Abundance of Whitethroats *Sylvia communis* and potential invertebrate prey, in two Sahelian sylvi-agricultural habitats

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Received 5 March 1996
Revised 9 July 1996

Summary

Sylviids present in farmland with indigenous tree and shrub species were absent from farmland planted with the alien species, Neem *Azadirachta indica*. Potential invertebrate prey was significantly less abundant in Neem than in native tree and shrub species. Insectivorous passerines are likely to benefit from attempts to restore the diversity of indigenous tree species on W African dry farmland.

Résumé

Les Sylviidés présents sur des terres cultivées avec arbres et arbustes indigènes étaient absents de celles plantées d'une espèce exotique, le Nim *Azadirachta indica*. Les invertebrés, proies potentielles, étaient de façon significative moins abondants sur les Nims que sur les arbres et arbustes du pays. Les passereaux insectivores devraient bénéficier vraisemblablement des efforts tendant à rétablir la diversité des espèces ligneuses indigènes sur les terres arables sèches d'Afrique de l'Ouest.

Introduction

In W Africa, Whitethroats *Sylvia communis* occur in shrubs and trees in savanna and farmland, where they feed on invertebrates (Morel & Morel 1992, Jones *et al.* 1996). Drought in the Sahel since 1969 is thought to have contributed to the decline in numbers of Whitethroats breeding in Britain (Marchant *et al.*1990), and of crop yields in W African farmland (Agnew 1995).

Sorghum and bulrush millet are the main cereal crops grown in the dry farmland known in Hausa as *tudu*. Trees and shrubs are an integral part of this farming system, contributing nutrients to, and consolidating the soil and providing products such as fuel, timber, fodder, fruit and medicines. Increasing pressure on farmland and tree resources from the 1920s prompted the introduction of fast-growing, drought-tolerant species such as *Eucalyptus* spp. and Neem *Azadirachta indica*.

Neem is an Asian species which provides timber for building and fuel (Maydell 1990), and is a source of a broad spectrum insecticide used on crops and stored grain (Nigam *et al.* 1994). It has been widely planted in the Sahel as windbreaks, amenity and shade trees, and as plantations which are coppiced at 8–10 year intervals. Plantations continue to be interplanted with cereals in the early stages of the coppice rotation.

Methods

In January 1996, at Nguru, northern Nigeria (12°53'N, 10°27'E) I assessed the abundance of Whitethroats and their potential invertebrate food in an area of tudu with indigenous tree and shrub species, and in recently coppiced Neem plantation. Details of the woody flora are given by Jones *et al.* (1996).

Bird abundance was assessed using point counts in tudu (55 points) and in recently coppiced Neem plantation (25 points). Point counts were conducted in the early morning at 100 m intervals along random bearings through each habitat. After walking to the count point, three minutes were allowed for birds to settle down before the count was started. Birds of all species were then counted over a two minute period, and the distance from the observer to each bird was estimated.

Tree species, position, height and canopy width were recorded within a 25-metre radius of each count point. Tree numbers at each point were used to calculate tree density, and overall cover for each point was calculated from canopy diameter of individual trees and shrubs. For Whitethroats, observer to bird distances up to 80 m were used to calculate density using the program DISTANCE (Buckland *et al.* 1993). Whitethroat density was also calculated using data from within a 25 m radius as an actual count (Jones *et al.* 1996).

Invertebrates were collected from *Piliostigma reticulatum*, the dominant shrub species in tudu, and from Neem coppice regrowth at 20 m intervals using a 35 x 53 cm beating tray. Thirty beating tray samples were collected from each species, in the early morning and at a height of 1 m. Because of the vertical structure of shrubs, foliage immediately above the tray was bent over and shaken for approximately 5 s per sample. The contents of the tray were then quickly transferred to a polythene bag.

Thirty beating tray samples of invertebrates were also collected from mature Neem trees and twenty were taken from each of two indigenous tree species, *Acacia senegal* and *A. nilotica*, at a height of 3–4 m. In trees, the tray was suspended 0.5 m from the end of a sectional pole by two cords, attached near the centre of the tray, and beaten against the foliage for approximately 5 s per sample.

Invertebrate samples were stored in alcohol and subsequently identified using a low power binocular microscope. The invertebrate groups recognised were ants (Formicidae), plant hoppers (Cicadelidae), plant bugs (Miridae), caterpillars (Lepidoptera), beetles (Coleoptera), spiders (Araneae), flies (Diptera) and miscellaneous (other taxa). Because of the slight difference in sampling method in trees and shrubs, the two datasets were analysed separately.

Results

The presence of mature trees in tudu increased the mean height of vegetation in this habitat, but median tree/shrub height was 1.5 m in both habitats. Tree density per count point was lower in tudu than in the closely planted Neem plantation (means ± 1SE: tudu 62 ± 21 ha^{-1}, Neem 505 ± 19 ha^{-1}, $t_{78} = 13.07$, $P < 0.001$), but the overall cover of woody vegetation did not differ significantly between the two habitats (tudu 749 ± 145 m^2ha^{-1}, Neem 894 ± 173 m^2ha^{-1}, $t_{78} = 0.59$, ns).

Whitethroat density in tudu was 1.28 birds ha^{-1} (birds within 25 m of the count point) or 1.10 ha^{-1} (95% confidence interval, 0.71–1.73) using all distance data. Whitethroat, Subalpine Warbler *S. cantillans* and Tawny-flanked Prinia *Prinia subflava* were present in a ratio 3:1:1, but insufficient data were available to calculate density for the latter two species. No sylviids were recorded in Neem plantation.

