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# SPECIATION OF THE GENUS SCYTALOPUS (FAM. RHINOCRYPTIDAE: AVES, PASSERIFORMES) BY THEIR MELODIC DIALECTS ACCORDING TO THEIR UMWELT

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**Abstract:** Vocalisation and evolutionary studies were carried out in three related species of *Scytalopus* in Chile that have likely experienced adaptive modification. These 'teleonomic' changes were a result of external influences, but they reflect an inherent programme as a result of phylogenetic evolution. Each environmental change, referred to as an open programme, is evident in the genome of the species.It is therefore likely that the different harmonics and dialects of species of the genus *Scytalopus* have been incorporated as a behavioural pattern in a process of continuous adaptation, which is part of an intimate relationship with the respective changes in their umwelten. In addition, a continuous natural drift adapts and modifies phenotypic aspects in relation to the circumstances and modifications of the species' umwelten. Therefore, the speciation of the genus *Scytalopus* is related to the modifications of its melodic dialects as a function of its umwelt.
**Keywords:** *S. magellanicus*, *S.fuscus*, *S. antarcticum*, Rhynocriptidae, Vocalisations, Melodic dialects, Umwelt,Chile.

Many authors who have studied the genus *Scytalopus* note that the species are enigmatic and cryptic (Krabbe *et al*., 2003). In Chile,studies have been carried out on vocalizations and the evolutionary ecology of three species of *Scytalopus*. In *S. fuscus,* the call frequency is 2.27 KHz (Riveros *et al*., 1994). In

*S. magellanicus* (Fig 1b), the call tone intensity is -70 dB (Correa, 2024) with an overtone of 4.1 KHz. In the recently described new species *S. antarcticum* from Isla Navarino, Chile (Fig. 1c) (Correa, 2024), the call vocalisation has an intensity of -45 dB with an overtone of 4.7 KHz, which is higher than that of *S. magellanicus* and *S. fuscus*. This implies the presence of an adaptive modification (Lorenz, 1978) and that individuals of this genus have evolved in parallel with their habitat through adaptation to certain expected variability of the specific habitat.

These teleonomic changes (Monod, 1970) provoked by external influences reflect a built-in programme referred to as "open programme theory"(Mayr, 1942), which is likely present in the genome of each of these species. Thus the different harmonics and melodic dialects of the vocalisations of *Scytalopus* species are incorporated as behavioural patterns along a continuum, enhanced by natural drift (Maturana *et al*., 2000) in relation to changes in their umwelten (Uexküll *et al*., 1934). These changes have caused the genome of *Scytalopus* spp. to incorporate some modifications in the archetype of their vocalisations, which differ from the original melodic dialects, thus achieving a concordance with the environment in which the species interacts on a daily basis. Therefore, the behaviour of *Scytalopus* spp. has created an historical development in the form of a modification of melodies within various specific dialects.

In general, birds of the order Passeriformes have remarkable behavioural plasticity (Rehkämper*et al.,* 1991) for interacting with different umwelten (Correa *et al*., 2003). The author has recorded them in various habitat types that are teleonomically favourable, i.e., they are '*weltoffenheit*' (open to the world) (Lorenz, 1978). Generally, the species of this family display behaviours demonstrating a well-developed curiosity. Thus, when occupying a new habitat, these birds have the behavioural capacity to modify their vocalisations into various melodic dialects, as seen in the species *S. antarcticum* (Correa, 2024). However, *S. fuscus*, the other species found in Chile, would be forced to modify its melodic behaviour in dialects with variations in the vocal tones when interacting in relatively open habitats, such as the Andean habitat and Mediterranean sclerophyllous shrubs areas, and open scrub habitats with low cover in the central zone of the Chilean Mediterranean sclerophyllous forest. On the other hand, The author has observed on several occasions the

