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RESEARCH ARTICLE

Microbial Profile and Physico-chemical Analysis of the Excreta of *Dendrocygna javanica* and *Anas platyrhynchos domesticus*

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Abstract

Objective: To evaluate the physico-chemical composition and the presence of potentially useful bacterial to be used as biofertilizer in the excreta of Dendrocygna javanica and Anas platyrhynchos domesticus. **Methodology**: The microbial culture and physico-chemical analysis was done at the department of botany, Gauhati university. Six different media were taken for microbial growth. After 24 hours of observation microbial colonies were counted and recorded. For physico-chemical analysis four parameters were taken viz., organic carbon, ash content, moisture content and pH, as those four components are essential for soil and plant growth. **Findings**: The excreta of Dendrocygna javanica show abundant growth of nitrogen fixing bacteria, less fastidious bacteria, yeast, moulds, Acetenomycetes and phosphate solubilizing bacteria. Physico chemical analysis have also shown favourable result against Dendrocygna javanica, indicating the biofertilizer nature of its excreta. **Novelty:** There is limited literature available concerning the microbial profile and physico chemical analysis of faeces of Dendrocygna javanica and Anas platyrhynchos domesticus. Infect, the present study provided the guidance for culturing and conserving these two duck species since these have a good possibility as bio fertilizers.

Keywords: Dendrocygna javanica; Anas platyrhynchos domesticus; microbial culture; physicochemical; excreta; biofertilizer

1 Introduction

The gut of avian species hosts a variety of microbes, gut microbiota plays an important role in digestion and absorption capacity of the bird, the intestinal flora also plays a key role in intestinal functioning, intestinal flora also interacts with the immune system for disease resistance [(1)]. Despite great diversity of gut microbes, research on intestinal microbiota of birds is lagging behind in comparison to mammalian research, of which is also dominated by domestic poultry. Moreover, wild birds vary widely in environmental preferences, physiology and migratory behaviour. So, a wide variety of

microorganism are able to colonize in the gut of migratory bird as that of resident bird do. A total of 32 bacterial phyla were identified in 21 fecal samples of six aquatic bird species [Relict gulls (L. relictus), muscovy ducks (C. moschata), ruddy shelducks (T. ferruginea), demoiselle cranes (A. virgo), whooper swans (C. cygnus), and black swans (C. atratus)] [(2)] majority of which breed and migrate in wetlands. Assam, a North-eastern state has 3513 wetlands [(3)] of which maximum number of wetlands are found in Nagaon district. These wetlands are rich in different type of migratory birds. Dendrocygna javanica commonly known as 'Lesser whistling duck' (LWD) is a local migratory bird found in 'Hahila' wetlands of Nagoun district of Assam, available throughout the season. They are nocturnal feeders, visit only unpolluted site of wetland and feed mainly on plants from water as well as grains from cultivated rice and shed their excreta there itself. The main threat to these LWD is illegal hunting, habitat loss, wetland pollution by municipal waste and excessive use of agro-chemicals in the farmlands that result into growth of bushy plants. 'Hahila' wetland also harbour Anas platyrhynchos domesticus commonly known as 'Pati hanh' or common duck (CD), domesticated by humans for meat and egg since ages.

The present study aims to investigate the physico-chemical composition and the presence of potentially useful bacterial to be used as biofertilizer in the excreta of Dendrocygna javanica and Anas platyrhynchos domesticus. The findings of the study contribute to the understanding of physico-chemical and microbial composition of these two species of birds living in almost the same environment with slight difference in food source. The study also provides a theoretical basis of bird and wetland protection

2 Materials and Method

2.1 Study Area

The study was conducted at the "Hahila Beel" and Morikolong area of Nagaon district of Assam, situated at the southern bank of river Brahmaputra. This wetland is located between 26°16′13″N and 26°16′47″N latitudes and 92°42′40″E and 92°43′54″E longitudes. The Morikolong area has a latitude 26°35′38″ and a longitude of 92°69′22″.

2.2 Sample collection:

Faeces of both the ducks were collected aseptically in vials. The colour of the excreta of LWD was found to be dark black and that of CD was almost light brown. The samples were analysed at bacteriology laboratory of the Department of Botany, Gauhati University.

