BIOLOGIJA
2024. Vol. 70. No. 4. P. 191–197

ISSN 1392-0146 eISSN 2029-0578
DOI: https://doi.org/10.6001/biologija.2024.70.4.3

The importance of berries of some invasive shrub species in the diet of birds in an urbanised habitat in South African grasslands

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Fruits play an important role as a source of diet for many bird species in southern Africa. In some areas, e.g., in the Highveld, planting of fruit trees and berries in urbanised areas may cause expansion of the population and the range of some frugivore birds. A study on birds feeding on fruits was carried out in an urbanised habitat in the Highveld. Out of 51 bird species recorded in the study area, four were found to feed regularly on berries of exotic tree/shrub species, namely *Onychognathus morio*, *Pycnonotus nigricans*, *Zosterops pallidus*, and *Colius striatus*. In the dry season, *Pyracantha angustifolia* was by far the most important in that regard (62.5%), followed by *Melia azedarach* (21.1%). Other exotic berry species were picked much less often. Birds fed on berries mostly in June, July and August, i.e., in the dry season (85% of recorded birds). Although berries were still available later, they were taken by birds only sporadically. This study suggests that, at least in grasslands and semideserts of southern Africa, planting fruit trees and shrubs in urbanised areas may contribute to the expansion of the range and/or the population increase of some frugivorous species.

Keywords: *Onychognathus morio*, *Pycnonotus nigricans*, *Zosterops pallidus*, *Colius striatus*, frugivores birds, diet, urban ecology, alien plants, Lesotho

INTRODUCTION

Berries and other fruits are important components of the diet of many bird species. As an evolutionary consequence, frugivory plays an important role in seed dispersal and plant biogeography, such as dynamics of geographical ranges, population and community dynamics, population expansion, extinctions, or invasions (Udvardy, 1969; Morton, 1973).

In southern Africa, the guild of frugivores is represented by such avian families as Musophagidae, Coliidae, Captionidae, Lybiidae, Pycnonotidae, Turdidae, Sturnidae, Zosteropidae, and Estrildidae (Snow, 1981; Kopij, 2000a, 200b, 2006, 2014a). Many species belonging to these families have recently expanded their ranges in southern Africa as a result of spreading human-planted

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fruit trees. For example, in Lesotho, a small mountainous country in southern Africa, expansion of some barbet and starling species has been documented recently (Kopij, 2014b). Some of the species can become pests of cultivated fruit trees, some others as alien and invasive species (e.g., Indian Myna *Acridotheres tristis*, European Starling *Sturnus vulgaris*) may pose a threat to the indigenous species (Blackburn et al., 2009). It is therefore interesting to investigate the role of human-planted fruit and shrub trees as a source of food for birds. In this paper, a study was undertaken to show the role of such trees and shrubs as a source of food for birds in urbanised Highveld grasslands.

STUDY AREA

The National University of Lesotho (NUL) campus (82 ha) was designed as the main study area. It is situated at Roma, 32 km east of Maseru, Lesotho, southern Africa (29°28'S; 27°44'E), at the altitude of 1650 m above sea level.

The NUL campus represents a kind of urbanised parkland. There are buildings of various sizes, oxidation dams, cultivated fields and small gardens with vegetables, peaches, and plums. The whole area of the campus is also well endowed with various exotic trees (Ambose, Maphisa, 1999; Kopij, 2001, 2004, 2009; Talukdar, Ambrose, 2002).

The climate of Lesotho has four distinct seasons, namely: summer (November-January) characterised by high temperature and precipitation; winter (May–July) characterised by the lack of precipitation, warm temperature during the day and sudden drop after sunset; autumn (February–April), and spring (August–October) as transient periods between summer and winter. In 1998, the spring was dry and the summer wet, while in 1999 the reverse was true (Fig. 1).

METHODS

The study was conducted on the NUL campus between 1998 and 2001. Observations were conducted in 25 days: nine days in June, also nine days in July, and seven days in August. Each day, the observations were carried out in the morning and lasted 1–2 hours. Each day, all places with shrubs and trees bearing berries were visited. Bird species feeding on these berries were identified and counted. Observations were aided with 10 × 50 binoculars. The tree/shrub species were identified using Talukdar & Ambrose (2003) field guide.

