Faunal Monitoring of Ahmedabad Airport as a Part of Bird-Aircraft Strike Hazard (BASH) Study

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Abstract- Ahmedabad’s Sardar Vallabhbhai Patel International (SVPI) airport is known to have a high potential of bird-aircraft collision hazards. For determining the causes and magnitude of the problem and to find out likely solutions, birds, other small animals (mammals and reptiles) and insects were monitored by Gujarat Ecological Education and Research (GEER) Foundation, Gandhinagar during pre-monsoon and monsoon seasons between 2015 and 2017. For monitoring birds, two linear transects were laid, one each along each side of the runway. Besides transect-based bird surveys, bird species were also randomly recorded in other parts of the airport premises and even outside it (within 1 km belt parallel to the airport boundary). A total of 59 species of birds were encountered within the airport premises that belonged to 30 different families. Of these, 48 species were recorded along the transects. The majority (i.e., 83%) of the total 59 species were either obligate or facultative insectivorous birds. As the majority of birds were found to be obligatorily or facultatively insectivorous, insect monitoring was also carried out. For recording insects(species/genera and their numbers), Visual Encounter Survey (VES) was carried out in the operational area. A total of 80 species of insects were encountered which belonged to 42 families and 11 orders. Some measures that were suggested by GEER Foundation for reducing the chances of bird-aircraft collision included regulating the growth of grasses through regular grass-cutting preferably before sunrise or after sunset, controlling population of rodents and termites, considering to facilitate artificial grasses/tuft cover. By roping in GEER Foundation for faunal monitoring seasonally SVPI airport authorities have provided an example of ecological concerns in airport management. Other airports in the country should follow this example.

Keywords- Birds, Bird Aircraft Strike Hazard (BASH), Black kite, Insects, Sardar Vallabhbhai Patel (SVP) International Airport

I. INTRODUCTION

When a bird or a group of birds is struck by an aircraft, it is referred to as a bird strike [1, 2]. It is also referred to as Bird-Aircraft Strike Hazard (BASH). The problem has started when human being invented and started using aircraft, especially the jet aircraft which, due to very high speed, do not give birds an opportunity to escape. BASH poses safety and economic hazards especially during take-off and landing of an aircraft.

From 1999 to 2008, total 71 aircraft accidents occurred due to birdstrikes and 6 of them led to fatal injuries [3]. Considering the value of human life and the huge cost involved in aircraft damage, every effort must be made to minimize the possibilities of BASH. Bird-strike problem should be solved not only to minimize the possibility of loss of human life and loss of money but also to continue the peaceful co-existence by man and birds alike.

Some of the most hazardous birds listed for aircraft flights, which include geese, gulls, pigeons and doves, starlings, sparrows, crows, eagles, hawks, kestrels, and owls [4, 5]. The reasons for the existence of the birds in the airport area have illustrated in past studies [5]. According to them and some other researchers, birds get attracted to airports for food (e.g. earthworms, termites, grasshoppers, small reptiles/mammals, and seeds), water and shelter. They are also attracted to the airports as they may provide suitable nesting or roosting habitats. Solid waste disposal sites (especially open dump sites) around airports also attract birds though sanitary landfills are less attractive to birds than open dumps [6].

Ahmedabad city’s Sardar Vallabhbhai Patel (SVP) International airport in Gujarat State is considered as one of the top-most civilian airports from the viewpoint of the potential of bird-aircraft strike or bird-hit hazard. The rise in the incidences of bird-hits at the SVP International airport has communicated the Directorate General of Civil Aviation (DGCA) to declare it a ‘critical airport’ [7]. To find out the solution to this issue, it was decided by the Airport Environment Management Committee (AEMC) to assign the task of conducting surveys of birds and other fauna (especially entomofauna as many insects constitute...
food of insectivorous birds) to GEER Foundation (an AEMC member). In turn, GEER Foundation carried out surveys during pre-monsoon and monsoon period between 2015 and 2017. It resulted into the comprehensive profile of birds, insects and other fauna occurring at SVP International airport and some insight into causes and likely solution to the threat of BASH at this international airport.

