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SEASONAL OCCURRENCE, MIGRATIONS AND HABITAT RELATIONSHIPS OF BLUE-TAILED AND BLUE-THROATED BEE-EATERS *MEROPS PHILIPPINUS* AND *M. VIRIDIS* IN PENINSULAR MALAYSIA

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ABSTRACT. — Field studies conducted in the central part of Peninsular Malaysia in 1963–1968 are reported here. The blue-tailed bee-eater *Merops philippinus* was an abundant winter visitor to open country in the lowlands from October–March, with passage migration in October and March probably exceeding 1 million birds. The blue-throated bee-eater *M. viridis* occurred in two discrete populations: a summer population in open country in the lowlands that arrived in late February and March, nested in April–July and departed southwards in July–August; and a winter population in forest in the mountains that arrived in October and departed in April. *M. philippinus* was precisely segregated from the summer population of *M. viridis* by date and from the winter population by location and habitat. This segregation hypothetically resulted from interspecific competition.

KEY WORDS. — bee-eaters, breeding, competition, habitat, Malaysia, *Merops philippinus*, *Merops viridis*, migration, wintering

INTRODUCTION

Four species of bee-eater (Meropidae) breed in Peninsular Malaysia, but only two are widespread and numerous in the southern part of the peninsula: the blue-tailed bee-eater *Merops philippinus* and the blue-throated bee-eater *M. viridis*. The former species is a passage migrant and [Northern hemisphere] winter visitor, but *M. viridis* has a complex status thought to include seasonal breeders, winter visitors and passage migrants, which apparently occupy different habitats (Medway & Wells, 1976; Wells, 1999). Here, I report field observations made in the 1960s that help to clarify the status of *M. viridis* and its possible interactions with *M. philippinus*.

METHODS

In 1963–1968, I studied birds in Peninsular Malaysia, especially in the states of Selangor, Negri Sembilan and Pahang. I particularly focused on the migration of oriental honey-buzzards *Pernis ptilorhyncus* and Japanese sparrowhawks *Accipiter gularis*, and often observed migrating bee-eaters at the same time. I searched for and counted migrating raptors and bee-eaters at Petaling Jaya for short periods (30–60 min) at various times of day on about one-third of the days in five autumns (September–early November) and four springs (mid-March to early May). Once or twice during each of these seasons, I conducted transects across the width of the coastal plain from Kuala Lumpur to Port Klang (c. 31 km) stopping every 4–6 km and counting hawks and bee-eaters for 30–40 min at each stop. I spent about 25 days at Port Dickson during the migration seasons and counted hawks and bee-eaters arriving and departing from Tanjong Tuan (Cape Rachado). I also visited the flooded tin-mines at Sungei Way (now part of Subang) 2–6 times each month and assisted with mist-netting operations there (Nisbet & Medway, 1972); I visited the *M. viridis* colony at Sungei Buloh (Stader, 1996) several times and assisted with ringing; and I observed bee-eaters at many other locations, including Petaling Jaya, Ulu Gombak, Bukit Fraser (Nisbet, 1968a), Ampang, Ampang Reservoir, a patch of lowland forest at Subang, Pulau Tengah and Kuala Selangor (Fig. 1). My observations were sporadic at most locations, so I would not have obtained reliable first or last dates for bee-eaters at any site except Petaling Jaya and Sungei Way. This paper has been condensed from a longer draft that I wrote in 1967 and uses numbers and dates that were included in that draft, but I have not been able to check or extend this information by consulting my original field notes.

RESULTS

Blue-tailed bee-eater. — *M. philippinus* breeds from southern China south to the northern part of the Thai-Malay Peninsula

and winters from Thailand south to Sumatra and Java (Wells, 1999; Fry, 2001). In my study-area, it was an abundant winter visitor and passage migrant, found strictly in open country, e.g., in cultivated and cleared areas along the coast, tin-mines, rice-fields and the outskirts of towns. At night it formed large roosts in tall isolated trees or mangroves; one roost I watched in mangroves at Pulau Tengah, Selangor, was used by tens of thousands of birds, and reportedly still held 5,000–10,000 birds in the 1980s (Nisbet, 1968b; Wells, 1999). One bird ringed at Sungei Way on 13 Jan.1965 was retrapped there on 10 Feb.1966, showing fidelity to the wintering site.

