

## Supplementary Information

### Molecular and morphological evidences place the extinct New Zealand endemic *Turnagra capensis* in the Oriolidae

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#### Re-evaluation of Christidis et al.'s results

##### The U51734 *Turnagra* sequence

We compared our *Turnagra* cytochrome *b* sequence with that obtained by Christidis et al. (1996a, Genbank accession number U51734). The two sequences differ in 108 positions in the shared portion (15.1 %, length 716 bp). Both sequences align well with other cytochrome *b* sequences, both are coding and lack indels. Using the BLAST search function both sequences appear to be unique and distinct from any other passerine sequence present in Genbank. When compared with other Oriolidae sequences, our *Turnagra* sequence has an average p-distance of 13.5 % only, while Christidis et al. sequence is more divergent (16.2 %). Our cytochrome *b* sequence was re-sequenced producing identical results and its similarity to those of the Oriolidae is congruent with the results obtained from other genes. Therefore we are confident that our sequence is correct.

We believe that Christidis et al.'s sequence does not represent a correct *Turnagra* cytochrome *b*. It is unlikely to be the sequence of another species after a laboratory contamination or a pseudogene. However, a stretch of 134 bp in a region otherwise rather variable of the gene is identical to *Pachycephala pectoralis* (Genbank accession number FJ821134) (Fig. S1). Although more work is needed to understand the real nature of U51734, it might be a chimeric sequence.