II. STUDY AREA

Sardar Vallabhbhai (SVP) Patel International Airport is located in Ahmedabad city of Gujarat State, India (Fig.1). Ahmedabad is the sixth largest city and eighth largest metropolitan area of India, with a metropolitan population of 6.5 million (World Gazetteer, retrieved 11 April 2012). It is the largest city of Gujarat state.

Fig.1 Location of Sardar Vallabhbhai Patel (SVP) international airport, Ahmedabad, Gujarat, India

The Ahmedabad Airport or Sardar Vallabhbhai Patel (SVP) International airport is named after Statesman and former Deputy Prime Minister Shri Sardar Vallabhbhai Patel. The airport is located in the north-east part of Ahmedabad city at 23° 04' 16.28" N Latitude and 072° 37' 35.15" E Longitude. It is India's eighth busiest airport with an average of 250 aircraft movements a day. It serves the metropolitan areas of two cities in the State of Gujarat - Ahmedabad, and Gandhinagar. The airport currently consists of four terminals i.e domestic, international, an additional terminal for secondary traffic and a cargo terminal. The airport is spread over an area of 4.55 km² with the runway measuring 3,600 m. It is situated at the height of 57.61m from the Mean Sea Level.

III. MATERIAL AND METHODS

Surveys for birds and other fauna (mainly insects and secondarily small mammals and reptiles) were carried out in pre-monsoon (mainly, early June) and monsoon (mainly, August) seasons between 2015 and 2017. The reason for conducting surveys in pre-monsoon and monsoon was that chances of bird-aircraft hazards would typically increase during this time-frame as per the past trend. For bird (species and population) monitoring, one transect was permanently laid (with its end-points marked with a GPS receiver) on each of the two sides of the runway (Fig.2).
Besides species and population monitoring of birds along the two sides of the runway, other parts of the airport premises (at some distance away from the runway) were also assessed for bird species inventorying with the permission and logistic help (especially, a vehicle) of SVPI airport authorities for this purpose, the airport authorities had provided a vehicle. The bird observations were made with the help of a pair of 10X50 binoculars. During each visit to the airport the surveys were conducted from 8 am to 6 pm within the study area and total 80 man-hours were spent for this work each year between 2015 and 2017. The Visual Encounter Survey (VES) approach was adopted for inventorying insects. Total 8 quadrats each of 1mx1m laid for insect inventory at equal distance (500m) along the transects that were walked for bird inventory. Almost all insects encountered were photographed. Insects were identified using recognized insect identification manuals/field guides [8, 9, 10 and 11].

IV. RESULTS AND DISCUSSION

A total of 59 species of birds were recorded (Table 1) along the two transects parallel to the runway and at randomly selected observation points within the airport premises. They belonged to 30 different families. It was found that the family Accipitridae (i.e., family of raptors) was represented by a maximum number of species (i.e., 6 species; Fig.3). The family Cisticollidae (i.e., prinias/warblers) was also represented by a relatively good number of species (i.e., 5 species). However, species richness was relatively lower for the rest of the families (Fig.3)
Table 1. Checklist of birds recorded on SVP international airport during pre-monsoon and monsoon period between 2015 and 2017 along with their food items*