plumage phenotype of *S. fuscus* adult males with dark grey plumage and a white spot on the forehead (Fig. 1a) larger than that of*S. magellanicus* (personal observation), and similar to the plumage phenotype of males of the Andean species *S. atratus* distributed through Peru, Colombia, Ecuador, and Venezuela. Specimens of *S. fuscus* are similar to the data recorded (Goodall *et al*., 1945) in fragmented Mediterranean sclerophyllous forests in central Chile (Correa *et al*., 2020), where again we are faced with another phenotypic modification in congruence with its ontogenetic niche (Fig. 2, Fig. 3) (Correa *et al*., 2017). However, sympatry studies of these *Scytalopus* species in relatively small and fragmented areas reveal that these species are closely linked geographically and in close interaction with each other (Correa *et al*., 2020).

According to diet studies (Correa, *et al*. 1990; Rozzi *et al*., 1996; Krabbe *et al*., 2003), *S. magellanicus* has an omnivorous and opportunistic diet, i.e.,it is a non-selective species in terms of food, which is reflected in a greater congruence with its environment or umwelt. On the other hand, I have observed

*S. magellanicus* individuals both isolated and in congruence with their ontogenic niche, in habitats related to natural catastrophes (such as the Valdivia earthquake of 1960),as well as in fragments of unflooded land, and moving away from fragmented and flooded forest comprised of woody tree species, e.g., of the *Myrtaceae* family. *Myrtaceae* thrive along with other water resistant species in Misquihué, near the Maullín river (unpublished field notes), but when the fragments are flooded, these species become locally extinct along with the destruction of their umwelt. However, I have also observed individuals of *S. magellanicus* in fragmented forests, depredated by anthropogenic activities, both in open habitats in Chiloé Insular and in forests depredated by exotic species in Puerto Williams, Cape Horn e.g., *S. antarcticum* and *S. magellanicus* nesting and in congruence with their umwelten (Correa, 2023). Therefore, not being in congruence with their umwelt, extinction is probable. In addition, the individual's environmental needs and the stress conditions triggered through its behaviour, can cause a modification in the genome of the *Scytalopus* spp., modifying their songs in different melodic dialects in harmony with their umwelt. Taxonomists would later classify them as different species (Krabbe *et al.*, 2003). Consequently, behaviour is a driving force that regulates and modifies the genome, generating new species with melodies composed of different dialects (Diaz *et al.,* 2018; Correa, 2021).

As a result of these observations and studies, the diversity of calls in *Scytalopus* species that are due to changes in their umwelt, provide individuals with the ability to modify their behaviour and subsequently trigger melodic variations through their songs. These variations are part of the learning process in the continuum of life these and other Passeriformes including *Turdus falklandii* (unpublished manuscript).

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a) Dusky Tapaculo (male) in *Quila sp*.
Illustration: F. Klaussen R.