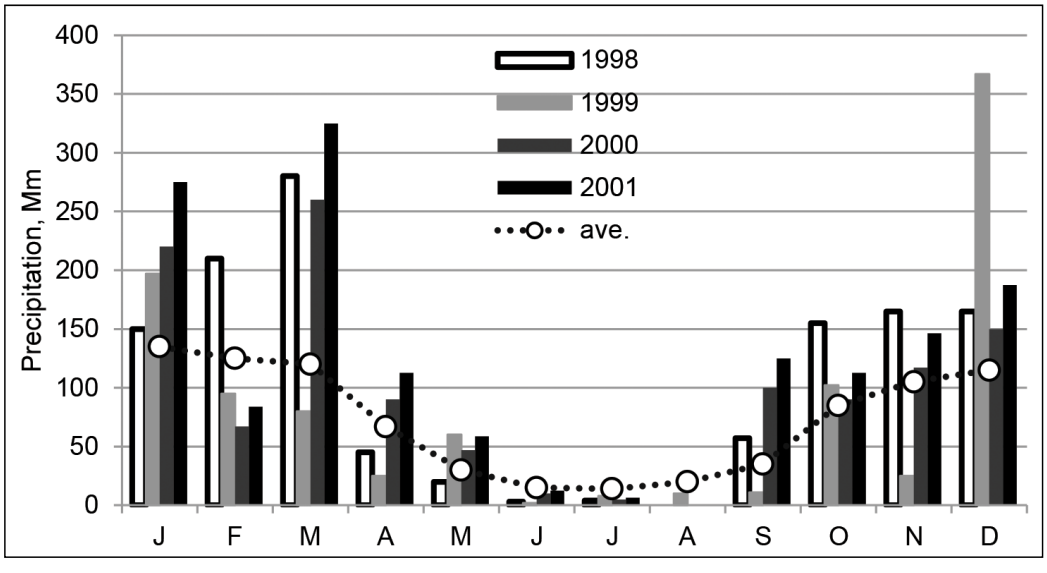

Fig. 1. Monthly rainfall at Roma during the period of 1998–2001, with a long-term average. (Data on the rainfall at Roma were obtained from David Ambrose.)

RESULTS

Birds fed on four species of berry-yielding trees and shrubs: Yellow firethorn *Pyracantha angustifolia* (Rosaceae), Cotoneaster *Cotoneaster* sp. (Rosaceae), Persian lilac *Melia azedarach* (Meliaceae), and Privet *Ligustrum vulgaris* (Oleaceae). All these ornamental woody species are alien to sub-Saharan Africa and originate from the southern Palearctic region. They are regarded as invasive species in southern Africa. All of them are abundant in the study area. Berries of these species are mildly poisonous to human, but not to birds. They are, therefore, not collected by people.

In the dry season, the Yellow firethorn was by far the most important as bird food (62.5%), followed by Persian lilac (21.1%). Other exotic berry species were fed upon only occasionally (Table 2). It is, however, important to add that the Yellow fir-thorn was also the most common exotic tree/shrub species in the study area, while the Privet was the least common. In the dry season, the Yellow firethorn is most often fed upon in July, the Persian Lilac in August, while the Cotoneaster in June (Fig. 2).

Out of 51 bird species recorded in the study area during the study period (Kopij, 2001), four were found to feed regularly on berries of exotic tree/shrub species, namely, the Red-winged Starling *Onychognathus morio*, the Red-eyed Bulbul *Pycnonotus nigricans*, the Cape White-eye *Zosterops pallidus*, and the Speckled Mousebird *Colius striatus*. Together, they comprised 99.6% of all birds feeding on berries recorded (Table 1). The remaining species, viz. the Olive Thrush *Turdus olivaceus* and the Crested Barbet *Trachyphonus vaillantii* fed on these barriers only occasionally (Table 1). All these species are resident in the study area throughout the year and all of them are indigenous to southern Africa.

