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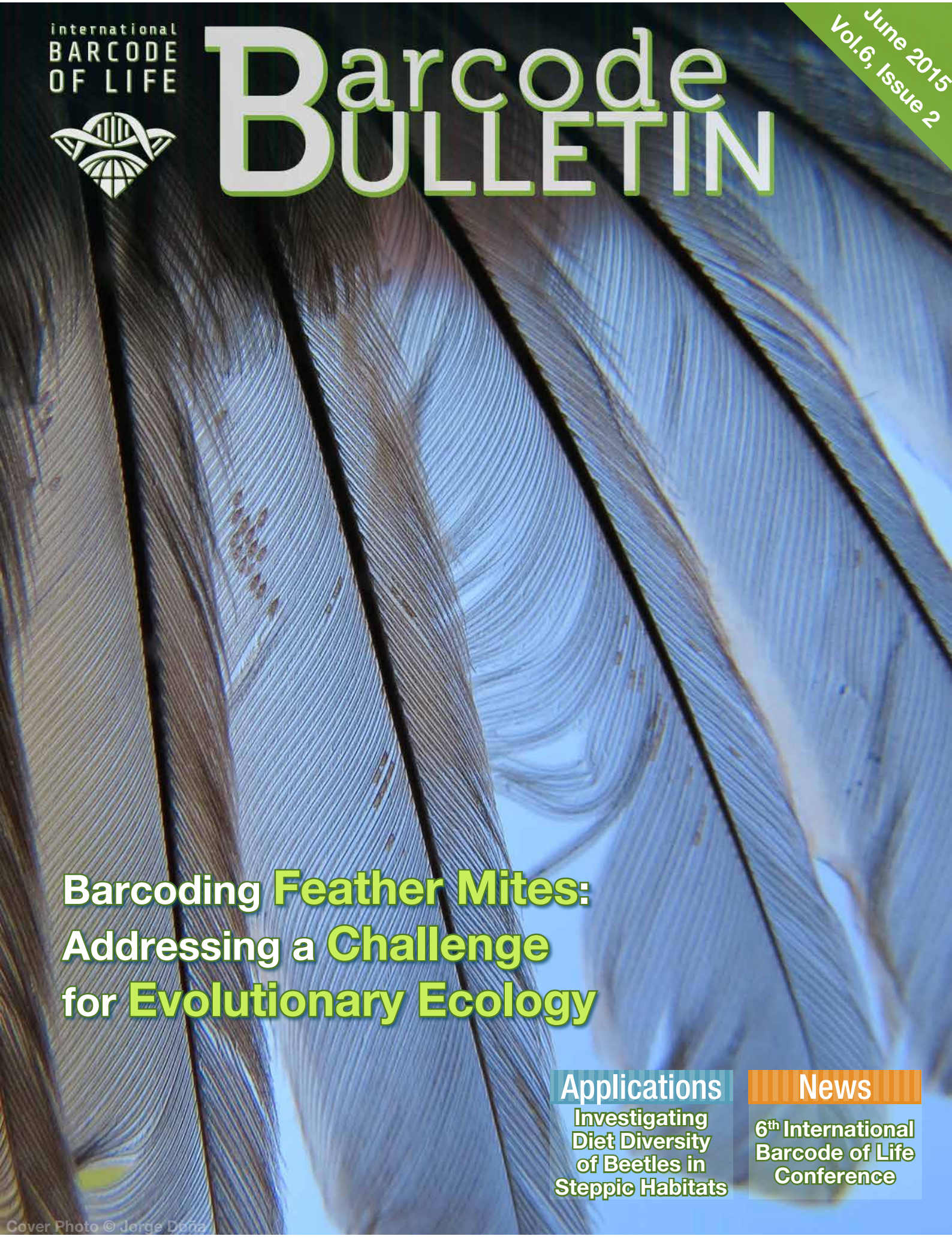

Barcoding Feather Mites: Addressing a Challenge for Evolutionary Ecology

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6th International Barcode of Life Conference

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SEM of a pair of feather mites in copula (Pterolichidae).

Photo © Dave Walter (University of Alberta)

Barcoding Feather Mites

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Feather mites are among the most abundant ectosymbionts associated with birds. They live permanently on birds and are transmitted among them mainly by direct bird-to-bird body contact (e.g. from parents to offspring in the nest).

Within feather mites some families belonging to Analgoidea are inhabitants of the skin and nasal cavities of their avian hosts. These mites seem to be true parasites of birds. However, most feather mites are highly specialized dwellers of different microhabitats of the plumage where they cause no visible damage to their hosts. In fact, a few recent studies even suggest that these feather mites may be commensals or even mutualists of birds, cleaning feathers from bacteria and fungi that otherwise compromise feather structure.

How feather mites interact with birds is an open challenge for evolutionary ecology.

On the other hand, it is shown that some species, being typical inhabitants of the downy feathers, can cause heavy bursts of mange when hosts are in unnatural or unfavorable conditions. This briefly exemplifies how little we know about even basic aspects of feather mite biology and about the interaction between feather mites and birds.

About 2600 species of feather mites have been described in the world and many more species have yet to be discovered. Understanding the evolutionary formation and maintenance of this vast biodiversity and how these mites interact with birds are open challenges for evolutionary ecology.

"...DNA barcoding represents a leap forward that will surely stimulate and facilitate future ecological and evolutionary studies of these fascinating mites."

A first step towards understanding the evolutionary ecology of this group is describing the network of interactions between birds and feather mite species. However, the species-level identification of feather mites is a not simple task. This is because females of some taxa and immature stages of many species are often indistinguishable by means of light microscopy. Males generally provide the best identification cues but even they require a high level of taxonomic expertise for accurate species identification.

In a recent study, we provided the largest library of DNA barcodes currently available for feather mites associated with the most abundant European passerine species and we tested the accuracy of the method. Moreover, using these tiny mites we explored other issues around barcoding relevant to their extended usability and confidence in addressing issues of molecular systematics. Through computational simulations, we also calculated the effect of sampling effort (measured as number of species and species composition) on threshold calculations. This approach provides increased confidence in calculations of thresholds, dissipating doubts about optimal library size for a particular taxonomic group. In addition, we discovered a 200-bp minibarcode region that provides the same accuracy as the full-length barcode (602 bp).

The accuracy of mite species identification was perfect but decreased when singletons (species represented by only one individual) or species of the taxonomically conflictive *Proctophyllodes pinnatus* group were included. In fact, using barcodes we confirmed previous taxonomic issues within the *P. pinnatus* group. Overall, the integrative taxonomy approach we applied made it possible to discover three new putative cryptic species as well as validate three others which were suspected to be new to science on the basis of morphological characteristics.

There is still much to be discovered about the biology of feather mites, and certainly DNA barcoding represents a leap forward that will surely stimulate and facilitate future ecological and evolutionary studies of these fascinating mites.

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SEM of a male *Trouessartia bifurcata* (Astigmata:Trouessartiidae), collected from an Eurasian blackcap (Sylviidae: *Sylvia atricapilla*).

Image credit: Heather Proctor (University of Alberta)