Invertebrates per beating tray sample were significantly more abundant in *Piliostigma* than in coppiced Neem ($t_{58} = 6.06$, $P < 0.001$), as were ants ($t_{58} = 3.78$, $P < 0.001$), plant hoppers ($t_{58} = 5.03$, $P < 0.001$) and beetles ($t_{58} = 2.11$, $P < 0.05$) (Fig. 1).

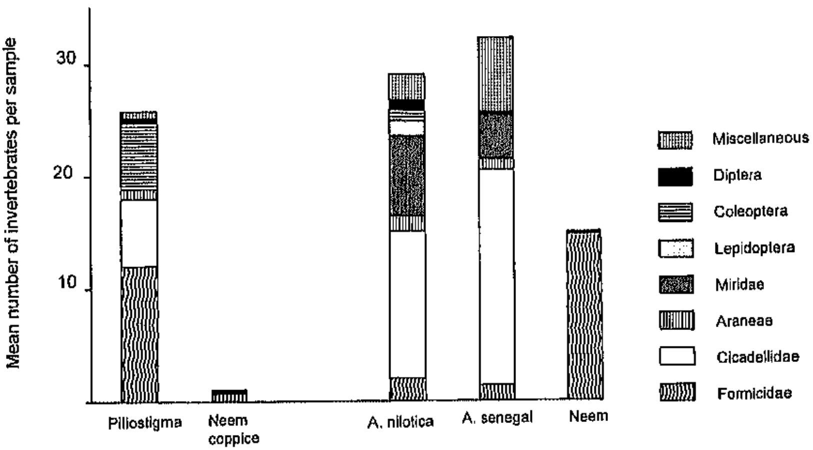

Figure 1. Abundance of invertebrates in trees and shrubs.

Within the three tree species, invertebrate abundance per beating tray sample was also lower in Neem for most individual groups: plant hoppers (ANOVA, $F_{2,67} = 3.47$, $P < 0.05$), plant bugs (ANOVA, $F_{2,67} = 18.914$, $P < 0.001$), caterpillars (ANOVA, $F_{2,67} = 23.25$, $P < 0.001$) and spiders (ANOVA, $F_{2,67} = 7.93$, $P < 0.001$) as well as for all groups considered together (MANOVA, $F_{24,174} = 10.99$, $P < 0.001$). However ants were more abundant in Neem trees than in the acacias (ANOVA, $F_{2,67} = 3.03$, $P = 0.055$) (Fig. 1).

Discussion

Both Whitethroat density estimates for tudu are similar to a previous estimate of 1.3 ha^{-1} for the same site (Jones *et al.* 1996). This was the highest density of any recorded at ten different sites (including native *Acacia-Balanites* woodland) by Jones *et al.* whose study did not include farmland planted with Neem. Farmland with native trees and shrubs therefore appears to be an important winter habitat for Whitethroats.

The absence of pest invertebrates associated with Neem is one reason for its widespread adoption in the Sahel. The lack of invertebrates, apart from ants, associated with Neem may be attributable to the presence in leaves and fruit of the insecticide azadirachtin (Nigam *et al.* 1994).

Stoate & Moreby (1995) found that ants comprised 55% of the invertebrate component of Whitethroat diet in northern Senegal in March. However, at that site fruit was the major component, associated with pre-migratory fattening, and abundance of fruit rather than invertebrates appeared to determine the abundance of migratory sylviids (Stoate 1995). Earlier in the season invertebrates are thought to be taken because of their higher protein content (Morel & Morel 1992, Jones *et al.* 1996) and Whitethroat abundance is likely to be determined by their availability.

Miridae, Coleoptera, Lepidoptera larvae and Diptera together comprised 42% of the invertebrates eaten by Whitethroats at the Senegal site (Stoate & Moreby, 1995) and all of these groups were scarce or absent from Neem at Nguru.

Although the data presented here suggest that Neem has no direct conservation benefit to invertebrates or insectivorous birds, its introduction to dryland farming has diverted pressure for timber and fuel from indigenous trees in adjacent tudu. Introduction of Neem has also led to awareness of a need for sustainable management of native species, including encouragment of their natural regeneration on farmland (Kerkhof 1993; Cline-Cole 1995). However, as a highly successful introduced species, an improved understanding of Neem's ecology is required. It produces berries which are consumed by birds, and its seeds are spread to other areas, including tudu, where they germinate and grow successfully. Neem comprised 8% of the woody flora in the tudu site, including both young and mature trees. It grows faster than most indigenous species (Maydell 1990; Kerkhof 1993) and, if unmanaged, its invasive habit could lead to domination of indigenous woody flora.

As well as their greater conservation value, many of the native species have important human uses which are not met by Neem, including provision of fruit, browse for livestock, and a wider range of timber and medicinal uses. Wider recognition of the advantage of indigenous tree species diversity in farmland over single species plantations (Kerkhof 1993; Cline-Cole 1995) is likely to benefit both avian and human users.

Acknowledgments

I am grateful to Gert Polet and other staff of the IUCN Hadejia-Nguru Wetlands Conservation Project, and to the Wetland Trust for support for this work. Will Cresswell and Juliet Vickery provided invaluable information on their work at Nguru, Steve Moreby provided entomological assistance and Ronald Keay provided information on Neem. Nicholas Aebischer, Peter Jones, Alan Tye and C.H. Fry made helpful criticisms of earlier drafts.

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