



Bird Pests: Damage and Ecofriendly Management

Mani Chellappan^{1*}, M.T. Ranjith¹, Vipin Chaudhary² and K.A. Sreejeshnath¹

¹AINP on Vertebrate Pest Management, College of Agriculture, Vellanikkara, KAU Thrissur 680656, India

²AINP on Vertebrate Pest Management, ICAR-Central Arid Zone Research Institute, Jodhpur 342003, India

Received: June 30, 2023 Accepted: October 31, 2023

Abstract: In various agro-ecological zones of the nation, birds have been known to severely damage a range of crops at their susceptible stages. The amount of bird damage to any crop relies on a variety of factors, including the density of the local bird population, area covered by the crop, cropping pattern, season, and the physiological condition of the birds. It has been identified that about 1200 species of birds belonging to 20 different families and only 2% of it damage the crops. The Grey Partridge (*Perdix perdix*), Blue Rock Pigeon (*Columba livia*), and House Sparrow (*Passer domesticus*) have been found to cause the maximum damage to crops. Other species which nest close to agricultural areas include the Rose-ringed parakeet (*Pseittacula crameri*), Baya weaver (*Ploceus philippinus*), Tricoloured munia (*Lonchura malacca*), and Spotted dove (*Spilopelia chinensis*) also extensively damage the crops. Moreover, it has been documented that bird damage varied with respect to seasons, areas, number of species, their density, concentration of migrants, and their feeding patterns. It was also more prevalent in the isolated fields that matured slowly or quickly. In order to attain the desired yields, the production system must be safeguarded and birds pests must be effectively managed to reduce crop losses. While traditional methods for managing predatory birds include erecting a perch amid crop fields, scare crows and drumming, the eco-friendly methods of controlling birds include modifying habitat, block plantations, reflective ribbon, reflective paper plates, and hybrids that are resistant to birds.

Key words: Bird damage, management, agricultural crops, depredatory birds.

India is bestowed with rich avi-faunal diversity and the number of bird species recorded in the country is more than 1200 belongs to 20 avian orders. Many of the birds are important pollinators and indicators of a healthy ecosystem. Since ancient times, birds have been an essential component of attractiveness and many cultures have an amazing place in their mythology for birds. Most of these birds have a complex status (beneficial/depredatory/neutral/unknown) in relation to their habitat. Out of the total, 25 species of (2%) birds cause damage to human interests. In several agro-ecological

OPEN ACCESS

Edited by

Praveen Kumar
Vipin Chaudhary
K.S. Jadon
S.C. Meena

*Correspondence

Mani Chellappan
Mani.chellappan@kau.in

Citation

Chellappan, M, Ranjith, M.T., Chaudhary, Vipin and Sreejeshnath, K.A. 2023. Bird pests: damage and ecofriendly management. *Annals of Arid Zone* 62(4): 361-372.
doi: 10.59512/aaz.2023.62.4.11
<https://epubs.icar.org.in/index.php/AAZ/article/view/138097>

zones of the country, birds are known to inflict significant economic damage on a variety of crops at vulnerable stages. The extent of crop damage caused by birds depends on a number of factors, including the concentration of the local bird population, the total area covered with crops, cropping pattern, season, and the physiological status of birds. Managing the depredatory birds is considerably different from the conventional pest management approaches. Indian Wildlife (Protection) Act, 1972 prohibits use of any measures to trap or harm or kill most of bird species, leave alone the national or endangered or threatened species. Whistler (2007), Dharamkumarsinhji (1956) and Ali and Ripley (1971) mentioned that house sparrow (*Passer domesticus*), baya (*Ploceus philippinus*), parakeet (*Psittacula krameri*) and peafowl (*Pavo cristatus*), etc. cause significant loss in agricultural crops. Sharma (1972) described the negative impact that peafowl brought to the cultivated crops. Crop pests in the Indian desert included doves, house sparrows, white-throated munias, and parakeets (Rana, 1973). Investigation on both basic and applied aspects of birds as harmful and beneficial components in agricultural ecosystems has generated valid information that has helped to evolve technologies for their management. Non-lethal control measures call for special attention and research on them should be intensified. Studies have been conducted on various chemical and physical bird repellents which ensure protection to the germinating and maturing crops. Various depredatory birds and their damages in agricultural crops and the management strategies are given hereunder.

Indian Peafowl

The well-known and fairly globally recognized Indian peafowl or Blue pea fowl (*Pavo cristatus*), a native of the Indian subcontinent, is an exotic in many areas of the world. Indian peafowl is the largest among the pheasants. It is a member of the Phasianidae family and Galliformes order. In numerous cultures and mythologies, *Pavo cristatus* are mentioned. It is a widespread endemic breeder who lives in Nepal, India, and Sri Lanka with its long train of elaborate upper tail-coverts, magnificent colors, and dramatic mating dance, the male (peacock) is one of the world's most popular birds (Ali and Ripley, 1980). The Indian peafowl forages for berries and grains on the ground in open

woodland or on farmland, but it also preys on snakes, lizards, and small rodents. Peafowls have been observed to consume a variety of plant materials, including leaves, grass seeds and flower parts, cotton fruits, acacia seeds, *Cyperus* rhizomes, standing cereal crops (Sridhara, 2016). The kind of damage caused by peafowl varies according to the type of crop and its stage of development. In Kerala peafowl became huge threat to paddy cultivation and it cause damage to rice plants in its two critical stages, namely the seedling and mature stages. It feeds on the sprouting seeds from the nursery bed during the nursery stage. As it forages, it tramples the seedlings in the bed, which causes an uneven distribution of seedlings and lowers their quality. In the maturity stage, the birds consume the paddy by stripping off the grain from the panicle with their beaks and the extent of damage ranges from 1 to 5% (Govind and Jayson, 2018). The study on intensity of damage caused by peafowl to various types of crops showed that a higher damage was observed in rice (83.5%) followed by other cereal crops (62.50%), spicy crops (33%) and leafy vegetables (19.5%), whereas, comparatively a less damage was observed in plantation crops (14%), tubers (6%) and legumes (11%) (Senaratna *et al.*, 2019). Paranjpe and Dange (2020) investigated the human-peafowl interaction in selected villages of Maharashtra and Rajasthan observed that peafowls preferred the agricultural land as a source of food, water display sites and resting sites and caused yield loss ranging from 5-20% in various field crops growing in the region.