| Sr. No. | Family           | Common Name                 | Scientific Name | Food                                      |
|---------|------------------|-----------------------------|-----------------|-------------------------------------------|
| 1       | Accipitridae     | Black Kite                  | Milvus migrans  | Insects, rodents, reptiles, Offals        |
| 2       | Accipitridae     | Black-winged Kite           | Elanus caeruleus| Insects, reptiles, rodents, small birds   |
| 3       | Accipitridae     | Shikra                      | Accipiter badius| Rodents, reptiles, birds, insects         |
| 4       | Accipitridae     | Buzzard sp.                 | Buteo sp.       | Insect a part of the diet                 |
| 5       | Accipitridae     | White-rumped Vulture        | Gyps bengalensis| Scavenger                                 |
| 6       | Accipitridae     | Booted Hawk Eagle          | --              | No insects                                |
| 7       | Alaudidae        | Ashy-crowned Finch- Lark    | Eremopterix griseus| Insects(and seeds)                        |
| 8       | Alaudidae        | Rufous-tailed Lark          | Ammomanes phoenicura| insect not main, but a part of the diet |
| 9       | Alcedinidae      | White-wattled Kingfisher    | Halycon smyrnensis| Various small animals and insects         |
| 10      | Apodidae         | House Swift                 | Apus affinis    | Insects                                   |
| 11      | Ardeidae         | Cattle Egret                | Bubulcus ibis   | Insects, spiders, frogs, earthworms       |
| 12      | Ardeidae         | Indian Pond Heron           | Ardeola grayii  | Fish, amphibians, and Insects             |
| 13      | Charadriidae     | Red-Wattled Lapwing         | Vanellus indicus| Mainly insects                            |
| 14      | Charadriidae     | Yellow-wattled Lapwing      | Vanellus malabaricus| Mainly insects                           |
| 15      | Cisticolidae     | Ashy prinia                 | Prinia socialis | insects                                   |
| 16      | Cisticolidae     | Common tailorbird           | Orthotomus sutorius| Insects                                 |
| 17      | Cisticolidae     | Grey-Breasted Prinia        | Prinia hodgsonii| Insects                                   |
| 18 | Cisticolidae | Rufous-fronted Prinia | Prinia buchanani | Insects |
| 19 | Cisticolidae | Zitting Cisticola | Cisticola juncidis | Insects |
| 20 | Columbidae | Blue Rock Pigeon | Columba livia | Seeds, Grains |
| 21 | Columbidae | Eurasian Collared Dove | Streptopelia decaocto | Grains, Seeds |
| 22 | Columbidae | Laughing Dove | Streptopelia senegalensis | Grains, seeds |
| 23 | Coraciidae | Indian Roller | Coracias benghalensis | Insects, small vertebrates |
| 24 | Corvidae | House Crow | Corvus splendens | Various food including insects |
| 25 | Corvidae | Rufous Treepie | Dendrocitta vagabunda | Rodents, reptiles, small birds, eggs, Insects |
| 26 | Corvidae | Large-billed Crow | Corvus macrorhynchos | Insects-not main food, but included in the diet |
| 27 | Cisticolidae | Asian Koel | Eudynamys scolopaceus | Insects, (also grain, fruits, and Others) |
| 28 | Cisticolidae | Greater Coucal | Centropus sinensis | Insects, rodents, reptiles, eggs |
