tree, while *Ficus bengalensis* and *Cedrella toona*, each contained (1.18) nests per tree. Other observations were also made on Faisalabad to Hafizabad, Jhang, Toba Tek Singh, Sukheki and Tandlianwala roads of Central Punjab, to study the roost composition in terms of parakeet numbers.

Statistically, there existed a strong correlation between the tree species and nests in the study area. Certainly, the availability of nests among trees, enhanced the parakeet numbers, and the reliability of prediction equation increased the coefficient of regression by 63.50%, (Fig. 1). Similarly, a correlation also existed between the total number of nests per roost in the study area and the nests ascertained per tree per roost. The reliability of prediction equation herein pointed out that, the co-efficient of regression increased by about 14%, indicating that, the nests contained per tree, might somewhat increased the probability of parakeet nests per roost (Fig. 2). It was also evident that, there was a significantly strong correlation between the available tree species in the study area and parakeet nests in different roosting sites. Here, the co-efficient of regression occurred to be about 51%, Furthermore, the increase of trees per roost, the probability of nests per trees would be enhanced, but with no certainty that, these would only belong to rose-ringed parakeets, and some other birds might also be included (Fig. 3). Seemingly, a reasonable relationship also existed between various trees and the parakeet estimated populations. Clearly, an increase in trees had a direct bearing on the number of parakeets, and the prediction equation showed the co-efficient of regression to be about 52% (Fig. 4).

Damage on maize: Parakeet damage to maize plants and kernels was recorded at the four developing stages *viz.* emerging, milky, dough and mature. Statistical significant differences occurred among the three field sections, and at the four growth stages (F = 2.46, df = 6, P = 0.0000). The highest percentage (%) damage (23.8±3.6) was recorded at mature stage while the least damage 7.6±1.0 occurred on

Fig. 1: Correlation between number of parakeet nests and proximity of parakeets per roost

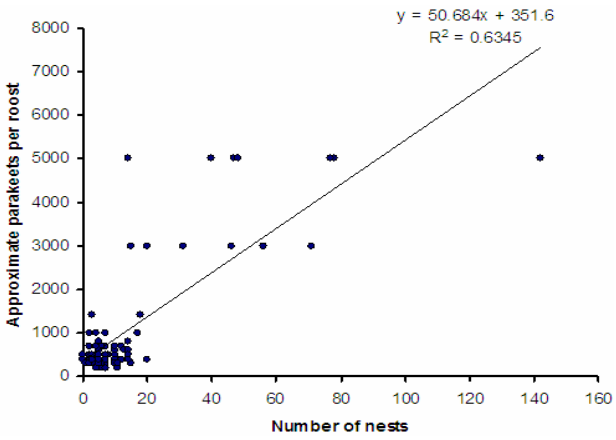


Fig. 2: Nests versus nests per tree, indicating strong correlation between both the variables

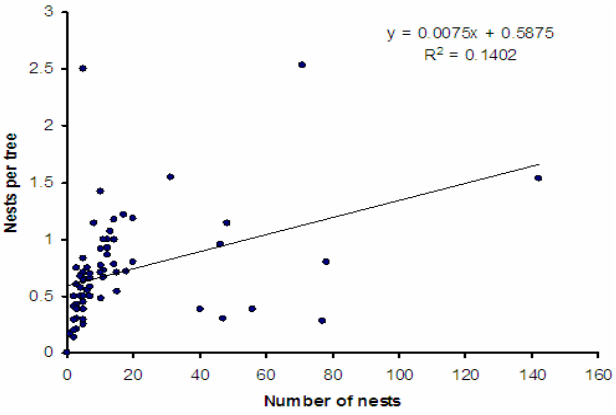


Fig. 3: Expression of correlation between the available tree species and parakeet nests during the course of the studies in various roosts of Central Punjab