##### Phylogenetic relationships

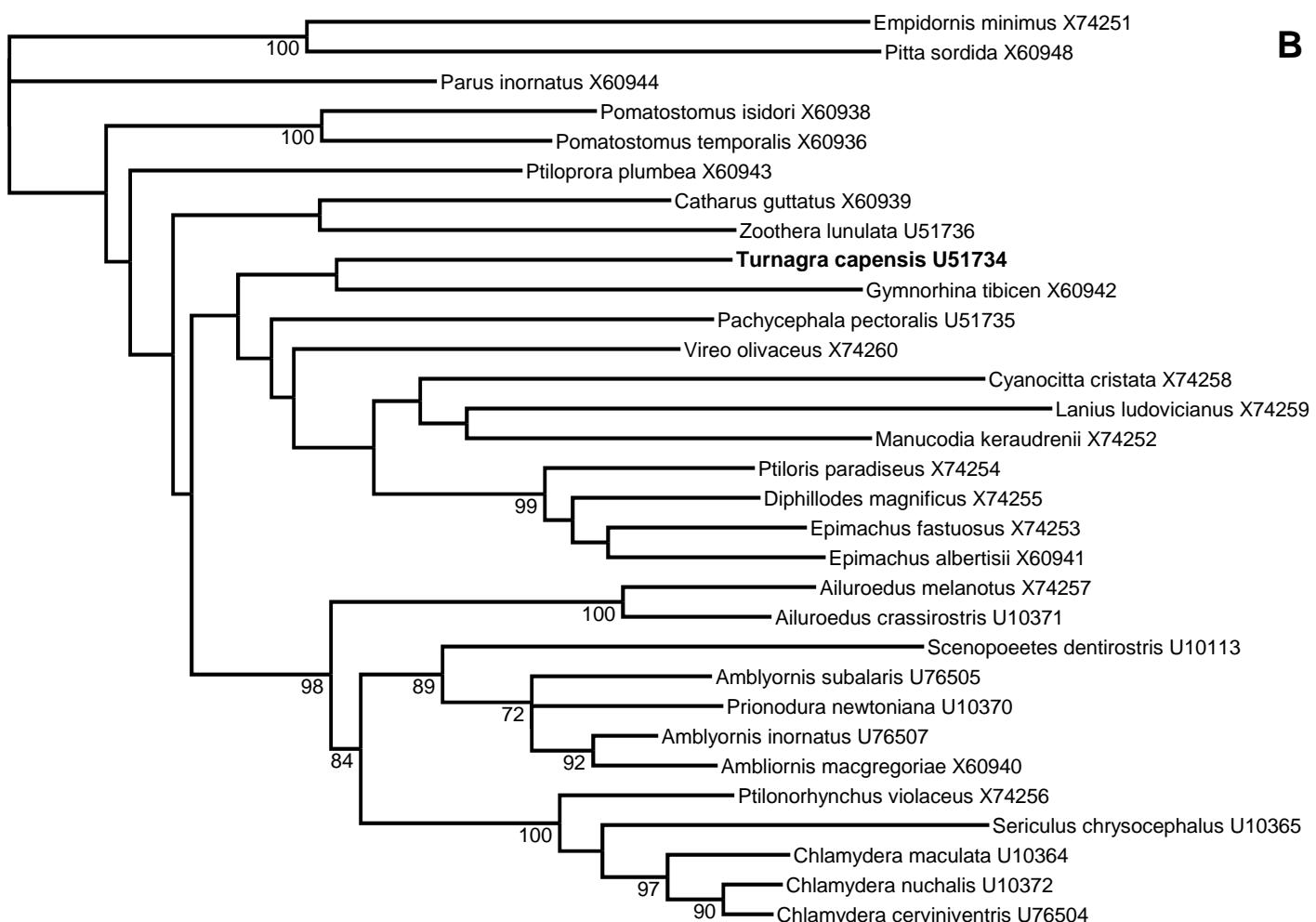
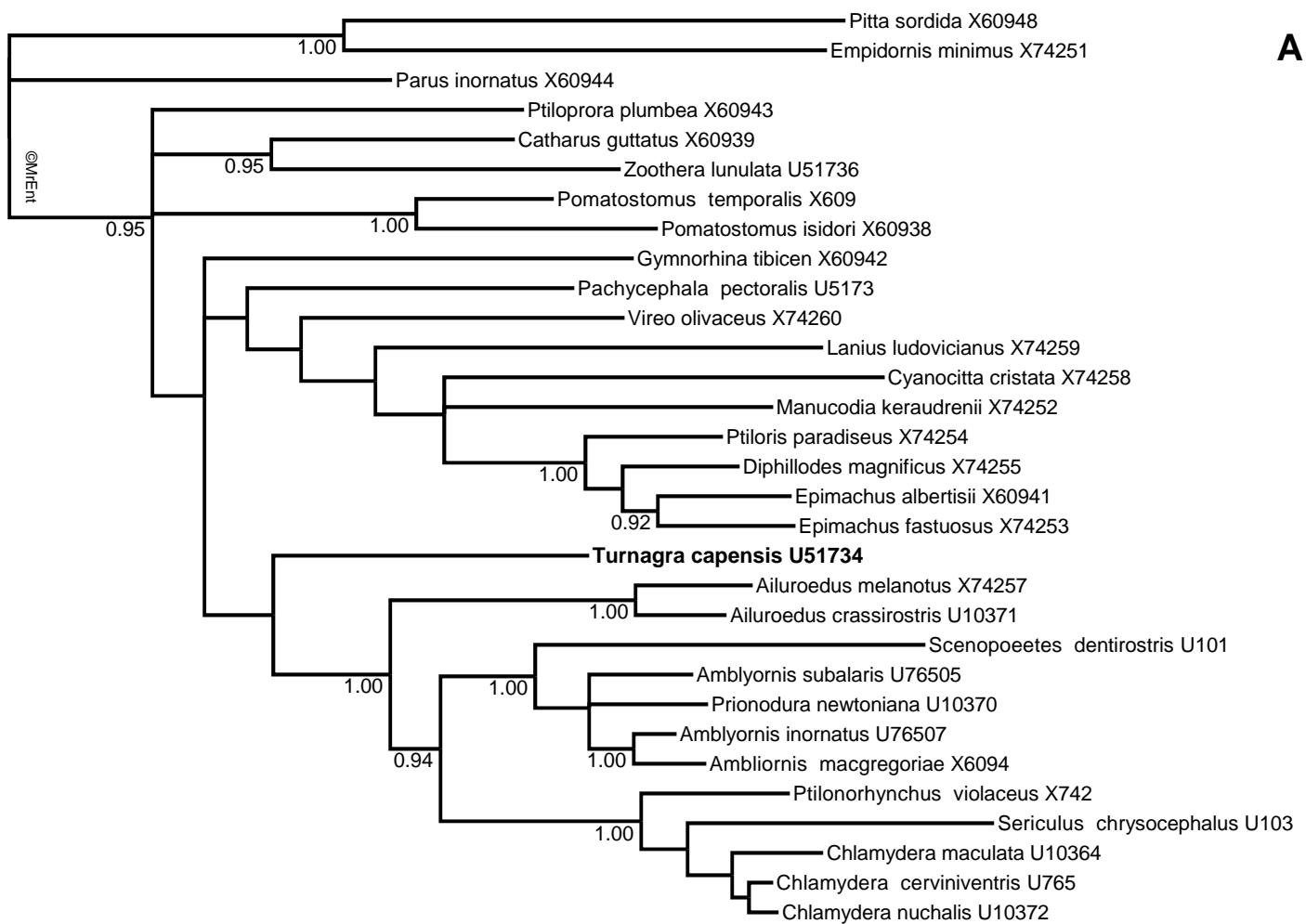
We re-analyzed Christidis et al.'s dataset (1996a) using four criteria: Bayesian inference, maximum likelihood, maximum parsimony and neighbour-joining. Bayesian inference (10 millions generations) and maximum likelihood have been carried out as indicated in the main text. The maximum parsimony analysis was performed using PAUP\*, with heuristic searches, the tree-bisection and reconnection branch-swapping algorithm and with 1000 random additions of taxa. The neighbour-joining tree was reconstructed using PAUP\*, with GTR+I+Γ corrected distances. The branch supports were evaluated using 1000 bootstrap replicates for both methods.