b) Magellanic Tapaculo (male)
Photo: Michel Gutierrez

c) *S. antarcticum* (male)
Photo: Alejandro Correa

**Figure 1 (a,b,c)**. Species of *Scytalopus* genus in Chile:

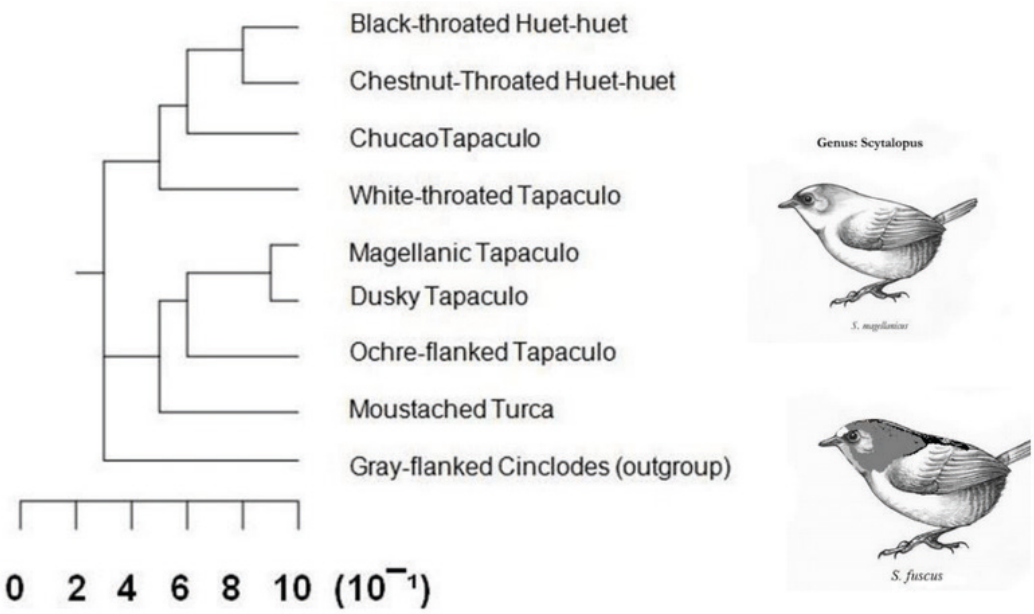


**Figure 2.** Phylogenetic tree (Russel & Rao index) of the species of Rhinocryptidae and the genus *Scytalopus*: *S. magellanicus* (Magellanic Tapaculo) and *S. fuscus* (Dusky Tapaculo) observed in Chile (*S. antarcticum* was not included as it was not yet known), based on behaviours, ecological characteristics, and plumage phenotype with the sister lineage of the order Passeriformes (*Cinclodes oustaleti*) (Source: Correa *et al.* 2017). The tree shows that when the behavioural variable is included, *Scytalopus* species are more similar.

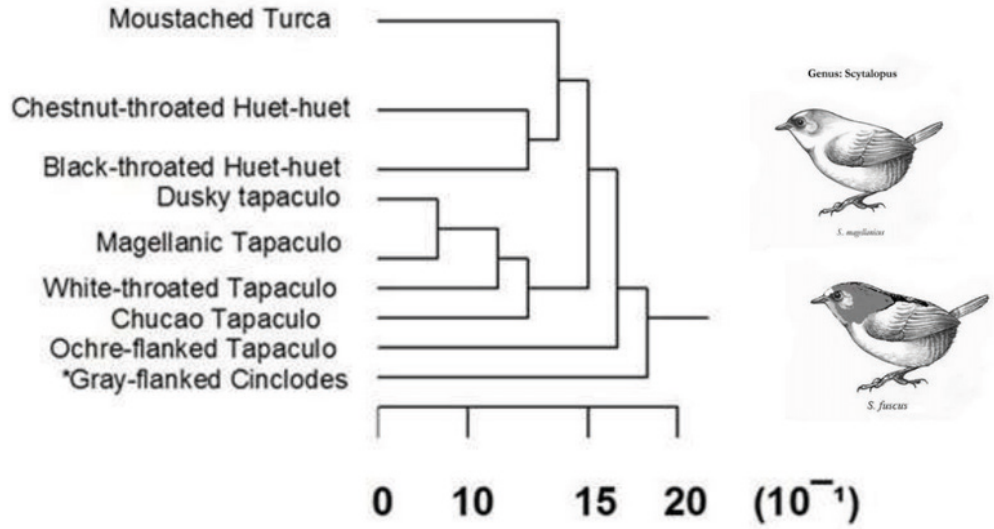


**Figure 3.** Phylogenetic tree (cluster analysis, normalised metric distance out of 100) of rhinocryptid species (*S. antarcticum* was not included as it was not yet known) based on: behaviour, ecological niches, plumage morphology with the 'outgroup' (*Cinclodes oustaleti*), a sister lineage (Source: Correa *et al.*, 2017). In this figure, without the behavioural variable *Scytalopus* species differ in some phenotypic traits.