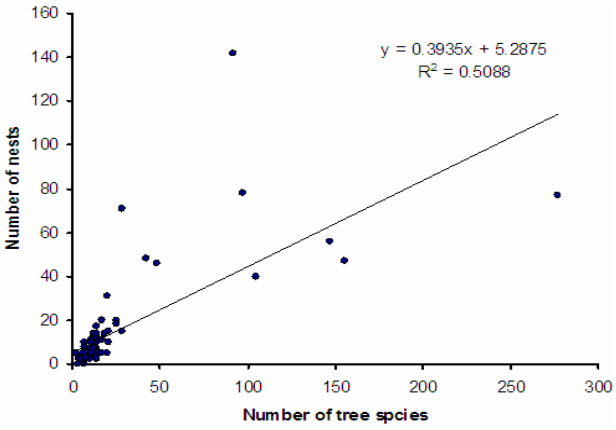


Fig. 4: Relationship between various tree species and parakeet's proximity per roost in the study sites

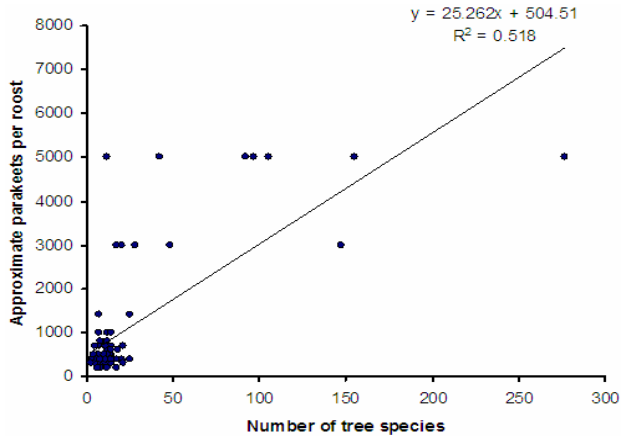


Fig. 5: Parakeet damage to maize at various stages in study area

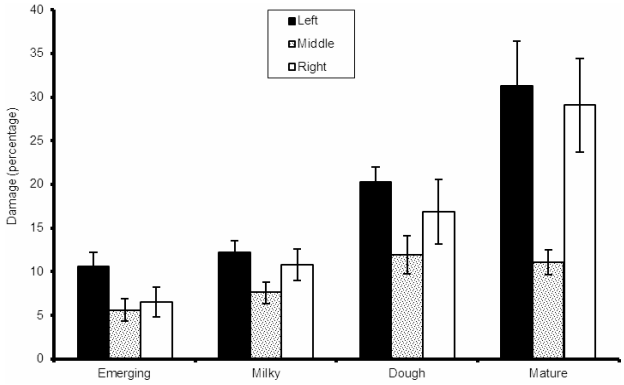
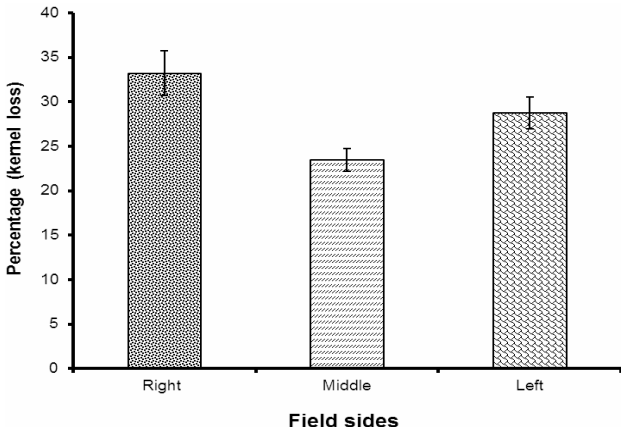


Fig. 6: Kernel loss recorded per cob at the mature stage of maize



the emerging stage. For both milky and dough stages, the depredations ranged between both of them (Fig. 5). Variations among the three field sides with regard to kernel loss per cob (recorded at mature stage) showed non-significant differences (P>0.05). However, maximum kernel loss (33.2±2.48) occurred on the right field station, while a