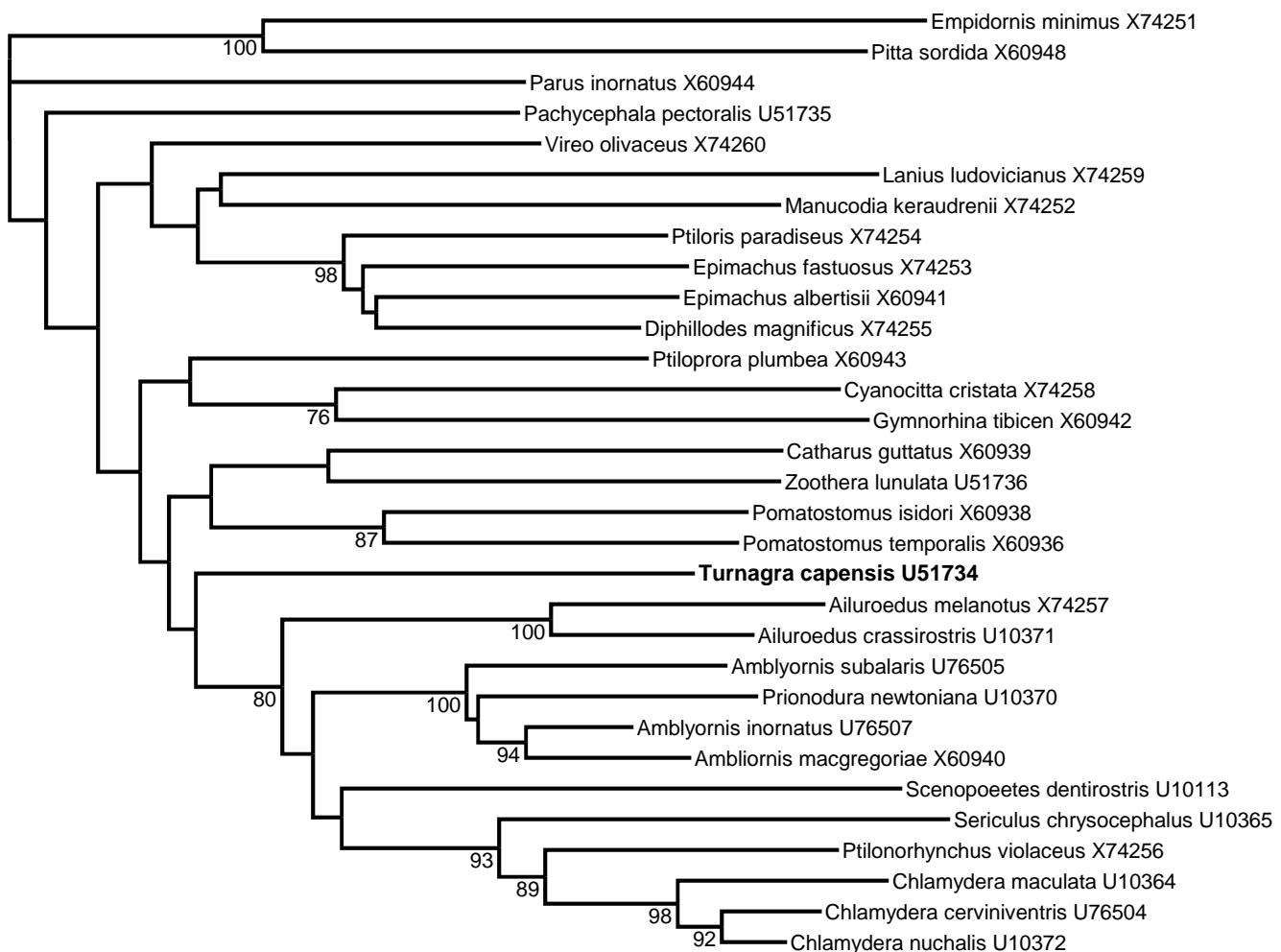
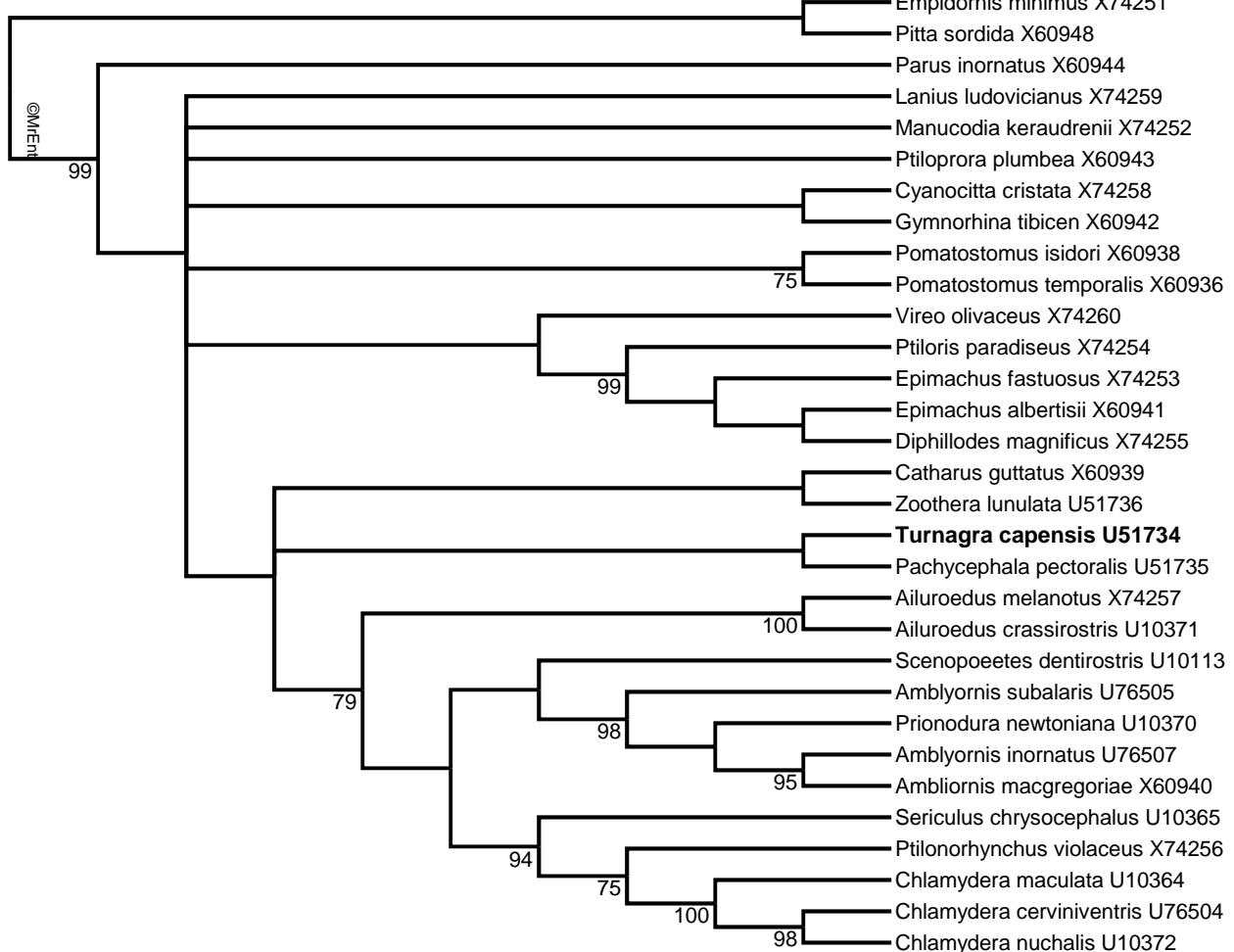
Beside the problem represented by the sequence itself, the dataset used by Christidis et al. (1996a) does not support a close relationships between *Turnagra* U51734 and the Ptilonorhynchidae. Such association is recovered only in the Bayesian and neighbour-joining trees. In the maximum likelihood topology *Turnagra* is sister to *Gymnorhina tibicen* while in the maximum parsimony tree it forms a clade with *Pachycephala pectoralis* (Fig. S2). In all cases the placement of *Turnagra* does not receive any statistical support.