Of the recorded birds, 85% fed on berries mostly in June, July and August, i.e., in the dry season. In September, the Red-winged Starling still fed regularly on berries, and although berries were still available later, they were taken by birds only sporadically (Table 1).

In the dry season, Yellow firethorn berries were fed upon mainly by the Red-winged Starling and, to a lesser extent, by the Red-eyed Bulbul and the Cape White-eye. The Persian lilac berries were mostly picked by the Red-winged Starling and less often by the Red-eyed Bulbul. The Privet were collected mostly by the Red-eyed Bulbul and, to a lesser extent, by the Red-winged Starling, while Cotoneaster berries mainly by the Cape White-eye and Speckled Mousebird (Table 2).

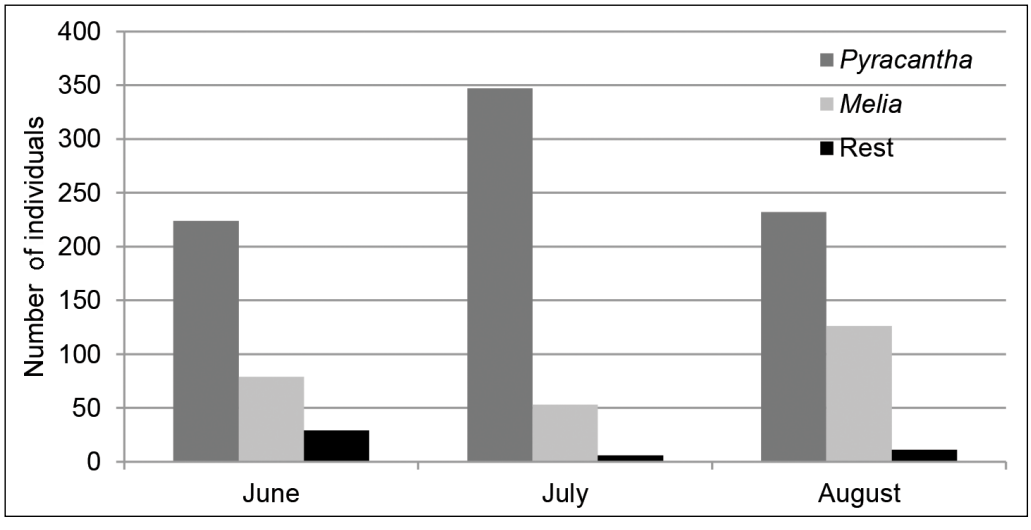

Fig. 2. Seasonal variation in the importance of main berries as food of birds in the dry season (June–August)

Table 1. **Seasonal variation in the consumption of berries by birds. Numbers of individuals of particular bird species feeding on berries**

Bird species	Dry season			Wet season			Total	
	June	July	Aug.	Sept.	Oct.	Nov.	N	%
Red-winged Starling	8.6	57.8	84.0	84.9	100.0	0.0	739	57.5
Red-eyed Bulbul	38.9	21.6	3.0	5.8	0.0	0.0	231	18.0
Cape White-eye	35.4	13.2	3.5	7.0	0.0	0.0	190	14.8
Speckled Mousebird	15.9	7.1	9.5	2.3	0.0	100.0	120	9.3
Olive Thrush	0.6	0.2	0.0	0.0	0.0	0.0	3	0.2
Crested Barbet	0.6	0.0	0.0	0.0	0.0	0.0	2	0.2
No. birds observed	314	408	369	172	20	2	1285	
% birds observed	24.4	31.7	28.7	13.4	1.6	0.2		100.0

Table 2. **Contribution of berries of a particular tree/shrub to the diet of bird species in the dry season (June-August). N – number of individuals**