White-rumped Munia

The white-rumped munia (*Lonchura striata*) or white-rumped mannikin, also known as the striated finch in aviculture, is a small passerine bird in the Estrildidae family of waxbill "finches". These species are not related to true finches (Fringillidae) or true sparrows (Passeridae). It is endemic to tropical continental Asia and a few surrounding islands, and it has become naturalized in parts of Japan (Grimmett *et al.*, 2011). Individuals of white rumped munia strictly follow communal roosting and foraging. They move as flocks from morning to evening and maintain the flock size throughout the day. White-rumped munia typically consumes grass seeds, primarily rice, but also those from other grasses (such as *Eragrostis*, bamboo, and sedges (Cyperaceae); also, it consumes

seeds from casuarina (*Casuarina*) cones and filamentous green algae (of the genus *Spirogyra*) from shallow water. Munia's are a big threat to the rice farmers and causes considerable losses during two critical stages, namely milky stage and mature stage. In the milky stage and maturity stage, the birds consume the paddy by stripping off the grain from the panicle with their beaks and the average extent of damage ranges from 1 to 2.3%. They are also reported to cause significant damage in date plum fields in Gujarat (Sridhara, 2016).

Rose Ringed Parakeet

The ring-necked parakeet (*Psittacula krameri*), also known as the Indian ring neck parrot and the rose-ringed parakeet, is a medium-sized parrot belonging to the genus *Psittacula* in the family *Psittacidae*. Its natural ranges are fragmented between Africa and the Indian Subcontinent, and it has since been brought to many other regions of the world where feral populations have already established themselves and are being bred for the exotic pet trade. It is one of the few parrot species that has survived the onslaught of urbanization and deforestation and is one of the few that have effectively adapted to living in disturbed habitats. Rose-ringed Parakeet, *Psittacula krameri*, is the most common and destructive bird from agricultural perspective which inflicts huge damage to standing cereal crops, fruit orchards, and vegetable crops (Kushwaha and Roy, 2002). The Rose-ringed Parakeet is known to cause 10 to 30% damage in Andhra Pradesh and 14 to 16% damage in Kerala. In Punjab, the mean percentage of parakeet damage in different years ranged from 5.7 to 29% (Rao and Dubey, 2006). A single Rose-ringed Parakeet, *Psittacula krameri*, consumes about 15 g of sunflower seeds per day. In maize, emerging tender cobs are damaged along with the silky style and green tender spathe (husk). In milky stage, green spathe (husk) is cut into pieces and the cobs are partially exposed and the grains are damaged by feeding on the milky contents. In dough stage, the exposed tender grains are removed and fed and in mature stage, the husk is pulled out and the grains are fed and thus sometimes damaging the cob completely (Ikisan, 2023). Rose-ringed Parakeet cause damage to guava fruit at ripening stage and the pattern of damage is like triangular marks and deep gouges. It was estimated that

that parakeet incidence in guava at rind and variation stages results in 2.79 to 4.60% and 1.94 to 4.99% damage respectively (Malhi and Kaur, 2001). In Himachal Pradesh, rose ringed parakeet caused 5 to 12.5% damage in apple, whereas in Gujarat, Andhra Pradesh, and Punjab, rose ringed parakeet inflict damage to paddy crops to the tune of 1%, 1 to 6.5% and 3% respectively (Sridhara, 2016). In Gujarat, Andhra Pradesh and Rajasthan, sorghum and maize crops have suffered major losses due to parakeets' incidence which enter the fields in massive groups. In sorghum fields, the damage ranged from 2.3 to 48%, while in maize fields, it ranged between 3 and 20% (Sridhara, 2016).

White Cheeked Barbet

The white-cheeked barbet, (*Megalaima viridis*) is a member of the Capitonidae family and Megalaimatinae subfamily in the order Piciformes. It is an indigenous, widely dispersed species that can be found in villages and forests of Kerala (Sashikumar *et al.*, 2001). Barbets are mostly frugivorous, significant plant seed dispersers, and play a key role in preserving the ecosystem's health. Barbet habitats appear to require trees with enough dead wood in their branches that can be used to create chambers for both roosting and nesting (Shorts and Horne, 2002). White cheeked barbet mostly causes damage in the fruit crops. Because they are arboreal, these barbets rarely come to the ground. They obtained water from their fruit-based diet. They cause slight annoyance to the farmers by consuming fruits from the orchards (Chakravarthy, 2004). White cheeked barbet cause damage to mango fruits and papaya at ripening stage and the pattern of damage is like round with wide and deep gouges. The extent of damage ranges from 2 to 4%. White cheeked barbet are considered a minor pest as their number is less when compared to other depredatory birds like crows, parakeets' bulbuls and besides they are solitary in nature.

Common Crow

The house crow (*Corvus splendens*), is a common bird of the Corvidae family that is of Asian origin but are now found in many parts of the world. It is indigenous to southern Myanmar, southern Thailand, the coast of southern Iran, and Nepal, Bangladesh, India, Pakistan, Sri Lanka, the Maldives, and the Laccadive Islands. It is associated with human

settlements throughout its range, from small villages to large cities. Due to a human population explosion in these areas, this species has also proportionately multiplied. Being an omnivorous scavenger has enabled it to thrive in different circumstances (Brook *et al.*, 2003). They devour almost everything that is edible. House crows are a major problem on grapes in Karnataka. It also nibbles the berries that have been packed after harvest. In Punjab, house crow causes 12% damage to peach (*Prunus persia*) fruits. Also, it is a major pest in Kerala of fruit crops like mango and papaya. They mainly feed on the fruits during ripening stage and form marks which are wide, deep, round or shapeless. The extent of damage ranges from 10 to 15%. Their attacks are typically seen during the day, but they can also cause damage at night in some areas. They inflict upto 1% damage in dates fields at Gujarat. Common crow along with rose-ringed parakeet caused 10 to 30%, 40 to 90% and 5.7 and 29% damage in various crops in Andra Pradesh, Gujarat and Punjab respectively. In oil palm fields of west Godavari district of Andhra Pradesh (3.3 to 30%) and south Gujarat (10 to 27%) experienced greater damage due the common crow (Sridhara, 2016).