Fig. 7: Parakeet damage recorded at various growth stages of sunflower

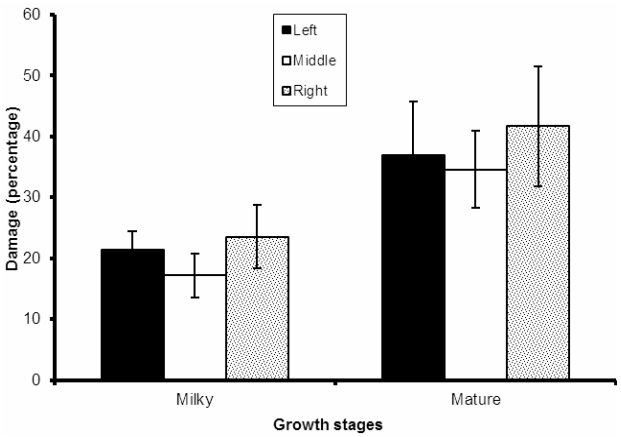
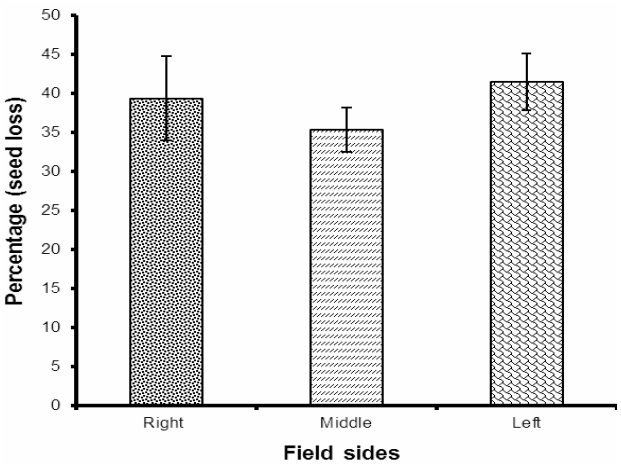


Fig. 8: Seed depredations by the rose-ringed parakeet on mature stage in sunflower



comparable damage was recorded for the middle and left hand sides of this crop (Fig. 6).

Damage on sunflower: Highest damage, 37.8±4.58 was evinced on the mature sunflower stage, while the minimum, 20.7±2.3 occurred on the milky stage. For three crop sections, intensive depredations, 41.7±9.9 was reported on the mature stage (Fig. 7), while a comparable obliteration had been substantiated for the sunflower seeds losses with respect to three crops sides (Fig. 8). Seemingly, the parakeets sustained no surveillance on both crops, and continued their visitations relentlessly throughout the day.

DISCUSSION

Data of the present studies significantly clarifies that, there existed an overwhelming rose-ringed parakeet population throughout the roosts in the study area. Parakeets were observed inhabiting suitable trees as their roosts and nests. Some of them appeared permanent and stable, located closely to the cultivated plantations, where they exploited

tall tree depressions and holes. Seemingly, the parakeet numbers were also sufficient even in smaller roosts.

Parakeet, being largely communal, assembled in substantial numbers, customarily in the evening, following the day long activities, within their roosts to spend the night, as also described elsewhere (Rao & Shivarynayan, 1981; Sarwar *et al*., 1989), in India and Pakistan. Importance of roosting has also been recorded among other birds viz. brown throated parakeets (*Aratinga pertinex*), blackbirds (*Agelaius phoeniceus*), Amazon parrots (*Amazona amazonica*) and barn swallows (*Hrundo rustica*), (Heisterberg, 1983; Mabb, 1997; Linz *et al.*, 1991; Harms & Eberhard, 2003; Gordo, 2006), who consider that, roosts besides being the centre of diurnal activity, also serves as a nightly resting site and also regarded as a source of annoyance to the farm crops, detering the crop quality and enhancing economic losses, in particular in multiple cropping practices, with hardly any expenditure on energy by to and from visitations during the day (Roberts, 1991).