2.3 Microbial Test

2.3.1. Serial dilution: Serial dilutions of the samples was performed to determine the microbial culture density in cells per ml [(4)]

2.3.1 Media preparation

Media was prepared after dilution of the samples;10^{-6} diluted samples were loaded in growth media each having three replicas and one control. Six different types of media were taken viz. Nutrient agar (for less fastidious microbes), BAM media M127 (for Yeast and molds), Casein starch agar media (for Actinomycetes), Jensen's media (for N_2 fixing bacteria), Aleksandrow agar (for K solubilizing bacteria), Pikovskaya's agar (for P solubilizing Bacteria) was taken. After 24 hours of observation, microbial colonies were counted and recorded.

2.4 Physico-Chemical analysis

2.4.1 Organic carbon:

Organic carbon was estimated by Walkley-Black [(5)] method

2.4.2. Ash content

5gm fresh sample of both the ducks was put in two different crucibles and placed inside muffle furnace at 600° C. After retrieval of the ash, weight was recorded by the formula $Total\ ash\ content = \frac{Weight\ of\ the\ ash}{weight\ of\ the\ original\ sample} \times 100$

2.4.3 Moisture content

Percentage of moisture content was calculated by using the formula: $\text{Moisture content} = \frac{\text{wet weight-weight after drying}}{\text{weight weight}} \times 100$

2.4.4 PH

pH of the samples was analysed by using a digital pH meter

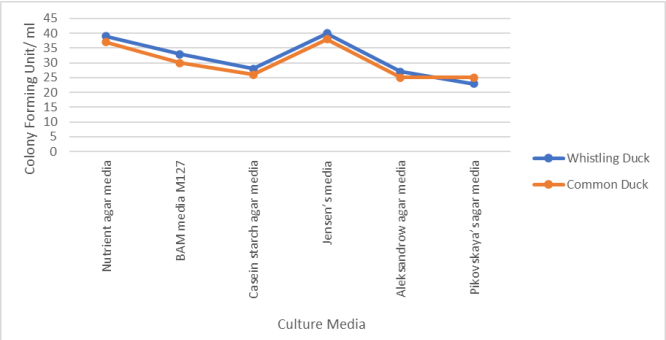

Fig 1. Colony forming unit in different media.

Table 1. CFU/ml in Microbial culture

Media	Sample	CFU/ml
Nutrient agar media	S1	39×10^6
	S2	37×10^6
BAM media M127	S1	33×10^6
	S2	30×10^6
Casein starch agar media	S1	28×10^6
	S2	26×10^6
Jensen's media	S1	40×10^6
	S2	38×10^6
Aleksandrow agar media	S1	27×10^6
	S2	25×10^6
Pikovskaya's agar media	S1	23×10^6
	S2	25×10^6

S1 = Lesser Whistling Duck, S2 = Common Duck

Table 2. Physico-Chemical analysis

	Organic Carbon	Ash content	Moisture content	pH
Whistling Duck	1.4%	5%	1.62%	7.72
Common duck	0.96%	2%	3.45%	5.48

3 Result and Discussion

Birds are a group of endothermic vertebrates, which belong to the class 'Aves'. Duck is a common name for many bird species in the Waterfowl family 'Anatidae'. Birds are uricotelic organisms that excrete uric acid in the form of paste. The excretory product of birds contains many useful microbes that enrich the quality of soil by acting as biofertilizer. This property was established by number of studies such as the one given by Salunki et al [6]. To facilitate the reading of the discussion, this work first presents the microbial culture result in Table 1 and Figure 1 which shows the presence of nitrogen-fixing bacteria, phosphate and potassium solubilizing bacteria, less fastidious bacteria, yeast, moulds, and Actinomycetes population. The growth of microbes in different media indicates their presence in the excreta and as the excreta are released into the soil, it may act as biofertilizer for crops. In the excreta of LWD, a maximum of 40×10^6 CFU/ml was observed in Jensen's media, indicating the presence of high number of nitrogen fixing bacteria followed by Nitrate agar media, BAM media M127, Casein starch agar media, Aleksandrow agar media with 39×10^6 CFU/ml, 33×10^6 CFU/ml, 28×10^6 CFU/ml and 27×10^6 CFU/ml indicating the presence of less