Spotted Dove

The spotted dove (*Spilopelia chinensis*), a diminutive pigeon with a rather long tail, is a typical resident breeding bird throughout its native habitat in Southeast Asia and the Indian subcontinent. The species has been brought into many regions of the world, where feral populations have grown. This species was traditionally included with other turtle-doves in the genus *Streptopelia*, but research indicates that they are distinct from other members of that genus. The median coverts of the Indian and Sri Lankan subspecies are composed of brown feathers with Rufous spots on their tips and are divided at the tip by a spreading grey shaft streak (Ali and Ripley, 1980). Spotted doves move around in pairs or small groups as they forage on the ground for grass seeds, grains, fallen fruits and seeds of other plants. They forage for berries and grains on the ground in open woodland or on farmland. They become major pest in various agricultural fields, and their attacks are mainly seen in the early stages of crop growth, especially after sowing. They cause damage to newly sowed millets, matured mustard and sunflower and

also to the crop during post harvesting stage which are kept on the threshing ground or in the godowns. In Kerala, spotted dove is a huge threat to paddy fields. It feeds on the sprouting seeds from the nursery bed during the nursery stage, and the phases of seedling germination. Following post-sowing irrigation, the birds gather the seed from the field and eat the soaked seeds that were germinating. Additionally, they rip out the developing young seedlings. As it forages, it tramples the seedlings in the bed, which causes an uneven distribution of seedlings and lowers their quality, extent of damage ranges from 10 to 15% in rice.

Grey Headed Swampen

Purple moorhen popularly known as the grey headed swamp hen (*Porphyrio poliocephalous*) has been emerging as a serious threat to paddy production in different parts of Kerala. They are migrant species of birds belongs to avian family Rallidae. Through they are identical to domesticated hen in both size and shape but have characteristic purple blue plumages and possess long legs, beaks and forehead which are in red colour. While walking, they move their tail both upward and downward and produce characteristic sound and can perceive even minute disturbances from surroundings and move quickly to safer zones. This bird is common and widespread across much of the Indian subcontinent. They prefer to reside in fields which are adjacent to water bodies such as kole lands of Thrissur, pokkali areas of Alappuzha. Their populations vary locally in their habits: some are bold and nearly indifferent to humans while others are secretive. Most readily observed in refuges where it becomes acclimated to people.

Gray-headed swamp hens primarily consume plant matter, particularly the shoots and tubers of semi-aquatic and aquatic plants like reeds and rushes. In Kerala, people primarily consume paddy rice plants and sugar cane. They forage by slowly walking through shallow wetlands, picking at vegetation with their bills or grasping it and pulling it up. They use their enormous feet to balance themselves as well as to grasp plant food and bring it to the bill to eat. The occurrence of purple moorhen has been reported from rice fields adjacent to bodies of water, and the extent of

damage ranges from 10 to 50%. They build their nests in paddy fields. They cut the seedlings at ground level and use their legs and beaks to extract the plant's inner soft parts. Their attacks are typically seen during the day, but they can also cause damage at night in some areas. The grey headed swamp hen has emerged as the a serious threat to agriculture in Kerala. They have caused enormous damage in the last five years, particularly in Thrissur. They attack rice crops in groups, and as a result, the crop in a single fields can vanish in days or even in hours.

Plum Headed Parakeet

The plum-headed parakeet (*Psittacula cyanocephala*) belongs to the family Psittacidae of parakeets. It is native to the Indian Subcontinent and was once considered to be conspecific with the blossom-headed parakeet (*Psittacula roseata*), but it was later upgraded to a distinct species. Plum-headed parakeets are found in flocks, with the males having a pinkish-purple head and the females having a grey head. The most prevalent and harmful bird from the standpoint of agriculture is the the plum-headed parakeet (*Psittacula cyanocephala*), which causes significant harm to standing vegetable, fruit, and grain crops. In Andhra Pradesh, the plum-headed parakeet is known to cause 10-35% damage, while in Kerala, 18-20% damage. *Psittacula cyanocephala*, a single plum headed parakeet, eats roughly 10 g of sunflower seeds every day. In maize, the silky style, green tender spathe (husk), and emerging tender cobs are all injured. In maize, emerging tender cobs are damaged along with the silky style and green tender spathe (husk). The cobs are partially exposed during the milky stage, the green spathe (husk) is broken up, and the grains are damaged by feeding on the milky fluids. In the mature stage, the husk is pulled out and grains are fed, resulting in complete damage to the cob, as opposed to the dough stage, where the exposed tender grains are removed and given. Guava fruit is harmed by rose-ringed parakeets at the ripening stage, and the pattern of damage resembles triangle marks and deep gouges (Ikisan, 2023).

Baya Weaver

South and Southeast Asia are home to the Baya Weaver (*Ploceus philippinus*). They usually live in or close to grassland, farmed areas,

brush, and secondary growths. These are about the size of a house sparrow (15 cm), and both the males and the female look like female house sparrows when they are not breeding. Their short, square tail is paired with a thick, conical bill. They are gregarious and social birds. On the ground and on the plants, they search in flocks for seeds. The compact formations and intricate motions of flocks in flight are common. Because they can harm ripening crops and are known to pick paddy and other grains from harvested fields, they are occasionally regarded as pests. They spend the night in reed beds beside to water bodies. For both food and nesting material, they rely on both wild grasses like guinea grass (*Panicum maximum*) and crops like paddy. Baya weavers still constitute a serious threat to rice farmers because of their frequent attacks, which cause substantial losses for the farmers. Baya weavers cause harm to rice plants during their two critical stages, the milk stage and the mature stage. Using their beaks to scrape the grain from the panicle, birds consume paddy during the milk stage and maturity stage and cause damage from 1.8% to 5.8%. Bird damage to wheat varied across the country from 0.2 to 41%. Among the various states, Rajasthan suffered significantly more damage than Gujarat or Punjab and the crops were damaged by 13 different bird species in all, with the Baya weaver being the main culprit (Sridhara, 2016).