Present studies also indicated that, the depredations on both maize and sunflower, incidentally both considered as cash crops in the country, were fairly pronounced, more conveniently in the unprotected situation, and in the multiple cropping systems of Central Punjab, Pakistan. Depredations were virtually relentless in the unguarded conditions, as maize and sunflower happen to be the highly preferred crops to parakeets, resulting in considerable economic losses. As the parakeet's menu is fairly large, therefore, it has a wide choice of food. Seemingly, it goes for the best in terms of nutrition available to it and at an easily accessible place. It was also evident that, the damage was more towards the corners of the filed, than in the middle, possibly owing to a relatively trouble free access, and averting frequent doorway in the centre.

One of the significant ecological factors in enhancing the roosts of parakeets has been the long existence of multiple cropping practices, more commonly for the sake o convenience of farmers, here in the region of Central Punjab (Khan & Hussain, 1990; Roberts, 1991). Results indicated that, although the plant losses by the parakeets for various growth stages in both the crops were apparent, but their tenacity increased appreciably at the maturity, suggesting their predilection. Invariably, the kernel (seed) losses were also fairly high on the damaged cobs and heads, ranging more than 70% in the unguarded situation. Logically, shorter distance the parakeets would cover from and to their roosts, would grant several visits throughout the day, more persistently in the early morning and late evening hours, that is, the exit and return time to their roosts, as has also been reported by (Roberts, 1991; Sushil & Kumar, 1994). Conceivably, the damage might be far less if the roosts would be located away from the food crops. Similar damage proportions have also been reported on cockatoos and blackbirds in the unprotected conditions (Fleming *et al.*, 2002; Hagy *et al.*, 2007), which resulted also in significant economic losses. A comparable data on blackbird damage has also been recorded by Conover and Dolbeer (1989) on maize, while a substantial (42%) loss was incurred by the same bird on sunflower plants on mature stages (Cummings *et al*., 1989; Linz & Hanzel, 1997) in the plains of United States. Importantly, the bird damage and economic losses would not be relentless, when crops would be well protected against bird depredations (Dolbeer, 1989; Tillman *et al.*, 2000; Oerke & Dehne, 2004).

Work done in Pakistan for crop and orchard management against the pillage of rose-ringed parakeets and others, is scanty to date. Only few attempts have been made in this regard (Khan & Ahmad, 1983; Brooks & Hussain, 1990; Hussain *et al.*, 1992; Beg *et al.*, 1995), sparsely in open country, predominantly in captivity, and devoid of a plausible and bird deterrent technology, bird pests would continue destroying the invaluable crops in Pakistan. Therefore, possibly, incorporation of environment friendly techniques would be more appropriate. In their absence, the parakeets and other potent avian pests would continue to foster and continue with their ravages on economically important food crops. Unquestionably, the agro-ecosystems throughout the Central and Southern Punjab act as hub of activities for several avian pests, furnishing ample food resources and safe havens (Roberts, 1997), presumably adoption of an environmentally sustainable methodologies viz. frequent use of non chemical methods such as the use of reflecting ribbons, multi-mirror reflectors, distress sound players, bird hawk eye rotators, have been successfully used in various parts of the world, to inhibit avian depredations on crops (Flemming *et al*., 2008). Present studies provide an insight in to the parakeet populations here in the region of Central Punjab, and to employ such sustainable means, to bring at least, some respite to the farmers and agriculturists, and manage the parakeet populations.