Bird species	*Pyracantha*		*Melia*		*Ligustrum*		*Cotoneaster*		Total	
	N	%	N	%	N	%	N	%	N	%
Red-winged Starling	380	47.9	187	69.8	6	21.4	0	0.0	719	56.7
Red-eyed Bulbul	164	20.7	54	20.1	21	75.0	0	0.0	249	19.6
Cape White-eye	165	20.8	2	0.7	1	3.6	11	61.1	180	14.2
Speckled Mousebird	80	10.1	24	9.0	0	0.0	7	38.9	115	9.1
Olive Thrush	2	0.3	1	0.4	0	0.0	0	0.0	3	0.2
Crested Barbet	2	0.3	0	0.0	0	0.0	0	0.0	2	0.2
Total	793	62.5	268	21.1	28	2.2	18	1.4	1268	100.0

During the dry season, the mean flock size of the Red-winged Starling steadily increased, while that of the Red-eyed Bulbul steadily declined (Table 3). The mean feeding flock size of the Cape White-eye and the Speckled Mousebird remained similar throughout the dry season.

Table 3. **Seasonal variations in the feeding frequency (total number of feeding birds) and mean flock size of birds foraging on berries in the dry season (June–August).**

Pyr. – *Pyracantha*, Mel. – *Melia.*

Bird species	Value	June		July		August	
		Pyr.	Mel.	Pyr.	Mel.	Pyr.	Mel.
Red-winged Starling	Σ	11	16	189	41	186	124
	x	2.8	5.3	11.8	4.6	18.6	10.3
	s.d.	2.4	4.0	12.0	2.3	13.4	8.5
	n	4	3	17	9	10	12
Red-eyed Bulbul	Σ	81	41	77	11	6	2
	x	5.1	3.2	4.8	2.2	2.0	2.0
	s.d.	3.8	3.7	3.9	1.3	0.0	0.0

Table 3. **(Continued)**

Bird species	Value	June		July		August	
		Pyr.	Mel.	Pyr.	Mel.	Pyr.	Mel.
	n	17	13	17	5	3	1
Cape White-eye	Σ	103	2	54	0	8	0
	x	6.4	2.0	6.0	0.0	4.0	0.0
	s.d.	4.6	0.0	2.5	0.0	0.0	0.0
	n	17	1	9	0	2	0
Speckled Mousebird	Σ	25	20	27	0	32	0
	x	2.5	4.0	3.0	0.0	4.6	0.0
	s.d.	2.0	2.0	2.3	0.0	1.5	0.0
	n	10	5	9	0	7	0
Other	Σ	4	0	0	0	0	1
	x	1.0	0.0	0.0	0.0	0.0	1.0
	s.d.	0.0	0.0	0.0	0.0	0.0	0.0
	n	4	0	0	0	0	1

DISCUSSION

In Africa, little is known about the role of cultivated fruit trees and shrubs as sources of food for wild birds. Kopij (2000) studied birds feeding on berries in suburbs of Bloemfontein in the Highveld, South Africa. The feeding guild was composed of six species, viz. the Red-faced Mousebird *Urocolius indicus*, the White-backed Mousebird *Colius colius*, the Olive Thrush *Turdus olivaceus*, the Red-eyed Bulbul *Pycnonotus nigricans*, the Wattled Starling *Creatophora cinerea*, and the Cape White-eye *Zosterops pallidus*. The main species of trees and shrubs yielding berries fed on by birds were *W*hite Stinkwood (*Celtis africana*), Privet, and Transvall Milkplum (*Bequaertiodendron megalismontana*) (Kopij, 2000). For the comparison, the number of bird species feeding on berries is similar to that in Europe, where the following species were recorded in this group: *Turdus* species the Blackbird (*Turdus merula*), the Song Thrush (*T. philomelos*), the Fieldfare (*T. pilaris*), the Mistle Thrush (*T. viscivorus*), the Redwing (*T. iliacus*), the Robin (*Erithacus rubecula*), and the European Starling (*Sturnus vulgaris*) (Snow, Snow 1988). Altogether there are 48 genera within six families in Africa, which include specialised frugivore bird species (Snow, 1981). In comparison with other tropical regions of the world, the number is rather low. According to Snow (1981), it is because in Africa, the main plant families coevolving with frugivorous birds, such as Lauraceae, Burseraceae, and Palmae, are rather poorly represented by berry-yielding species in comparison with other parts of the tropical regions of the world, so is also the number of frugivorous species. However, it should be pointed out that fruits are not the preferred food even by typical frugivore species, as fruits are less nutritious than insect diet. Many bird species which have fruit as staple food in non-breeding season switch to insect diet during the breeding season when insects are freely available (e.g., Kopij, 2008). A great advantage of frugivory is that fruits are often superabundant, so birds do not need to compete for this resource (Morton, 1973), while insects are a limited resource in the dry season.