Common Teal

The ubiquitous and widespread Eurasian teal (*Anas crecca*), often known as the common teal or Eurasian green-winged teal, breeds in temperate Europe and migrates South during the outside of the breeding season. It is a very sociable duck that can form sizable groups. The Eurasian teal is frequently referred to as simply the teal (*Anas crecca*) which inhabits protected wetlands and feeds on aquatic invertebrates and seeds. The Eurasian teal is one of the smallest dabbling ducks still in existence, measuring 34 to 43 cm in length and weighing an average of 340 to 360 g for hens and drakes, respectively. The wingspan is 53 to 59 cm and 17.5 to 20.4 cm in length. The tarsus is 2.8 to 3.4 cm long and the bill is 3.2 to 4.0 cm long (Guillemain and Elmberg, 2014). The drakes in their nuptial plumage look grey from a distance, with a dark head, a yellowish back, and a white stripe extending along the flanks. They have a chestnut head

and upper neck with a large, iridescent dark green teardrop- or half-moon-shaped patch that begins just before the eye and arcs to the upper hind neck. A single line of that colour extends from the patch's forward end and curves along the base of the bill. The patch is framed by thin, yellowish-white lines. There are a few tiny, circular dark dots on the buff breast. The body plumage is predominantly white with thin and dense blackish vermiculations, appearing medium grey even from a close distance, with the exception of the white center of the belly. Every year, Green-winged teal destroy agricultural land along the migration path, but it is usually not severe enough to cause major economic loss.

Management of Depredatory Birds

Agro-ecosystems are so dynamic and constantly changing that it is essential to periodically develop appropriate bird pest management strategies to address newly emerging pest problems. Parakeets and other birds feed on sunflower, an oilseed crop that was introduced in Punjab during the 1980s and matures in May or June. Despite ripe wheat being present in the fields, parakeets used to eat the seeds of natural trees like mulberry and weed seeds of *Crotalaria medicaginea* before the introduction of sunflower (Saini *et al.*, 1994). Prior to 1970, when more oil-seed rape was being planted, it was observed that the wood pigeon population was rapidly expanding and turning into a problem in Britain (Feare *et al.*, 1988). Although this is unrealistic with regard to many areas of food production, these types of problems caused by birds may be prevented by reversing the trends in farm management that had caused the problems. However, we should be conscious of the alterations that had caused the harm because changing farming practices could help to solve the bird problems without impeding the impacted aims. The various methods that can be adopted by the farmers to minimize the damages caused by depredatory birds are given hereunder.

Use of Auditory and Visual Frightening Devices

Reflective ribbon: Reflective ribbons work on the principle that sudden bright flashes of light produce startling response and drive the bird from an area. The reflective ribbon can be used to scare off purple moorhen, rose ringed

parakeets, and Plum headed parakeets from the farming fields. The ribbon has red color or yellow in one side and silver color the other side or holographic surface on both sides. The reflective ribbon should be erected in north south direction in the field at a height of 45 cm above the crops on supports spaced at 1.5 to 2 m. apart The ribbon needs to be twisted at every one meter and be given support at every 5 m. This is highly effective during day time on bright sunny days. The sun's reflection and the wind's buzzing noise frighten the birds away from the field. However, the tool is only useful for 15 to 20 days since birds progressively become accustomed to it. Additionally, when the crop is produced in isolation and under poor lighting conditions, ribbons do not frighten birds. The method of bird scaring using ribbons is particularly successful and well-liked by farmers for protecting the crop during sensitive periods. In Andhra Pradesh, integrated bird pest management (IBPM), which uses reflective ribbons, botanicals, and wrapping in addition to ribbons in maize fields, increased yields. The use of botanicals and the installation of reflective ribbons proved successful in reducing avian pests, resulting in higher harvests. The economic studies conducted for the IBPM clearly showed that savings of up to Rs. 845 and Rs. 1520 could be made in sorghum and maize, respectively, as opposed to the conventional practice of using bird scares for the aforementioned purposes (Rao and Dubey, 2016).

Bioacoustics: The use of the sound devices can also successfully scare away the birds. One stereo tape recorder with a 30 watt amplifier, two speakers, and a 12 volt battery make up this device. Birds' cries for help are played on prerecorded tapes. The speakers should be maintained in bushes close to the field area, and the equipment should be operated from a distance of roughly 100 m. The frequency of play should be set up at regular intervals and should be dependent on the level of bird activity. Birds are kept away from maize fields and other crops by broadcasting these predatory bird distress cries. This approach works incredibly well for small-acreage crops and orchards. Using species-specific alarm sounds and predator calls, rose-ringed parakeets have been temporarily dissuaded from crops in both invasive (Anderson *et al.*, 2021) and native

ranges (India and Pakistan (Khan *et al.*, 2011; Mahesh *et al.*, 2017). Distress calls may draw in some species (Conover, 1994), a behavior that should be taken into account when trying to deter pest birds as well as when lethally removing invasive species through shooting or trapping. Distress calls can repel conspecifics and reduce crop damage (e.g., starlings; Conover and Perito 1981; Berge *et al.*, 2007; Delwiche *et al.*, 2007); however, distress calls may also attract some species. Distress cries may also deter non-target passerine species, which could have an effect on how they behave and use their surroundings.

Auditory deterring methods: The automatic cracker station can be used for deterring the depredatory birds like grey headed swamphen and pea fowl during both day and night hours. The sound produced from the crackers at regular interval from the equipment act as auditory repellents for the birds. In automatic mechanical bird scarer or pyrotechnic method a gadget produces sound and operates constantly throughout the duration of the day using one kilograms of calcium carbide and water. With this technique, one hectares of space can be covered, effectively lowering crop losses due to bird damage. Community level adaption will lower the cost even when the initial cost compared to purchasing the equipment is considerable. Devices called propane exploders use a spark to ignite propane in a firing chamber. This instrument, which causes numerous loud explosions, is widely used. Intermittent use of the shotgun strengthens the impact. Shell crackers are shotgun shells that explode 65 to 75 m distant when fired from a 12-gauge shotgun. However, one of the biggest negatives is the potential for burning dry vegetation. A launcher rod is required for rockets. They cover a lot more ground than shell crackers do. The birds are startled by the hissing sound as it moves through the air.