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REFERENCES

Bashir, El, S.A., 1978. *Review of Parakeet Damage and Suggested Control Methods*, pp: 15–20. Seminar, Bird Pest Problems in Agriculture, July 5-6, Karachi, Pakistan

Beg, M.A., M. Inam, M.M. Hassan and A.A. Khan, 1995. Foraging behaviour of rose-ringed parakeet in sunflower protected by reflecting tape. *Pakistan. J. Agric. Sci*., 32: 68–72

Bomford, M., 1992. Review of research on control of bird pest in Australia. *Proc. Vert. Pest Conf., July 7-10*, 13: 93–96

Brooks, J.E. and I. Hussain, 1990. *Control of Vertebrate Pests in Pakistan*, pp: 349–370. Technical Report, Pakistan Agriculture Research Council, Islamabad

Brooks, J.E., E. Ahmad, I. Hussain, S. Muneer and A.A. Khan, 1990. *A Training Manual on Vertebrate Pest Management, GOP/USAID/DWRC, Vertebrate Pest Control Project*, p: 314. National Agriculture Research Center, Pakistan Agriculture Research Council, Islamabad, Pakistan

Butler, C.J., 2003. Population biology of introduced rose ringed parakeet (*Psittacula Krameri)* in the UK. *Unpublished Ph.D. Thesis*, p: 277. Department of Zoology, Edward Grey Inst. of Field Ornithology, University of Oxford

Canover, M.R. and R.A. Dolbeer, 1989. Reflecting tapes fail to reduce blackbird damage to ripening corn fields. *Wild. Soc. Bull*., 17: 441–443

Colton, B. and B.S. Coombs, 1994. Sunflower industry. *In*: Coombs, B. (ed.), *Australian Grains: A Complete Reference Book on the Grain Industry*, pp: 400–404. Morescope Publishing, Camberwell

Crabb, A.C., J.J. Marois and T.P. Salmon, 1994. Evaluation of field sampling techniques for estimation of birds damage in pistachio orchard. *Proc.16th Vert. Pest Conf.*, pp: 335–345

Cummings, J.L., I.N. Guarion and C.E. Knittle, 1989. Chronology of blackbird damage to sunflowers. *Wild. Soc. Bull*., 17: 50–52

Curtis, P.D., E.D. Rowland, P.G. Jensen and M.P. Hoffman, 2004. Obstructive non-woven fiber barriers for reducing red-winged blackbird damage to sweet corn. *Crop Prot*., 23: 819–823

Dolbeer, R.A., 1989. Current status and lethal means of reducing bird damage in agriculture. *Proc. Int. Ornithol., Ottawa, Canada*, pp: 474–483

Dvir, E., 1985. Ring-necked parakeets are trying to make it in Israel. *Nat. Sci., Israel Ltd.*, 10: 115–120

Flemming, P.J.S., A. Gilmour and J.A. Thompson, 2002. Chronology and spatial distribution of cockatoo damage to two sunflower hybrids in south-eastern Australia, and influence of plant morphology on damage. *Agric. Econ. Environ*., 91: 127–137

Flemming, P.J.S., J.A. Thompson, A. Gilmour and P. Brown, 2008. Use of effective and non-chemical methods to reduce cockatoo damage to maize and sunflower plants in south-western Australia. *Agric. Econ. Environ*., 7: 185–192

Gordo, O., 2006. Unusual pre-roosting behabiour of barn swallows (*Hirundo rustica*) during autumn migration. *Revista Catalana d'Ornithol*., 22: 40–42

Gupta, M.K., B. Rajan and R. Baruha, 1998. Parakeet damage to sugarcane. *Indian J. Sugar*., 46: 961–968

Hagy, H.M., G.M. Linz and W.J. Bleir, 2007. Optimizing the use of decoy plots for blackbird control commercial sunflower. *Crop Prot*., 27: 1442–1447

Haq, A., A. Rashid, M.A. Butt, M. Aslam and A. Saeed, 2006. Evaluation of sunflower (*H. annuus* L.) hybrids for yield and yield components in Central *Punjab J. Agric. Res*., 44: 277–285

Harms, K.E. and J.R. Eberhard, 2003. Roosting Behavior of the Brown-throated Parakeet (*Aratinga pertinax*) and Roost Locations on Four Southern Caibbean Isands. *Ornitologia Notropical*, 14: 79–89

Heisterberg, J.F., 1983. Bird repellant seed corn treatment, efficacy, evaluations and current registration status. *Proc. Eastern Wildl. Damage Control Conference*, Vol. 3, p: 177