As it may be seen from this study, some alien and invasive berry-yielding shrubs may play a positive role in urbanised and rural areas in Lesotho as well as in other parts of southern Africa. These places can be considered

ecological islands with superabundant food resources during the non-breeding season (dry season) for several frugivore bird species, such as the Red-winged Staring, the Cape White-eye, mousebirds, and barbets.

The cultivation of exotic fruit shrub species in areas highly transformed by the human may therefore substantially increase the population density of some frugivore species. The populations may increase both in urbanised and natural habitats. However, as Mokotjomela et al. (2013) have found, birds such as the Olive Thrush, the Laughing Dove *Spilopelia senegalensis*, the Speckled Pigeon *Columba guinea*, the Pale-winged Starling *Onychognathus nabouroup*, and the European Starling prefer to eat berries of exotic species (*Solanum mauritianum*, *Lantana camarathan*, *Myoporum tenuifolium*, and *Pittosporum undulatum*) than indigenous ones (*Olea europaea* and *Chrysanthemoides monilifera*) in the Cape Floristic Region of South Africa. Such preference can also occur in the Highveld. It means that frugivore birds may disperse seeds of the alien species even more efficiently than the indigenous ones, which may pose an environmental problem. Planting these alien shrubs and trees in natural habitats, especially along rivers and other watercourses should be strictly prohibited, as, in the course of ever-growing competition and also being more efficiently dispersed by birds, these plants may replace the indigenous ones (Talukdar, 1982; Ambrose et al., 2000).

Received 7 October 2024
Accepted 24 October 2024

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KAI KURIŲ INVAZINIŲ KRŪMŲ UOGŲ SVARBA PAUKŠČIŲ MITYBAI URBANIZUOTOJE PIETŲ AFRIKOS PIEVŲ BUVEINĖJE

Santrauka

Vaisiai yra svarbi daugelio paukščių rūšių mitybos dalis Pietų Afrikoje. Kai kuriuose regionuose, pavyzdžiui, Highveld, vaismedžių ir uogakrūmių sodinimas urbanizuotose vietovėse gali paskatinti tam tikrų vaisiais mintančių paukščių populiacijos augimą ir arealo plėtimąsi. Urbanizuotoje Highveld buveinėje atliktu tyrimu siekta išsiaiškinti paukščių mitybą vaisiais. Tiriamojoje teritorijoje užregistruota 51 paukščių rūšis, iš kurių keturios reguliariai maitinosi egzotinių medžių ir krūmų uogomis: *Onychognathus morio*, *Pycnonotus nigricans*, *Zosterops pallidus* ir *Colius striatus*. Sausuoju sezonu *Pyracantha angustifolia* (62,5 %) ir *Melia azedarach* (21,1 %) buvo svarbiausi maisto šaltiniai. Kitos egzotinių uogų rūšys buvo vartojamos daug rečiau. Paukščiai daugiausia maitinosi uogomis birželio, liepos ir rugpjūčio mėnesiais (85 % užfiksuotų atvejų), t. y. per sausąjį sezoną. Nors uogų šiam regione buvo ir vėliau, paukščiai jas lesė tik retkarčiais. Tyrimas leidžia daryti prielaidą, kad Pietų Afrikos pievų ir pusdykumių regionuose vaismedžių ir krūmų sodinimas urbanizuotose teritorijose gali prisidėti prie tam tikrų vaisiais mintančių paukščių rūšių arealo plėtimosi ir / arba populiacijos didėjimo.

Raktažodžiai: *Onychognathus morio*, *Pycnonotus nigricans*, *Zosterops pallidus*, *Colius striatus*, vaisiais mintantys paukščiai, mityba, urbanistinė ekologija, svetimkraščiai augalai