In Punjab, parakeets were successfully discouraged from destroying guava using an acetylene exploder. For fields larger than four to five acres, particularly those in orchards, automatic mechanical bird scares or pyrotechnic methods are excellent. It should only be used when birds are visiting fields, and preventative measures are crucial (Raheja, 1992). When a bird is taken by a predator, distress sounds are made, shocking the predator into dropping

the prey. Distress calls' repulsiveness, rate of habituation, and impact of regional dialect are all factors that affect its efficacy. A distress call serves several purposes. It may also scare the predator to release its hold or attract another predator. It may also attract and warn conspecifics. In both laboratory and field settings in Punjab, parakeets were terrified and repulsed by recorded distress calls. Commercially accessible recorded alarm and distress sounds are particularly effective when played in pest birds' habitats. Calls that are amplified are more effective.

Scarers: Scarecrows are used by farmers to move and seem like human predators (Marsh *et al.*, 1992). Landowners claim that inflatable "wavy men" are effective, although limited research has found that their efficacy is questionable or minimal. Effectiveness of scarecrows can be increased by adding unpredictably loud sounds and motion, but if placed in well-known feeding areas, most birds will become accustomed to them (Cummings *et al.*, 1986). The effectiveness of hazing may be diminished as wildlife species start to tolerate human harassers when no unpleasant stimuli is present (Grant *et al.*, 2011). Helium-filled balloons with or without eyespots, hawk or owl, kites, scare crows, spot lights, flashing lights, strobe lights, Mylar tape, and laser are examples of visual horrors. In India, only scarecrows and Mylar tapes are used. Prey birds perceive their habitat as perilous because of falconry, local predators, raptor models, people, and guard dogs. Hawk kites are movable predator models that are suspended in the air (Hothem and DeHaven, 1982; Conover 1983 and 1984), but their effectiveness is only in the area directly beneath the model. Natural predator-prey systems are benefited by passive stimulation of natural predators (e.g., nest boxes and raptor perches) (Kross *et al.*, 2012; Harris *et al.*, 2018; Lindell *et al.*, 2018; Peisley 2017).

Lasers: It has been suggested that lasers may be used to deter birds. Previous studies have demonstrated their efficiency in scaring gulls and double crested cormorants. Later research produced contradictory findings. Under experimental circumstances, European starlings were not repulsed, while rock doves, mallards, and geese clearly avoided the beam (Blackwell *et al.*, 2002).

Habitat Management

Many pest birds have been found associated with particular habitat and changes making in the agricultural ecosystems will avoid bird damage. However, Feare *et al.* (1988) claimed that some success can be had in preventing the bird damage through the removal of particular attractions or the provision of substitute food. According to Feare and Wadsworth (1981), cow farms who fed their herd indoors saw less feed loss to European Starlings than those that fed their stock outside. It is expensive to completely exclude birds from crop scenarios, although exclusion can be justified economically when crops have high economic value, such as when cherry orchards are netted (Feare *et al.*, 1988) or wheat seed production regions are netted (Bruggers and Jaeger, 1982).

The depredatory breeding birds will be forced to abandon their breeding grounds in crop fields and migrate to another place if there is constant disturbance to their nesting locations in and around the harvested areas. In addition to manually destroying nests, parakeet populations were successfully reduced when the nests' entrances were sealed. When certain fruit-bearing trees are planted in and around cropped areas, they attract many granivorous birds during the fruiting period and lessen the impact at vulnerable stages. These trees include the Manila tamarind (*Pithecolobium dulce*), Flame of the Forest (*Butea monosperma*), Mulberry (*Morus alba*), and Toothbrush Tree (*Salvadora persica*). Aquatic plants present in the roosting site of Aquatic Birds provide protection from natural enemies, thus helps in building up of their population. Habitat manipulation is the most effective method against Grey headed Swamphen. The presence of aquatic plants at the purple moorhen's preferred roost spot shields the birds from natural predators, which promotes population growth. The removal of aquatic vegetation from the area around crop fields so deters birds from using that area as a roost. This has the drawback of making it very expensive to remove aquatic plants if they are dispersed across a vast area (Mani Chellappan and Ranjith, 2022).

Physical Barriers

Use of nets: The use of nets to keep birds away from fruit crops has been studied by Sinclair (1990). In the period of ripening, throw-

over netting provides momentary protection. The majority are low-cost, single-use nets. It takes a long time and might be very expensive to harvest a crop with a net. Numerous birds are also captured and killed by extruded nets. Throw-over nets are rarely consistently cost-effective due to the lack of market value in grape types. There are also inexpensive nets that can be installed on thin buildings. These require a lot of upkeep and should typically be updated every two to three years. They may only be financially viable if there is access to cheap labour. Nets are potentially 100% effective, non-toxic, noiseless, and reusable (Stuckey, 1973). The main barrier to utilizing netting to protect crops in developing nations is its high cost. However, it was discovered in Africa that using nets was less expensive than paying individuals to frighten birds (Bruggers and Ruelle, 1981). Among the physical barriers, T Net tied over the nursery bed at a height of 20 cm and fixed firmly on the ground with pegs completely prevents the intrusion of peafowl and offered complete protection of the seedlings. Similarly, erecting nylon rope (2 bottom layers) and reflective ribbon (top layer) at 30 cm intervals above the ground surface around the rice fields during the nursery stage and in the main field provide a grid appearance and make the area unattractive to Peafowl (Sreeja and Chellappan, 2017). The rice seedlings can be protected from the damage of purple moorhen by using net of various kinds' viz., nylon, polythene, cotton and polythene coated iron with mesh size of ¼ to ¾ inches. Though, it requires comparatively high investments, netting is durable and can be used for subsequent cropping periods also (Mani Chellappan and Ranjith, 2022).

Economics should be used to determine whether or not to net a certain area. Farmers frequently believe that netting is too expensive, however Sinclair (1990) discovered that this is untrue from a cost-benefit perspective if it is assumed that a grower borrows money at 18% interest and repays it throughout the net's 10-year lifespan using a 10% discount rate. Even at low to moderate levels of bird damage, netting becomes economically viable in newly planted, intensively tended cherry orchards with high-yielding fruit. Old orchards, however, are difficult to cover with netting, and it is unlikely to be cost-effective.