| 29 | Dicuridae | Black Drongo | Dicrurus macrocercus | Insects, nectar |
| 30 | Estrildidae | Indian Silverbill | Lonchura malabarica | Seeds, grains |
| 31 | Hirundinidae | Dusky Crag Martin | Hirundo concolor | Insects |
| 32 | Hirundinidae | Wire-tailed Swallow | Hirundo smithis | Insectivorous |
| 33 | Hirundinidae | Sand/Plain Martin | Riperia sp. | Insects |
| 34 | Laniidae | Long-tailed Shrike | Lanius schach | Insects |
| 35 | Leiothrichidae | Common Babbler | Turdoides caudatus | Mainly Insects |
| 36 | Leiothrichidae | Large Grey Babbler | Turdoides malcolmi | Mostly Insects |
| 37 | Leiothrichidae | Jungle Babbler | Turdoides striata | Mainly insects |
| 38 | Meropidae | Blue-tailed Bee-eater | Merops philippensis | Insects |
| 39 | Meropidae | Green Bee-Eater | Merops orientalis | Insects |
| 40 | Motacillidae | White Wagtail | Motacilla alba | insects |
| 41 | Motacillidae | Pipit sp. | Anthus | Insects |
| 42 | Muscicapidae | Common Stone Chat | Saxicola torquatus | insects |
| 43 | Muscicapidae | Indian Robin | Saxicoloides fulicata | Insects |
| 44 | Nectariniidae | Purple Sunbird | Cinnyris asiaticus | Mainly nectar, also insects |
| 45 | Passeridae | Chestnut-shouldered Petronia | Passer domesticus | Grains, Seeds |
| 46 | Phalacrocoracidae | Little Cormorant | Phalacrocorax niger | Fish |
| 47 | Phasianidae | Grey Francolin | Francolinus pondicerianus | Mainly vegetable matter, some amount of insects |
| 48 | Phasianidae | Indian Peafowl | Pavo cristatus | Mainly plant matter, but also insects |
| 49 | Ploceidae | Black-breasted Weaver | Ploceus benghalensis | Seeds, grains |
| 50 | Psittacidae | Rose-ringed Parakeet | Psittacula krameri | Plant matter |
| 51 | Pycnonotidae | Red-vented Bulbul | Pycnonotus cafer | Plant matter and insects |
| 52 | Strigidae | Spotted Owlet | Athene brama | Rodents, reptiles, birds, insects |
| 53 | Sturnidae | Bank Myna | Acidothres gингinionus | Insect, grains, Fruits |
| 54 | Sturnidae | Common Myna | Acidothres tristis | Mainly Insects |
The occurrence of 59 species of birds in approximately 5 sq.km area of the airport premises can be considered relatively high bird species richness in a non-winter season (which is known for good influx of migratory birds in various parts of the state). This is because SVP International airport is situated amidst the buzzing suburbs of Ahmedabad city like Kubernagar, Mehaninagar, Sardarnagar, Camp Hanuman etc. These areas have numerous roads with busy traffic, residential societies, and commercial buildings. Just adjacent to some portions of the boundary wall of the airport falling in areas like Kubernagar and Krishnanagar, densely packed buildings of some residential societies existed overlooking the airport premises. So, it was a riddle why species richness as high as 59 bird species occurred on the airport premises which included even rural and/or grassland birds like Grey Francolin, Ashy-crowned Sparrow-Lark, Rufous-tailed Lark, Blue-tailed Bee-eater, raptors etc. Therefore, investigations were carried out to understand or infer the reason for such high bird diversity on SVP International airport despite its location in the city’s suburban area. The investigations regarding the obligatory or facultative food of each of the species through review of the relevant and authentic literature [12].