Hotham, R.L., R.W. Dehaven and S.D. Fairaizl, 1988. *Bird Damage to Sunflower in North Dakota, South Dakota and Minnesota, 1979-1981*. US Fish Wildlife Serv. Tech. Report, 15

Hussain, I., I. Ahmad and A.A. Khan, 1992. Responses of caged rose-ringed parakeets to methiocarb. *Pakisatn J. Zool*., 24: 247–249

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

Jassra, A.W. and M.A. Rafi, 2003. *Cash Crop Farming in the Northern Pakistan: The Importance of Pollinator Diversity and Managed Pollination in Apricots*. GOP/NARC, Islamabad, Pakistan

Khan, A.A. and S. Ahmad, 1983. Parakeet damage to sunflower in Pakistan. *Proc. 9th Bird Control Sem., Bowling Green State University*, pp: 191–195. Ohio, United States

Khan, H.A. and M.A. Beg, 1998. Roosts and roosting habits of rose-ringed parakeet (*Psittacula kramei*) in Central Punjab, Pakistan. *Pakistan J. Boil. Sci*., 1: 37–38

Khan, A.A. and I. Hussain, 1990. Parakeet *(Psittacula krameri)* damage to standing maize crop in Pakistan. *Sar. J. Agric*., 2: 185–191

Linz, G.M., D.L. Vakoch, J.F. Cassel and R.B. Carlson, 1984. Food of red winged blackbirds *Agelaius phoeniceus*, in sunflower fields and corn fields. *Can. Field Nat*., 98: 38–44

Linz, G.M. and J.J. Hanzel, 1997. *Birds and Sunflower in Schneider*, pp: 381–394. Sunflower Science and Technology, American Society of Agronomy, Mad., Wisconsin

Oerke, E.C. and H.W. Dehne, 2004. Safeguarding production-losses in major crops and the role of crop protection. *Crop Prot*., 23: 275–285

Parwin, A., 1988. The importance of sunflower pests in Iran. *In: Proc. 12th Int. Sunflower Conf., Novi Sad, Yugoslavia*, July 25-29

Roberts, T.J., 1991. *Birds of Pakistan*, p: 667. Oxford University Press, London, England

Roberts, T.J., 1997. *Mammals of Pakistan*, p: 742. Oxford University Press, England

Sarwar, M., M.A. Beg, A.A. Khan and D. Shahwar, 1989a. Distribution and abundance of tree hollows and parakeet nests in agroecosystem of Central Punjab. *Pakistan J. Zool.*, 21: 139–146

Shafi, M.M., A.A. Khan and I. Hussain, 1986. Parakeet damage to citrus fruit in Punjab. *J. Bom. Nat. Hist. Soc*., 83: 439–444

Shafi, M.M., A.A. Khan and I. Hussain, 1986. Parakeet Damage to citrus fruit in Punjab. *J. Bomb. Nat. His. Soc*., 83: 439–444

Steel, R.G.D. and J.H. Torrie, 1990. *Principles and Procedures of Statistics*: *A Biomaterical Approach*, 2nd edition. McGraw Hill Book Co. Inc., New York

Sushil, K. and S. Kumar, 1994. Seed damage of tree (*Terminalia arjuna*) by the rose ringed parakeet (*Psittacula krameri*). *Indian J. Forest.*, 17: 151–153

Taber, R.D., A.N. Sheri and M.S. Ahmad, 1967. Mammals of Lyallpur District. *J. Mamm.*, 5: 214–218

Tillman, E.A., A.V. Doom and M.A. Avery, 2000. Bird damage to tropical fruit in south Florida. *Proc. Wildl. Dam. Con., October 5-8*, pp: 47–59

Yu, N. Yang, Y. Wang, D.S. Yue and J.H. Ran, 2010. Roosting behavior and roost selection by buff-throated partridges (*Tetraophasis szechenyii*) during the breeding season. *Zool. Stud*., 49: 461–466

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