Rope grid over the canopy: Erecting rope grid over the canopy of rice plant minimizes the attack of purple moorhen. The level of rope grid needs to be raised as the height of rice plant increases is one of the limitations of this method (Mani Chellappan and Ranjith, 2022).

Crop screening: The practice of “crop screening,” which involves planting tall-growing forage sorghum around the perimeter of a sunflower field, was inspired by observations of cockatoo feeding activity. The sunflower crop can be rendered unappealing to cockatoos and galahs, minimizing damage, by altering the visibility of feeding birds (Allen, 1990). Poorly constructed screens do not effectively create a visual barrier and do not lessen damage. This occurs when the sorghum is planted after the sunflower crop, grows slowly, or is physically or chemically harmed. Sunflowers cultivated in sloped terrain are not protected by screens.

Wrapping methods: Maize cobs were protected from parakeet and crow harm by wrapping nearby green leaves over them. The wrapped maize avoids harm from birds because it is concealed and camouflaged, preventing bird detection. Not every cob needs to be covered. Since parakeet damage only affects the field's outer three rows, covering 50% of the corn at random on those rows can effectively lessen bird damage. The process is much less time-consuming than scaring, extremely straightforward, and material-free. The grain yield is not negatively impacted. By using this method, farmers can save about Rs. 1900 per hectare (Rao and Dubey, 2016).

Using Repellents

Repellents come in two different varieties: primary repellents, which are immediately avoided owing to taste or smell, and secondary repellents, which are not immediately repulsive but nevertheless result in discomfort or disease when consumed (Bishop *et al.*, 2003). In Africa, especially among growers of sorghum and millet, the use of taste repellents against avian pests is well recognized. The fear effect is caused by some chemical repellents, which make birds that consume them agitated and prone to erraticism. (Seamans and Gosser, 2016). They are classed as irritants. To reduce the harm due to the peafowl in diverse crop environments, numerous management techniques can be applied. Rock doves, European starlings, house

sparrows, and house finches are all protected species from which methyl anthranilate (MA; CAS No. 134-20-3) is a registered repellent. MA is offered as volatilizing paint-on liquids, blocks, and pouches as well as a fog or spray for perches and roosts. It can also be used on a range of crops and irritates the trigeminal nerve, which makes it toxic to birds (Mason *et al.*, 1989; Avery *et al.*, 1996; Linz *et al.*, 2011). Seed treatment using a seed protectant when planting rice With Strontium chloride (0.2%) and copper oxychloride (0.2%) treatments on rice seeds decreased damage to the tune of 83.3% and 78.8%, respectively, during the nursery stage (Sreeja and Chellappan, 2017). In Gujarat and Andhra Pradesh, spraying botanical formulations like Bio-bird Repellent (BBR) and Fortune Aza (Neem formulation) increased yield while reducing the number of visiting birds. Spraying tobacco leaf decoction (10%) on milky-stage sorghum had a comparable impact. In addition to being effective, these botanicals are also cost-effective because using them to control avian pests can save farmers (Sridhara, 2016).

Physically and Chemically Preventing Access to Desired Food

Where birds clearly choose particular crop varieties, producing non-preferred cultivars may lessen damage (Feare *et al.*, 1988). According to reports, just as the Red-winged Blackbird's taste preferences for particular maize cultivars were impacted by color, so were the European Starling's preferences for specific cherry cultivars. By encircling the corn cobs by their leaves, it is possible to physically prevent birds from accessing their preferred diet (Dhindsa *et al.*, 1993). The destructive birds cannot access pineapple fruits that are covered in rosettes of spiky leaves and a thatch of dry grass (Srihari and Chakravarthy, 1998) or the complete garland of bunches of oil palm when six to eight dried (waste) bunches are tied along a metal wire (Chakravarthy *et al.*, 1998). Tannins (Feare *et al.*, 1988) or neem, *Mormodia foetida*, *Vernonia amygdalina*, and *Gliricidia sepium* extracts (Bright, 2000) are the main sources of chemical deterrent. Physical and chemical deterrents both lose their potency in the absence of substitute foods (Feare *et al.*, 1988), indicating that their effectiveness in reducing bird damage may be limited.

Farming Practices

Rarely do bird damages reverse agricultural development tendencies that sparked them. Partial reversals, however, can aid in protection. By burying the seed deeper in regions where harm is anticipated, for instance, European Starling damage to cereals that are germination could be avoided (Dolbeer *et al.*, 1979), albeit doing so can have additional drawbacks. Red-billed Quelea damage was lessened in semi-arid regions of Africa by cultivating maize rather than small-seeded cereals (Feare *et al.*, 1988). Because crops sown out of phase were relatively uncommon and rooks focused on them, Feare *et al.* (1988) discovered that early and late sown barley and oat fields in Scotland sustained more damage than main season sowing. When cucumber was planted on elevated basins alongside bottle gourd and creepers, there was an 8.5% decrease in bird damage in Karnataka (Srihari and Chakravarthy, 1998). Germany's use of legume catches crops alongside maize decreased the amount of bird damage to the crop (Germeier, 1997). All of these changes to management procedures require advance planning that takes bird damage into account; sadly, at this stage, farmers typically place little importance on it.