The investigation revealed that 49 species (i.e., 83%) of the total bird species recorded on the airport premises were those known to be either obligatorily or facultatively insect-eaters. The field monitoring on insect diversity on airport premises (along with the bird surveys along two bird transects and at random bird observation points) showed that a total of 80 species of insects occurred on the SVP International airport that belonged to 42 families and 11 orders (Table 2).

The highest number of insect species belonged to the Order Lepidoptera, i.e. 27% of total species composition (including 22 species of moths and butterflies) followed by Orthoptera i.e 15% of total species composition (including 12 species of grasshoppers and locusts). Relatively lesser number of species of the orders Embioptera, Isoptera (including termites) and Neuroptera (including Antlion) were encountered (Fig 4).
| Orthoptera | Acrididae | Amblytropidia mysteca (Saussure, 1861), Schistocerca gregaria (Forsskal, 1775), Heteroglyphus bani (Fabricius, 1798), Acrida conica (Fabricius, 1781), Acrida ungarica (Herbst, 1786), Acrida species, Chorthippus biguttulus (Linnaeus, 1758), Omocestus viridulus (Linnaeus, 1758), Chorodocus sp. |
| Pyrgomorphidae | Poekilocerus scintus (Fabricius, 1775), Atractomorpha crenulata (Fabricius, 1793) |
| Tettigidae | Paratettix sp. |
| Odonata | Coenagrionidae | Ischnura aurora (Brauer, 1865), Ceriagrion coromandelianum (Fabricius, 1798) |
| Libellulidae | Trithemis pallidinervis (Kirby, 1889), Pantala flavescens (Fabricius, 1798), Brachythemis contaminata (Fabricius, 1793), Crocothemis servilia (Drury, 1770), Bradinopyga geminate (Rambur, 1842), Orthetrum sabina (Drury, 1770), Trithemis aurora (Burmeister, 1839), Diplacodes trivialis (Rambur, 1842) |
| Embioptera | Embiidae | Embia sp. |
| Isoptera | Rhinotermitidae | Reticulitermes flavipes (Kollar, 1837) |
| Dictyoptera | Blattidae | Periplaneta americana (Linnaeus, 1758) |
| Mantidae | Mantis religiosa (Linnaeus, 1758) |
| Hemiptera | Aphididae | Aphis nerii (Boyer de Fonscolombe, 1841) |
| Cercopidae | Philaenus spumarius (Linnaeus, 1758) |
| Cicadidae | Platycleura octoguttata (Fabricius, 1798) |
| Coreidae | Cletus bipunctatus (Herrich-Schäffer, 1840) |
| Curculionidae | Conotrachelus posticatus (Boheman, 1837) |
| Lygaeidae | Lygaeus kalmii (Stal 1874), Lygaeus hospes (Fabricius, 1794) |
| Pentatomidae | Eysarcoris sp. |
| Pyrrhocoridae | Dysdercus cingulatus (Fabricius, 1775). |
| Neuroptera | Myrmeleontidae | Myrmeleon sp. |
| Diptera | Asilidae | Promachus sp. |
| Bombyliidae | Bombus sp. |
| Calliphoridae | Calliphora vomitoria (Linnaeus, 1758) |
| Muscidae | Musca domestica (Linnaeus 1758) |
| Sarcophagidae | Sarcophaga sp. |
| Tephritidae | Bactrocera sp. |
| Coleoptera | Buprestidae | Buprestis aurulenta (Linnaeus, 1767) |
| Carabidae | Brachinus sp. |
| Chrysomelidae | Charidotella sp., Crioceris sp. |
| Curculionidae | Artipus sp. |
| Geotrupidae | Anoplotrupes sp. |
| Meloidae | Mylabris pustulata (Thunberg, 1821) |
| Hymenoptera | Apidae | Apis cerana indica (Fabricius, 1798), Amegilla cingulata (Fabricius, 1775), Xylocopa auripennis (Lepeletier, 1841) |
| Braconidae | Opio sp. |
| Formicidae | Camponotus compressus (Fabricius, 1787), Monomorium minimum (Buckley, 1867) |
The population of insects (irrespective of the species) was high too, especially in monsoon season. During monsoon season, average insect population (in total 8 quadrats of 1mx1m laid at equal distance for along the transects walked for birds) for the years between 2015 and 2017 was found to be 928 individuals. Though during premonsoon, the average insect population was relatively low (n=230) in total 8 equi-distantly laid 1mx1m quadrats along the bird transects.