At Sungei Way, a few *M. philippinus* arrived each year in the third week of August and remained throughout September, but only a handful of birds were involved and I did not see the species anywhere else before mid-September. General arrival took place each year in the last 10 days of September and the species became abundant throughout the lowlands by the end of the month. From about 25 Sep.–5 Nov., massive diurnal movements to the south or SSE could be seen on almost every day over the coastal plain, on a front of 25–30 km. The movements were most conspicuous in the mornings (0800–1000 hours) and evenings (1630–1830 hours), but in fact continued all day, the birds flying too high in the heat of the day to be seen or heard from the ground unless searched for with binoculars. On good days at the height of the migration (10–24 Oct.) it was possible to see some 150–200 birds h^{-1} at many sites in the lowlands: assuming conservatively that all birds crossing a 500-m front were seen, this would lead to an estimate of total passage on the order of 100 000 birds d^{-1}, or well over one million birds during the autumn. I counted up to 1000 birds h^{-1} leaving the coast at Tanjong Tuan and flying SSW over the Strait of Melaka towards Sumatra, indicating some degree of concentration at that departure point.

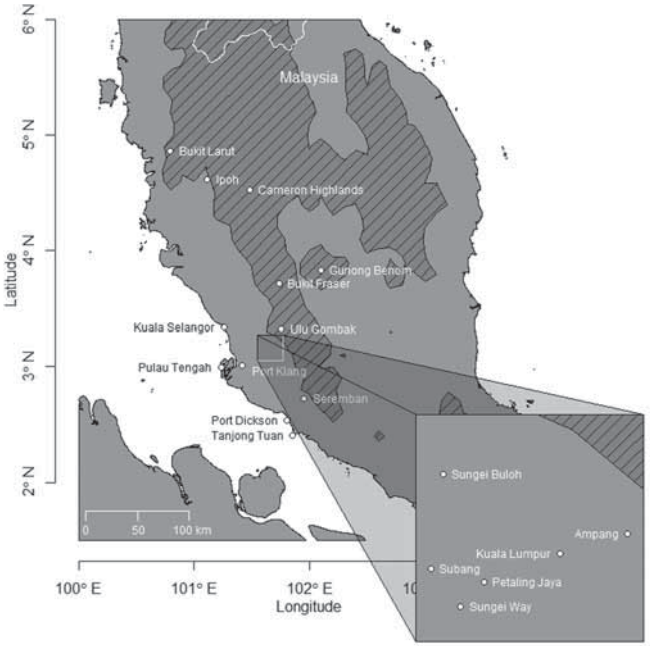

Fig. 1. Map of the central part of Peninsular Malaysia showing locations referred to in the text. Darker shading indicates areas >200 m above sea level.

Winter visitors departed during March; those that used the same perches near my house every day during the winter had left by 18 Mar. each year. Numbers remained high at the winter roosts and feeding areas for 5–10 d longer, but only stragglers were left by 1 Apr. From about 2–30 Mar., I saw large-scale movements to the north or NNW almost daily, very similar to the autumn movements described above. My highest count of incoming birds at Tanjong Tuan in March was 180 h^{-1}, indicating little or no concentration there.

Although both spring and autumn migration took place on a broad front over the lowlands at heights ranging up to at least 600 m, I only once saw *M. philippinus* migrating over the forested mountains or foothills 15–30 km east of the main stream of migration, despite regular observation during migration seasons at two points on the crest of the mountains at altitudes of 1200–1400 m. However, in Mar.1964 I saw numerous flocks flying over the 1,400 m summit of Bukit Larut (Maxwell's Hill), Perak (Medway & Nisbet, 1965); this mountain is isolated from the main range and located in the main stream of the species' migration over the lowlands.