References

- Ali, S. and Ripley, S.D. 1971. Handbook of the birds of India and Pakistan: Together with those of Nepal, Sikkim, Bhutan and Ceylon. Vol. 6, Cuckoo-shrikes to babaxes: synopsis nos. 1064-1271, Colour plates 65-72. Oxford University Press.
- Ali, S. and Ripley, S.D. 1980. *Handbook of the Birds of India and Pakistan* (2th Edn.), Oxford University Press.
- Allen, L.R. 1990. Habitat manipulation and the control of cockatoos and galahs. National Bird Pest Workshop, Armidale 8-9 February. NSW Agriculture and Fisheries, pp. 125-132.
- Anderson, C.J., Brennan, L.A., Bukoski, W.P., Hess, S.C., Klug, P.E., Kluever, B.M., Shiels, A.B. and Siers, S.R. 2021. *Rose-ringed Parakeet Population Control on Kaua'i Management Plan Recommendation*. Prepared for the State of Hawaii.
- Avery, M.L., Decker, D., Humphrey, J.S. and Laukert, C.C. 1996. Mint plant derivatives as blackbird feeding deterrents. *Crop Protection* 15(5): 461-464. [http://dx.doi.org/10.1016/0261-2194\(96\)00010-5](http://dx.doi.org/10.1016/0261-2194(96)00010-5).
- Berge, A., Delwiche, M., Gorenzel, W. and Salmon, T. 2007. Sonic broadcast unit for bird control in Vineyards. *Applied Engineering in Agriculture* 23: 819-825.
- Bishop, J., McKay, H., Parrott, D. and Allan, J. 2003. Review of international research literature regarding the effectiveness of auditory bird scaring techniques and potential alternatives. Produced by Central Science Laboratories for the Department for Environmental Food and Rural Affairs. London, United Kingdom, 52 p.
- Blackwell, B., Bernhardt, G.E. and Dolbeer, R.A. 2002. Lasers as nonlethal avian repellents. *Journal of Wildlife Management* 66: 250-258.
- Bright, E.O. 2000. Plant products as seed protectants against weaver birds. *Global Journal of Pure and Applied Science* 6: 379-383.
- Brook, B.W., Sodhi, N.S., Soh, M.C.K. and Lim, H.C. 2003. Abundance and projected control of invasive house crows in Singapore. *The Journal of Wildlife Management* 67(4): 808. <https://doi.org/10.2307/3802688>.
- Bruggers, R.L. and Jaeger, M.M. 1982. Bird pest and crop protection strategies for cereals of the semi-arid and African tropics sorghum in the eighties. In: *Proceedings of International Symposium on Sorghum*, pp. 303-312.
- Bruggers, R.L. and Ruelle, P. 1981. Economic impact of pest birds on ripening cereals in Senegal. *Protection Ecology* 3: 7-16.
- Chakravarthy, A.K. 2004. Role of vertebrates in inflicting diseases in fruit orchards and their management in fruit and vegetable diseases. In *Fruit and Vegetable Diseases* (Ed. K.G. Mukerji). Vol. 1, pp. 95-142.
- Chakravarthy, A.K., Srihari, J., Chandraprakash, Reddy, N.K., Kumar, K. and Varghese, A. 1998. Management of bird pests in oil palm plantations in Karnataka. In: *Advances IPM for Horticultural Crops* (Eds. P.P. Reddy and A. Kumar), Indian Institute of Horticultural Research, Bangalore, India.
- Conover, M.R. and Perito J.J. 1981. Response of starlings to distress calls and predator models holding conspecific prey. *Z. Tierpsychol.* 57:163-172.
- Conover, M.R. 1983. Pole-bound hawk-kites failed to protect maturing cornfields from blackbird Damage. In: *Bird Control Seminars Proceedings* (Eds. W.B. Jackson and B. Dodd Jackson), pp. 85-90. Bowling Green State University, Bowling Green, Ohio, USA.
- Conover, M.R., 1984. Comparative effectiveness of avitrol, exploders, and hawk-kites in reducing blackbird damage to corn. *Journal of Wildlife Management* 48: 109-116.
- Conover, M.R. 1994. How birds interpret distress calls: Implications for applied uses of distress Call playback. In: *Proceedings of the 16th Vertebrate Pest Conference* (Eds. W.S. Halverson

- and A.C. Crabb), pp. 233-234. University of California, Davis, California, USA.
- Cummings, J.L., Knittle, C.E. and Guarino, J.L. 1986. Evaluating a pop-up scarecrow coupled with a Propane exploder for reducing blackbird damage to ripening sunflower. In: *Proceedings of the 12th Vertebrate Pest Conference* (Ed. T.P. Salmon), pp. 286-291. University of California, Davis, California, USA.
- Delwiche, M.J., Houk, A., Gorenzel, W.P. and Salmon, T.P. 2007. Control of crows in almonds by broadcast distress calls. *Transactions of the ASABE* 50: 675-682.
- Dharamkumarsinhji, K.S. 1956. *Birds of Saurashtra*. Times of India Press, Bombay.
- Dhindsa, M.S, Saini, H.K., Sandhu, P.S. and Saini, M.S. 1993. The World of birds; A Souvenir on Ornithology Department of Zoology, Punjab Agricultural University Ludhiana, India.
- Dolbeer, R.A., Stickely, A.R. Jr. and Woroneckj, P.O. 1979. Starling *Sturnus vulgaris* damage to sprouting Wheat in Tennessee and Kentucky, USA. *Protec. Ecol.* 1: 159-169.
- Feare, C.J. and Wadsworth, J.T. 1981. Startling damage is farm using the complete diet system of feeding dairy cows. *Animal Production* 32: 179-185
- Feare, C.J., Smith, P.W.G and Inglis, I.R. 1988. Current status and potential of non-lethal means of reducing bird damage in agriculture. *Proc. Intern ornithology. Cong* 19: 493-506.
- Germeier, C.U. 1997. Possibilities and limits of growing wintering catch crops and use of reduced soil cultivation methods in ecological maize production. In: *Proceeds of the 4th Scientific Meeting on Ecological Agriculture*. Bonn, Germany.
- Govind, S.K. and Jayson, E.A. 2018. Damage to paddy *Oryza sativa* by Indian Peafowl *Pavo cristatus* near Chulannur Peafowl Sanctuary, Kerala, India. *Indian BIRDS* 14(5): 149-150.
- Grant, S., Young, J. and Riley, S. 2011. Assessment of Human-Coyote Conflicts: City and County of Broomfield, Colorado. Wildland Resources Faculty Publications Paper 1677.
- Grimmett, R., Inskipp, C. and Inskipp, T. 2011. *Birds of the Indian Subcontinent*. 2nd ed. London: Oxford University Press & Christopher Helm. 528 p.
- Guillemain, M. and Elmberg, J. 2014. *The Teal*. Bloomsberry Publishing, Plc. 327 p.
- Harris, E., de Crom, E.P., Fouche, J. and Wilson, A. 2018. Comparative study on the short-term effects of audio and visual raptor presence on a pigeon population, with a view towards pest control. *International Journal of Pest Management* 6: 31-39. <https://doi.org/10.1080/09670874.2018.1542185>.
- Hothem, R.L. and DeHaven, R.W. 1982. Raptor-mimicking kites for reducing bird damage to wine Grapes. In: *Proceedings of the 10th Vertebrate Pest Conference* (Eds. R.E. Marsh), pp. 171-178. University of California, Davis, California, USA.
- Ikisan, 2023. <https://www.ikisan.com/up-maize-harvesting-storage.html>. [Retrieved online on 25/09/2023]
- 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.
- Kross, S.M., Tylianakis, J.M. and Nelson, X.J. 2012. Effects of introducing threatened falcons into Vineyards on abundance of passeriformes and bird damage to grapes. *Conservation Biology* 26: 142-149.
- Kushwaha, S.P.S. and Roy, P.S. 2002. Geospatial technology for wildlife habitat evaluation. *Tropical Ecology* 43(1): 137-150.
- Lindell, C., Eaton, R.A., Howard, P.H., Roels, S.M. and Shave, M. 2018. Enhancing agricultural Landscapes to increase crop pest reduction by vertebrates. *Agriculture, Ecosystems and Environment* 257.
- Linz, D., Schotten, U., Neuberger, H.R., Böhm, M. and Wirth, K. 2011. Negative tracheal pressure during obstructive respiratory events promotes atrial fibrillation by vagal activation. *Heart Rhythm* 8(9): 1436-1443
- Mahesh, S., Rao, V.V., Surender, G. and Swamy, K. 2017. Distress feeding of depredatory birds in Sunflower and sorghum protected by bioacoustics. *bioRxiv*: 200097.
- Malhi, C.S. and Kaur, T. 2001. Birds damage in guava orchards with special reference to rose-ringed parakeet (*Psittacula krameri*). *Pestology* 25: 47-54.
- Mani Chellappan and Ranjith, M.T. 2022. *Purple Moorhen*. Technical bulletin. AINPVPM.
- Marsh, R.E., Erickson, W.A. and Salmon, T.P. 1992. Scarecrows and predator models for frightening birds from specific areas. In: *Proceedings of the 15th Vertebrate Pest Conference* (Eds. J.E. Borrecco and R.E. Marsh), pp. 112-114. University of California, Davis, California, USA.
- Mason, J.R, Adams, M.A. and Clark, L. 1989. Anthranilate repellency to starlings: chemical correlates and sensory perception. *Journal of Wildlife Management* 53: 55-64.
- Paranjpe, D. and Dange, P. 2020. A tale of two species: human and peafowl interactions in human dominated landscape influence each other's behaviour. *Current Science* 119(4): 670-679.
- Peisley, R.K. 2017. Bird control: Bird perches: A simple method to reduce bird damage to grapes. *Wine and Viticulture Journal* 32: 50.