fastidious bacteria, Yeast and molds, Actinomycetes, Potassium solubilizing bacteria respectively. However, a lowest of 25×10^6 CFU/ml was observed in Pikovskaya's agar media indicating the presence of Phosphate solubilizing bacteria in the least amount. However, in CD a maximum of 38×10^6 CFU/ml was observed in Jensen's media followed by Nitrate agar media, BAM media M127, Casein starch agar media and with 37×10^6 CFU/ml, 30×10^6 CFU/ml and 26×10^6 CFU/ml respectively and a minimum of 25×10^6 CFU/ml was observed in both Aleksandrow agar media and Pikovskaya's agar media. It is clear from the above result that the excreta of both LWD and CD are plentiful in nitrogen fixing bacteria that helps in the nitrification process making nitrogen available for plants. Nitrogen is the major plant macronutrient and also the major constituent for protein, nucleic acid, vitamin and hormone, plants assimilate it in the form of nitrate. Nitrogen as fertilizer assure a greater crop productivity and is widely used worldwide for many plants [7]. Zhongping Qiu et al. [8] performed a similar study in-chicken manure where nitrogen fixing bacteria converts more ammonia into total nitrogen. Nitrogen fixing bacteria like Azospirillum can produce phytohormones, defence against pathogens, tolerance to abiotic stress, increase the rate of mineral and water uptake as studied by Josiane Fukami et al. [9]. Earlier report also evaluated that Yeast are promising microorganism capable for increasing crop productivity due to their intrinsic property [10] accompanying this biologically active Actinomycetes are also able to enhance grain yield and quality considerably [11], at the same time Phosphate solubilising bacteria is also considered as efficient Bio fertilizer an eco-friendly alternative to chemical fertilizers [4]. Hence it needs to be focused that our study also revels the presence of less fastidious microbes, yeast and molds, Actinomycetes, and Phosphate solubilizing bacteria in excreta of both LWD and CD indicating their nature as biofertilizer.

Next, following another main objective of this work, physico-chemical characteristics of the excreta of both the ducks are presented in Table 2. Which shows high organic carbon, ash content and pH in the excreta of LWD as compared to CD. Organic carbon plays an important role in the physical, chemical and biological functioning of agricultural soil by improving soil health and increasing productivity [12] Thus, presence of organic carbon in the excreta can be beneficial for soil. The study shows 1.4% and 0.96% of organic carbon in the excreta of LWD and CD respectively. Coming to the next physico-chemical parameter i.e., ash content, the main chemical component of ash is carbon, with trace amount of calcium magnesium potassium and phosphorus [13] LWD shows 5% ash content in 5gm of fresh sample which shows the addition of the above constituent in soil through excreta. Soil moisture also plays a key role in the exchange of water and heat energy, it also supports transpiration and uptake of minerals through the roots. Excreta of whistling duck adds 1.64% and that of common duck adda 3.45% of moisture thus increasing plant mineral uptake. pH is another important parameter of soil. A pH of 7.72 was observed in the excreta of LWD indicating its alkaline nature. A high pH indicates more productivity by improving soil Carbon sequestration [14].

4 Conclusion

As observed from the present study, microbial culture of the excreta of LWD and CD shows different types of beneficial bacteria which add on to the enrichment of soil health and make the nutrient available for plant. Along with the microbial culture the physico-chemical analysis has also shown promising result in favour of LWD. Organic carbon, ash content, moisture content and the pH value all put on to the mineral uptake and productivity of plants. Thus, excreta of LWD can be a good potential bio fertilizer, but the main threat to these birds is illegal hunting, habitat loss, wetland pollution by municipal waste and excessive use of agro-chemicals in the farmlands. At present LWD are listed as Least concern in the IUCN Red Data book however, due to its exploitation it is not far for the bird to be considered as vulnerable and threatened. Additionally, Wetlands play an irreplaceable role in regulating the global climate, maintaining the global hydrological cycle and protecting the ecosystem diversity. Threat to wetland also decreases the global economy [15], urbanization and agricultural activities are other reasons to minimise the land use land cover area for wetlands [16]. Moreover, as these birds are local migratory found roaming from one wetland to another, any threat to wetlands can decreases the richness of aquatic migratory waterfowls [17].

This work has worked out the basic premise to drag the attention on protection of LWD as well as to raising public awareness regarding the importance of wetlands and the risk of wetland degradation. Further studies may be adopted to elucidate the effects of microbial culture of bird excreta which requires longer-term experiments that were not possible in the aforementioned experiments. There were hardly some literature found regarding the use of faeces of LWD. So, the present study will guide future researchers about the improvement of soil quality by using faeces as biofertilizer.

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