Previous and subsequent accounts of the seasonal status, habitats and migration of *M. philippinus* in Peninsular Malaysia and Singapore have been generally similar to mine (Young, 1941; McClure, 1961; Medway & Wells, 1976 and references therein; Hails & Jarvis, 1987; Wells, 1999; DeCandido et al., 2004a, 2004b; *The Birds of Singapore*). However, Wells (1999) stated that spring migration peaks in late March and early April (slightly later than my records), with none passing Singapore after mid-April, but with parties continuing to arrive at Tanjong Tuan until well into May.

Blue-throated bee-eater. — *M. viridis* breeds from southern and eastern China south to Sumatra and Java, including peninsular Malaysia; it winters over the same range as *M. philippinus* (Wells, 1999; Fry, 2001). Over much of the lowlands of Peninsular Malaysia it was a seasonal breeder, occupying the areas used by *M. philippinus* at the time that species departed in spring, and vacating them before *M. philippinus* returned in autumn. Its favoured habitat was open sandy areas near the coast, but it also bred in scattered colonies inland, especially around tin-mines, in agricultural areas and the suburbs of towns, and foraged widely during the day. Unlike *M. philippinus* it was at least as numerous on the east coast of Malaysia as in the west. It roosted in tall, isolated trees, often in the same trees as favoured by *M. philippinus*, but less consistently in mangroves.

Among the breeding colonies that I watched, one in Petaling Jaya was first occupied in three years in the period 12–23 Mar., and in the fourth not until 28 March; in each year it was vacated by the end of July. A few km away at Sungei Way, the first arrivals were seen each year during 28 Feb.–11 Mar., with departures in August or September. A bird ringed at Sungei Way on 27 Apr.1965 and retrapped there on 20 Jun.1965 (hence presumably a local breeder) was recaptured at the same place on 1 Sep.1966: this indicates that at least a few breeding birds lingered near their colonies until early autumn. A colony at Port Dickson was occupied in at least

two years before the end of February; excavation of burrows was well-advanced in one year by 20 Mar., and the colony was empty in two years by 27 Jul. I did not record spring migration through the lowlands, but I might have overlooked this species among the large numbers of *M. philippinus* migrating during March.

Southward migration over the lowlands of Peninsular Malaysia started around 16 Jul., reached a peak in early August and continued erratically and intermittently until the first week of September. The birds passed on a broad front in a similar manner to *M. philippinus*, but in much smaller numbers—rarely more than 1–2 flocks h^{-1}—and hence were usually detected only in the morning and evening. Southward movements were very conspicuous along the coast, e.g., at Port Dickson, where on two visits in late July I saw a succession of flocks passing SSE along the shore and turning SSW to cross the Straits of Melaka (I did not retain information on the size of these flocks). This was the first and most direct evidence that the birds that breed in Peninsular Malaysia emigrate after breeding; this has subsequently been confirmed by the recovery in southern Sumatra of a bird ringed at a colony in Selangor (Wells, 1999). On several occasions during August I saw flocks take up residence near my house, using perches different from those used by breeders in March–July, and disappear after a few days; I concluded that these were passage migrants.

In spite of diligent searching, I had only one record of *M. viridis* in the lowlands west of Kuala Lumpur later than 18 September. This was of a small flock that wintered in 1966–1967 in lowland rain-forest at Subang, Selangor—in an area that McClure & Husain (1965) and I had patrolled in three previous winters without finding the species.

In the forested mountains and foothills of central Peninsular Malaysia, *M. viridis* was exclusively a winter visitor, occurring along streams, openings and tracks in the rain forest, but also quite commonly on densely-forested hillsides; it was most numerous at altitudes below 1000 m. Regular observations in Ulu Gombak, Selangor, showed that it arrived in each year in late October and departed in the second half of April, with the latest record on 26 Apr. (Medway & Nisbet, 1967). In late October large numbers could be seen passing south over the mountain ridges (1000–1200 m) of Pahang and Selangor, and there was a similar return passage from 25 Mar. until late April. At Bukit Fraser, hundreds could be seen passing south daily in late October.