- Raheja, A.K. 1992. *Research Highlights of Agricultural Ornithology*. All India Co-ordinated Research Project of Agricultural Ornithology. Technical Bulletin-1. Andhra Pradesh Agricultural University, Hyderabad, India.
- Rana, B.D. 1973. Birds in 100 mm rainfall zone. *Newsletter for Bird Watchers* 3(8): 9362:372.
- Rao, V.V. and Dubey, O.P. 2006. Granivorous parakeet pest and their management. In: *Vertebrate Pests in Agriculture: The Indian Scenario* (Ed. S. Sridhara), pp. 29-61. Scientific Publishers (India), Jodhpur.
- Rao, V.V. and Dubey, O.P. 2016. Granivorous bird pest and their management. In: *Vertebrate Pest in Agriculture: The Indian Scenario* (Ed: Sridhara, V.). Scientific Publishers India Ltd. pp. 27-54.
- Saini, H.K., Dhindsa, M.S. and Toor, H. 1994. Food of the rose-ringed parakeet *Psittacula krameri*: a quantitative study. *Journal of the Bombay Natural History Society* 91: 96-103.
- Sashikumar, C., Praveen, J., Palote, M.J. and Nameer, P.O. 2001. *Birds of Kerala Status and Distribution*. DC Books Publication, Kerala, 835 p.
- Seamans, C.W. and Gosser, A. 2016. *Bird Dispersal Techniques*. Wildlife Damage Management Technical Series, pp. 1-12.
- Senaratna, D., Lingesh K and Attapattu, N.S.B.M. 2019. Foraging behavior based management strategy to minimize crop damage caused by Indian Pea Fowl (*Pavo cristatus*). *Journal of Ethology and Animal Science* 2(2): 000110.
- Sharma, I.K. 1972. Etude ecologique de la reproduction de la paon (*Pavo cristatus*). *Alauda* 40(4): 378-384.
- Shorts, L.L and Horne J.F.M. 2002. Order Piciforms. Family Capitonidae (Barbets) in handbook of the Birds of the world-Volume 7 Jacamars to Wood peckers (Eds. J. del Hoyo, A. Elliot and J. Sargatal), pp.140-219. Lynx Edicions Barcelona, Spain.
- Sinclair, R. 1990. The economics of netting for bird control. In *Proceedings National Bird Pest Workshop*, Armidale 8-9 February. NSW Agriculture and Fisheries, pp. 134-141.
- Sreeja, P. and Chellappan, Mani 2017. Management of Indian peafowl, *Pavo cristatus* (L.) on Rice in Kerala. *Annals of Plant Protection Science* 25(2): 304-307.
- Sridhara, S. 2016. *Vertebrate Pests in Agriculture: The Indian Scenario*. Scientific Publishers, 513 p.
- Srihari, K. and Chakravarthy, A. K. 1998. Ecological approaches for the management of vertebrate pests in Western ghat region of Karnataka. *Indian Journal of Ecology* 25: 55-61.
- Stuckey, J.J. 1973. Use of plastic netting. In: *Proceedings of the 6th Bird Control Sem. Bowling Green* (Eds. H. N. Cones, J. Jackson and W.B. Jackson), pp. 195-197. Ohio, USA.
- SulaiSimwat, G.S. 1975. Control of Rose-ringed parakeet in Punjab. *Indian Journal of Agricultural Sciences* 45(6): 269-272.
- Whistler, H. 2007. *Popular Handbook of Indian Birds*. Read books. 604 p.