VOCALISATION OF ORIENTAL MAGPIE ROBIN (Copsychus saularis Linnaeus, 1758) IN RESPONSE TO ENVIRONMENTAL FACTORS IN PENINSULAR MALAYSIA

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October 2018

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Urbanisation has caused an increase in the anthropogenic noise and changes in environmental gradients in urban areas. These two variables have been shown to alter urban birds' vocal communication structure in past studies. By using a common and vocally active bird species of urban areas in Malaysia, i.e. Oriental Magpie Robin (*Copsychus saularis*), this study described the territorial songs of the Oriental Magpie Robin; compared the bird's vocalisation in relation to anthropogenic noise present in the urban, suburban and rural areas in Peninsular Malaysia; and assessed the effects of urban environmental factors on the bird's vocalisation. The study was carried out in Kuala Lumpur, Putrajaya, Selangor and Negeri Sembilan between January and June 2017. Ambient factors (i.e. ambient noise, environment temperature, relative humidity and light intensity) and landscape factors (i.e. distances to building and major roads) were measured during sampling. Territorial songs of the bird were recorded and transcribed into spectrograms from which six parameters namely low frequency, high frequency, frequency ranges, length of strophe, number of elements per strophe, and time interval between strophes were derived. In urban areas, low frequency of song was found to increase significantly as compared to suburban and rural areas. The difference in noise, temperature and relative humidity in urban and suburban environment had led to both single and interaction effects towards the Oriental Magpie Robin's song parameters, i.e. low frequency, length of strophe, time interval between strophes and number of element per strophe. The results showed that the Oriental Magpie Robin had adapted to urban condition by regulating and altering their frequency of song. This implied that the Oriental Magpie Robin have the ability to alter their vocalisations according to certain habitat condition. Such vocal alteration and adjustment are expected to be important in ensuring the efficiency in transmission of songs and it is a form of species behavioural adaptation in different habitat types and condition. This study also found that the Oriental Magpie Robin is likely to have opportunistic-switch plasticity and this may explain the reasons why certain urban bird species are less susceptible to urbanisation.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Sarjana Sains

RESPONS SECARA VOKAL MURAI KAMPUNG (*Copsychus saularis* Linnaeus, 1758) TERHADAP FAKTOR PERSEKITARAN DI SEMENANJUNG MALAYSIA

Oleh

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Perbandaran telah menyebabkan peningkatan bunyi bising antropogenik dan perubahan dalam faktor persekitaran. Kedua-dua pembolehubah ini telah terbuki membawa kepada perubahan dalam struktur komunikasi secara vokal burung dalam kajian lepas. Dengan menggunakan spesies burung yang mudah dijumpai dan aktif dalam mengeluarkan panggilan di Malaysia, iaitu Murai Kampung (*Copsychus saularis*), kajian ini bertujuan untuk menerangkan panggilan kewilayahan Murai Kampung, membandingkan panggilan burung berdasarkan kepada bunyi antropogenik di kawasan bandar, pinggir bandar dan luar bandar di Semenanjung Malaysia, dan untuk menentukan faktor persekitaran bandar terhadap nyanyian burung tersebut. Kajian ini dijalankan di Kuala Lumpur, Putrajaya, Serdang, Negeri Sembilan antara bulan Januari dan Jun 2017. Panggilan kewilayahan telah direkodkan dan dianalisis dengan menggunakan spektrogram. Parameter termasuk frekuensi rendah, frekuensi tinggi, julat kekerapan, panjang *strophe*, bilangan elemen setiap *strophe*, dan jarak masa antara *strophe* digunakan untuk menganalisis panggilan Murai Kampung. Di kawasan bandar, frekuensi rendah panggilan telah didapati meningkat secara ketara berbanding dengan kawasan pinggir dan luar bandar. Perbezaan faktor persekitaran bandar seperti bunyi, suhu dan kelembapan juga membawa kesan utama dan kesan interaksi terhadap parameter panggilan Murai Kampung, iaitu kekerapan nyanyian, panjang *strophe*, selang masa antara *strophe* dan bilangan elemen setiap *strophe*. Hasil ini menunjukkan bahawa Murai Kampung di kawasan yang terlibat telah menyesuaikan diri dengan pelbagai keadaan habitat dengan mengawal dan mengubah frekuensi panggilan. Murai Kampung mempunyai keupayaan untuk mengubah panggilan mereka mengikut keadaan habitat tertentu. Pengubahan dan penyesuaian vokal ini adalah penting dalam memastikan penghantaran mesej melalui nyanyian secara berkesan dalam pelbagai keadaan habitat. Kajian ini juga menunjukkan bahawa Murai Kampung berkemungkinan memiliki '*opportunistic-switch plasticity*' dan ini dapat menjelaskan sebab mengapa sesetengah spesies burung adalah kurang dipengaruhi oleh kesan perbandaran.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirements for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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INTRODUCTION