In a narrow strip at the foot of the mountains, the seasonal status of *M. viridis* was different from either that in the lowlands or the mountains, perhaps resulting from the co-occurrence of birds from the two populations. In the towns of Ipoh, Kuala Lumpur and Seremban, I and contributors to the annual Bird Reports found *M. viridis* present throughout the year, but only in small numbers during the breeding season. I also found them numerous in forest at the foot of Gunong Benom, Pahang, in late February, ranging up to 800 m but not higher (Medway & Nisbet, 1968).

Previous and subsequent accounts of the seasonal status, breeding phenology, habitats and migration of this species in Peninsular Malaysia have been generally in accord with mine (Edgar, 1947; McClure, 1964; Medway & Wells, 1976 and references therein; Stader, 1996; Wells, 1999; DeCandido et al., 2004; Sreedharan, 2011). At a breeding colony at Sungei Buloh, birds arrived during March and April, and laid eggs from 8 Apr.–13 Jul. with a peak around 13 May (Stader, 1996). Medway & Wells (1976) stated that migratory flocks had been seen in forest as early as 7 and 15 Jul. (citing Medway & Wells, 1970 and Wells, 1974), but that the major influx occurred in September (earlier than I observed) and October (citing Medway & Nisbet, 1965, 1967). They reported spring arrivals at Tanjong Tuan starting in late February, and northward migration over the lowlands from 9 Mar. to early April. They mentioned migrating flocks at Bukit Fraser and at Cameron Highlands in mid-April and early May; McClure (1964) also reported migrants at Gunong Brinchang, Pahang in early May. DeCandido et al. (2004a, 2004b) observed small numbers arriving at Tanjong Tuan from 8–22 Mar. Sreedharan (2011) stated that the peak northward migration over Singapore was in March and early April, with extreme dates 25 Jan. and 5 May.

DISCUSSION

My observations indicated that *M. philippinus* was an abundant passage migrant and [Northern Hemisphere] winter visitor to in west-central Malaysia during the 1960s. They also demonstrated the existence of two distinct populations of *M. viridis*: (1) birds that bred in open country in the lowlands, arriving in March, breeding in April–July and departing southwards in August, with some passage migration from mid-July to early September; and (2) birds that wintered in forest in the foothills and mountains, arriving in October and departing in April (Fig. 2). Reports by others extend these dates somewhat, but those reports apparently referred only to small numbers. Others have reported similar differences in dates of occupation and habitat utilisation by *M. viridis* in different locations, but it has hitherto been ambiguous whether these referred to two discrete populations, or whether the birds that breed in the lowlands might move to the mountains for the winter (Medway & Wells, 1976; Wells, 1999; Sreedharan, 2011). My observations provide strong evidence that there were two discrete populations in the 1960s: (a) most breeders departed in July–August, long before the main arrival in the mountains in October; (b) migrants were seen passing south over the lowlands and departing from Tanjong Tuan in July–August; (c) wintering birds in the mountains remained until the second half of April, close to the peak of breeding in the lowlands (Fig. 2). The late departure of the wintering birds suggests that they were from a northern population (Nisbet, 1976), but I have not found any published data on breeding dates in the northern part of the range.

The wintering population of *M. philippinus* was separated from both populations of *M. viridis*: from the mountain population by location and habitat and from the lowland

population by date (Fig. 2). There was slight overlap at the margins in both cases, especially in spring when the peak migration of both species through the area took place in March (Fig. 2). However, the replacement of wintering *M. philippinus* by breeding *M. viridis* was very precise in mid-March: both species used the same perches near my house in Petaling Jaya, but *M. viridis* replaced *M. philippinus* within a few days around 15 Mar. and I never saw both species together, so that a casual observer would not have noticed the change.