High species diversity and high insect population during monsoon can be easily linked with good habitat conditions for entomofauna on the airport premises during pre-monsoon to monsoon each year. Good habitat conditions were found to get created due to good grass and herb cover especially in monsoon in many portions of the airport premises away from the runway. With few isolated showers even in pre-monsoon season (June), grass and herb growth was found to get initiated and that reached the peak during monsoon leading to high insect population in monsoon. Grasses and some herbs grew like weeds on the airport premises despite repeated efforts of the SVPI airport authorities to arrange for herb and grass harvesting mechanically. Weeds are known to be a primary food resource for many phytophagous insects [13]. Grass and herbaceous cover on the airport premises might also have provided cover to many insects so that they would not get directly exposed to insectivorous birds. The study has led to an inference that one of the reasons of good bird diversity on the airport premises may be due to a higher proportion of insectivorous bird species, which in turn might be due to high diversity and a good population of insects owing to grass and herb cover on the airport premises. Termite nests were found to exist beneath the weed cover and termites are known to be a good proteinaceous food for many birds including Black Kite (Milvus migrans). It is usually believed that Black Kites only feed on offals, but that is not true. Winged termites form a favorite food for Black Kites especially in monsoon when several kites are seen busy capturing winged termites in mid-air. Termites usually occur in large numbers and therefore they can easily draw the attention of foraging birds like Black Kites. In turn, they may get attracted towards the airport premises leading to increased chances BASH. The weed cover also provided good habitat for small rodents (e.g., rats and mice) and reptiles (e.g., lizards) and they also constitute food for Black Kites. Thus, it is likely that at SVP International airport, Black Kites have been getting offal from the careless solid waste dumping in the vicinity of the airport and in addition, they also might be getting termites, other insects and small rodents and reptiles on the airport premises. Therefore, Black Kite was found to be the most dominant/abundant bird on the SVPI airport premises. Table 3 indicates that Black Kite has not only been among the top 5 most abundant bird species (i.e., Black Kite, Cattle Egret, Blue Rock Pigeon, House Crow and Common Myna), but it has been the only species that had occurred in relatively good numbers irrespective of season (pre-monsoon and monsoon) at Ahmedabad airport. During the bird monitoring on airport premises, Black Kite was often found soaring/gliding over the run-way and it was also found to sit or devour prey on run-way. It was found that the kite had got used to the movement of aircrafts landing and taking-off at the airport making it one of the most hazardous bird at SVP International airport.

| Lepidoptera              |   |
|-------------------------|--|
| Vespidae                | Polistes wattii (Cameron, 1900), Icaria variegata (Smith, 1852), Delta esurien (Fabricus 1787) |
| Lepidoptera             |   |
| Nymphalidae             | Danaus chrysippus (Linnaeus, 1758), Acraea terpsicore (Linnaeus, 1758), Hypolimnas misippus (Linnaeus, 1764), Junonia almana (Linnaeus, 1758), Junonia orithya (Linnaeus, 1758) |
| Papilionidae            | Papilio demoleus (Linnaeus, 1758), Graphium agamennon (Linnaeus, 1758), Pachliopta aristolochiae (Fabricus, 1775) |
| Pieridae                | Catopsilia pomona (Fabricius, 1775), Eurema hecabe, Colotis amata (Fabricius, 1775), Ixias marianne (Cramer, 1779) |
| Lycaenidae              | Catochrysops strabo (Fabricius 1793), Chilades trochylus (Freyer 1845), Tarucus plinius (Fabricius, 1793), Zizina otis (Fabricius, 1787), Tarucus nara (Kollar, 1848), Zizula hyalax (Fabricius, 1775) |
| Hesperiidae             | Borbo cinnara (Wallace, 1866) |
| Erebidae                | Pyrrharctia Isabella (JE Smith, 1797) |
| Geometridae             | Hypothyra lutea (Stoll, 1781) |
| Pterophoridae           | Stenoptilia sp. |
Table 3: Seasonal population monitoring of bird species encountered along two transects in SVP International airport operation area Ahmedabad