1.1 Background study

Throughout the world, urbanisation involves important economic and social transformation which result in a greater geographic mobility (e.g. human migration), higher population growth, longer life expectancy and population ageing (United Nation, 2017). The world's population has reached nearly 7.6 billion in mid-2017 (United Nation, 2017). United Nations Conference on Trade and Development (UNCTAD) also stated that America has the highest rate of urbanisation (80%) compared to other developing region, followed by Asia and Oceania (48%) and Africa (40%) (UNCTAD, 2017).

In Southeast Asia, Malaysia is one of the countries that has undergone rapid urbanisation over the last half of a century. In 2010, Kuala Lumpur and Putrajaya have successfully in achieving 100% urban population by means of having all their residents living in urban areas, followed by Selangor (91.4%) and Penang (90.6 %) (Hasan and Nair, 2014).

In many parts of the world, changes in vegetation structure has reduced the diversity and abundance of terrestrial animals (McKinney, 2006; Faeth *et al.*, 2011) promoting biotic homogenisation (i.e. process of increase in genetic, taxonomic and functional similarity). As the abundance of native species decreases, non-native species have been recruited (Shochat *et al.*, 2010a). This happens when urbanisation alters the natural selection regime that places native species at competitive disadvantage as well as by reducing their natural enemies (McKinney, 2006). McKinney (2006) also emphasized that non-native species is capable to survive in urban environment and they can become dominant and aggressive than native species. This could lead to extinction of the native species (Shochat *et al.*, 2010b).

Besides reducing diversity and abundance of terrestrial animals, urban environmental condition also affects birds' reproductive rate (Halfwerk *et al.*, 2011b) and vocalisation structure (Lowry *et al.*, 2012; Goodwin and Podos, 2013; Luther *et al.*, 2015). Previous studies have shown that environment does cause birds to regulate their vocalisation structure and frequency to avoid masking by anthropogenic noise (Spotless Starling (*Sturnus unicolor*), and House Sparrow (*Passer domesticus*), Arroyo-Solis *et al.*, 2013 and Common Blackbird (*Turdus merula*), Nemeth *et al*., 2013) and reproductive rate (Halfwerk *et al*. 2011b).

Changes in behaviour produced by particular genotype due to environmental factors are known as phenotypic plasticity (Thibert-Plante and Hendry, 2011). It is one of adaptation abilities used by animals to live in certain environment. Not all animals can live in various types of environment. The Oriental Magpie Robin (*Copyschus saularis*) is a bird species that can be found in many open and semi-open habitats (Davison and Yeap, 2010) including urban, suburban and rural areas. It may have adaptation ability to survive in various habitats. Different from other urban birds, Oriental Magpie Robin has various types of song structure. As urbanisation in Malaysia arises, urban environmental factors such as anthropogenic noise may also cause Oriental Magpie Robin to alter their song as a form of adaptation.

Thus, there is a need to assess the effect of environmental factors on Oriental Magpie Robin's vocalisation as this type of study is still lacking in Malaysia. Bird survey via vocalisation is relatively less invasive than traditional survey methods (i.e. capture and mark, and the use of radio-transmitter) as the latter might cause stress to subject. In addition, survey method by vocalisation can also be used to determine changes in bird behaviour, if any.

This study was carried with the hypothesis to test whether (i) territorial song of the Oriental Magpie Robin is different among different individuals, (ii) frequency of the bird's song changes along with rural-urban gradient, and (iii) environmental factors such as light, temperature, humidity, noise and, distance to road and building affect the bird's vocalisation.

1.2 Objectives

The main objective of the study was to examine the vocalisation of Oriental Magpie Robin in response to environmental factors in Peninsular Malaysia. The specific objectives of this study were;

1) To describe the territorial songs of the Oriental Magpie Robin,
2) To compare the bird's vocalisation in relation to anthropogenic noise present in the urban, suburban and rural areas in Peninsular Malaysia, and
3) To assess the effects of environmental factors (e.g. light, temperature, humidity, noise and, distance to road and building) on the bird's vocalisation.

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