I earlier suggested that the precise segregation of the two species might have resulted from interspecific competition (Nisbet, 1976). There is certainly potential for competition: they have almost identical diets (Avery & Penny, 1978; Wells, 1999; Fry, 2001), they were both abundant in the lowlands of Peninsular Malaysia, and in my study-area they foraged in the same way, used the same perches and the same roosts. *M. viridis* is distinctly smaller (Wells, 1999) and might therefore be an inferior competitor. That would explain why the breeding population of *M. viridis* departs (one of the few Malaysian species known to emigrate after breeding) before *M. philippinus* arrives in autumn and why the wintering population occupies a different habitat from *M. philippinus* (it is also different from the habitat *M. viridis* uses in the breeding season when *M. philippinus* in absent). However, the existence and importance of competition are conjectural and would have to be verified by studying the two species at a place and time where they co-occur—e.g., at a mixed breeding colony such as that studied by Avery & Penny (1978) in mainland Penang.

If *M. viridis* is in fact an inferior competitor, it would not escape competition with *M. philippinus* simply by emigrating to Sumatra, because *M. philippinus* winters in large numbers there also. A prediction from the competition hypothesis would be that the Malaysian population of *M. viridis* would winter in forest in Sumatra, in the same way that the northern population winters in forest in Malaysia. If it does so, it would be jeopardised by the ongoing destruction of forests in Sumatra, so one would further predict a decline in the Malaysian breeding population even if breeding success remains high. Numbers of *M. philippinus* reported in recent years have been lower than those I recorded in the 1960s (Wells, 1999; DeCandido et al., 2004 a, 2004b), but there is no way to make a systematic comparison, and there is no recent information on numbers of *M. viridis*.

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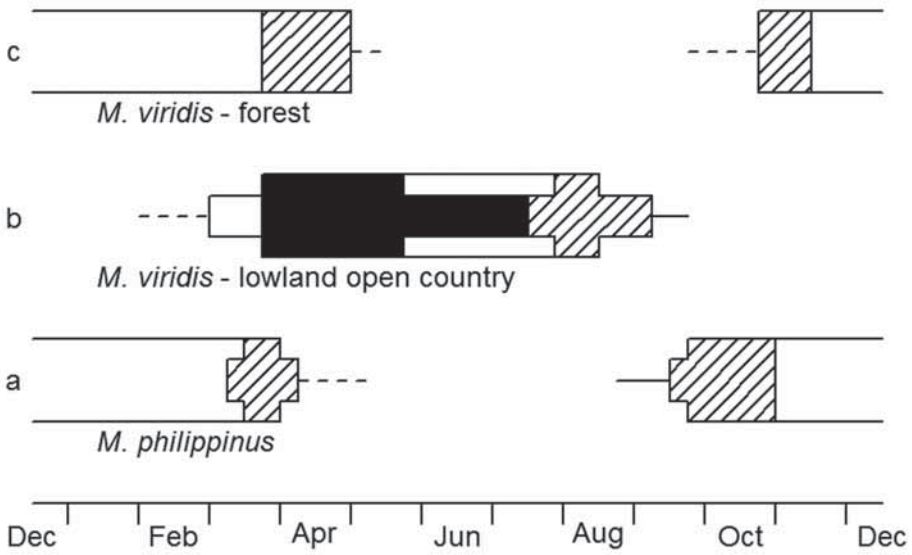

Fig. 2. Annual cycles of three populations of bee-eaters in Peninsular Malaysia in the 1960s: a, *Merops philippinus*; b, *M. viridis*, breeding population in lowland open country; c, *M. viridis*, wintering population in forest (mainly in the mountains). Solid bars, breeding (excavating burrows, eggs and chicks); hatched bars, passage migration; open bars, winter, prebreeding or postbreeding. Width of bars indicates relative numbers; solid lines, very small numbers; dashed lines, small numbers reported by others.

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