| Sr. No. | Common name            | Number of Birds | Monsoon season | Premonsoon season |
|---------|------------------------|-----------------|----------------|-------------------|
|         |                        |                 | Average        | Highest           | Average | Highest |
| 1       | Rosy Starling          | 2513            | 5000           | 0                 | 0       |
| 2       | Cattle Egret           | 105             | 203            | 15                | 19      |
| 3       | Blue Rock Pigeon       | 87              | 163            | 22                | 30      |
| 4       | Black Kite             | 75              | 102            | 43                | 57      |
| 5       | House Crow             | 29              | 52             | 10                | 16      |
| 6       | Common Myna            | 18              | 30             | 18                | 22      |
| 7       | Black-headed Ibis      | 16              | 24             | 4                 | 8       |
| 8       | Red-wattled Lapwing    | 14              | 15             | 17                | 29      |
| 9       | Green Bee-eater        | 12              | 17             | 6                 | 8       |
| 10      | Black Drongo           | 11              | 17             | 10                | 17      |
| 11      | Rose-ring Parakeet     | 10              | 17             | 7                 | 11      |
| 12      | Bank Myna              | 10              | 13             | 9                 | 12      |
| 13      | House Sparrow          | 9               | 14             | 1                 | 1       |
| 14      | Indian Silverbill      | 7               | 9              | 0                 | 0       |
| 15      | Red-vented Bulbul      | 6               | 7              | 5                 | 8       |
| 16      | ZittingCisticola       | 5               | 9              | 7                 | 9       |
| 17      | Eurasian Collared Dove | 5               | 7              | 2                 | 3       |
| 18      | Laughing Dove          | 5               | 7              | 3                 | 5       |
| 19      | Large Grey Babbler     | 5               | 5              | 1                 | 2       |
| 20      | Blue-tailed Bee-eater  | 5               | 1              | 2                 | 3       |
| 21      | Grey Francolin         | 5               | 7              | 6                 | 7       |
| 22      | Indian Peafowl         | 5               | 5              | 0                 | 0       |
| 23      | Ashy Prinia            | 4               | 4              | 2                 | 2       |
| 24      | Common Tailorbird      | 4               | 7              | 2                 | 3       |
| 25      | White-throated Kingfisher | 3              | 4              | 1                 | 2       |
| 26      | Dusky Crag Martin      | 3               | 6              | 1                 | 1       |
| 27      | Red-naped Ibis         | 3               | 6              | 2                 | 3       |
| 28      | Oriental White-eye     | 3               | 6              | 0                 | 0       |
| 29      | Rufous-fronted Prinia  | 3               | 5              | 1                 | 2       |
| 30      | Indian Roller          | 3               | 4              | 1                 | 1       |
| 31      | Indian Robin           | 3               | 4              | 4                 | 5       |
| 32      | Ashy-crowned Finch-Lark| 2               | 4              | 2                 | 4       |
| 33      | Grey-breasted Prinia   | 2               | 4              | 1                 | 2       |
Table 3 also indicates that Rosy Starling (*Pastor roseus*), an early immigrant to Gujarat each year has occurred in massive numbers (upto 5000 individuals), but only during monsoon. Rosy Starling feeds on insects like locusts and grasshoppers beside plant-based food. Rosy Starling can create a problem for an aircraft due to their habit of flying in huge flocks. Red-wattled Lapwing (*Vanellus indicus*) was the only insectivorous bird that is known to actively forage during the night also and thus it has the potential to cause trouble to the air-crafts landing or taking-off at nights. If individuals of this species are allowed to nest on the airport operational area, they can be more troublesome for the aircraft.

### V. CONCLUSION AND RECOMMENDATIONS

SVP International Airport supports a large number of bird species in pre-monsoon to monsoon season as the airport attracts large number insectivorous bird species owing to the fast-growing weed cover that exists on the airport premises that supports high insect diversity and population. During a study on birds at Ahmedabad airport (SVP International Airport) and its environs had indicated that Black Kite occurs on the airport premises in good numbers irrespective of the season (pre-monsoon or monsoon) [7]. Usually, every animal mainly were drawn to an area due to the availability of preferred food and habitat. for minimizing the potential of bird-aircraft collision hazards at SVP International airport, various measures can be planned and implemented such as a) regular harvesting of grass and herb cover (i.e., weed cover) for discouraging insect occurrence, b) controlling population of rodents, c) proper control of termites on the airport premises as they constitute one of the food items of Black Kites and other birds can be done to keep away these birds, d) explore the possibility of grass harvesting/cutting at night or during crepuscular (dawn/duck) hours as kites and other birds preferring insects and other small animals as food opportunistically flocks at the harvesting spots during day-time, e) maintaining the cover of only single grass species as a part of habitat management and f) using artificial grass/turf cover instead of currently existing natural/wild grass cover.

SVP International Airport has taken a proper initiative by roping in GEER Foundation for conducting an investigation on birds, insects and other small fauna, a step towards reducing BASH. All other airports may follow this step considering the seriousness of the issue.

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