**Figure S1.** Alignments of *Turnagra* U51734 cytochrome *b* sequence with a selection of published *Pachycephala* species. The highly similar region shared by *Turnagra* and *Pachycephala pectoralis* FJ821134 is highlight in grey.

U51734_Turnagra_capensis FJ821134_Pachycephala_pectoralis EF592236_Pachycephala_schlegelii FJ821133_Pachycephala_olivacea EF592238_Pachycephala_simplex EF592239_Pachycephala_soror	10      20      30      40      50      60      70      80      90      100      110      120      130      140 <pre> TTGGATCCCTCTAGGCATCTGCCAGCTGTGACCCAAATCATCACAGGCCACTACTAGCCACACATTATACAGCAGACACCAACCTAGGCCCTCTACTCAGTAGCCATACATGCCGAAACGTACAATTGGATGACTAAT .....C.....T.....A.....T.....A.....G.....C.....T.....C.....G.....TCA.....T.....GC.....C.....T.....C.....C.....C .....C.....T.....A.....T.....A.....G.....C.....T.....C.....T.....C.....TCA.....T.....TACCT.....T.....TC.....C.....C .....C.....T.....C.....C.....T.....TTC.....T.....GCT.....C.....T.....C.....T.....T.....TC.....C.....C.....C .....T.....T.....C.....C.....G.....T.....A.....C.....T.....C.....C.....T.....TTCA.....T.....GC.....C.....T.....C .....T.....T.....C.....A.....G.....T.....A.....C.....T.....C.....C.....T.....TTC.....T.....GC.....C.....T.....C </pre>
U51734_Turnagra_capensis FJ821134_Pachycephala_pectoralis EF592236_Pachycephala_schlegelii FJ821133_Pachycephala_olivacea EF592238_Pachycephala_simplex EF592239_Pachycephala_soror	150      160      170      180      190      200      210      220      230      240      250      260      270      280 <pre> CCGAAATCTACATGCCAATGGAGCCTCCCTCTTCTCATCTGCATCTATCTTCACATTGGACGAGGAATTTACTATGGCTCCTACCTAAACAAAGAACCTGAAACATTGGAGTTATCCTCCTCCCTACCCCTTATAGCTA .....CT.....C.....A.....C.....A.....T.....C.....A.....C.....C.....T.....C.....C.....A.....T.....G.....C.....C.....T.....T.A.....T.A.....A .....C.....C.....A.....C.....A.....A.....T.....C.....A.....C.....C.....C.....A.....T.....G.....C.....C.....T.....T.A.....A.....A .....C.....C.....A.....C.....A.....T.....C.....C.....C.....C.....C.....A.....T.....T.....T.....T.A.....T.....A.....A .....CT.....C.....A.....C.....A.....A.....C.....C.....C.....C.....C.....A.....T.....C.....T.....T.AC.....A.....A .....C.....C.....A.....AC.....T.....C.....C.....C.....C.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A </pre>
U51734_Turnagra_capensis FJ821134_Pachycephala_pectoralis EF592236_Pachycephala_schlegelii FJ821133_Pachycephala_olivacea EF592238_Pachycephala_simplex EF592239_Pachycephala_soror	290      300      310      320      330      340      350      360      370      380      390      400      410      420 <pre> CAGTTTTGAGCTATGTCCTCCCTGAGGACAAATATCTTCTGAGGGCTACAGTAATCACCAACCTATTCTCAGCCATCCCCTACATCGGCCAAACCTAGTAGAAATGGGCATGAGGTGGATTCTCAGTAGACAAC .....T.....C.....C.....T.....C.....G.....A.....A.....A.....A.....T.....A.....A.....A.....T.....A.....A.....A.....A.....A .....C.....C.....T.....C.....A.....T.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A .....C.....C.....G.....C.....A.....A.....A.....A.....A.....C.....T.....A.....A.....A.....G.....T.....G.....A.....A.....C.....A.....T .....T.....C.....C.....T.....C.....A.....A.....A.....A.....A.....T.....T.....A.....A.....A.....A.....A.....A.....A.....A.....T .....T.....C.....A.....A.....A.....A.....A.....A.....A.....A.....T.....T.....A.....A.....A.....A.....A.....A.....A.....A.....T </pre>
U51734_Turnagra_capensis FJ821134_Pachycephala_pectoralis EF592236_Pachycephala_schlegelii FJ821133_Pachycephala_olivacea EF592238_Pachycephala_simplex EF592239_Pachycephala_soror	430      440      450      460      470      480      490      500      510      520      530      540      550      560 <pre> CCAACATTAACCGGTTCTTTGCCCTTCACTCCTCTCCGGTTGTAAATCGCAGGCCCTCACCTAGTCCACCTCACCTTCTACATGAAACTGGATCAAACATCCCCTAGGAATCCCATCAGACTGCGCACAAATCCC .....C.....A.....T.....A.....T.....C.....A.....A.....C.....G.....A.....A.....A.....T.....A.....G.....C.....A.....C.....C.....A.....T.....T .....TC.....T.....A.....T.....T.....C.....A.....A.....C.....T.....A.....A.....A.....T.....A.....C.....A.....T.....C.....C.....T.....T .....C.....T.....A.....T.....C.....T.....C.....A.....C.....T.....A.....A.....A.....A.....T.....A.....C.....A.....T.....C.....C.....T.....T .....C.....TC.....T.....A.....C.....A.....T.....C.....A.....C.....A.....A.....A.....A.....A.....C.....A.....C.....T.....G.....C.....C .....TC.....T.....A.....C.....T.....C.....A.....C.....T.....A.....A.....A.....A.....A.....C.....A.....C.....A.....T.....T.....G.....C.....C .....TC.....T.....A.....C.....T.....C.....A.....C.....T.....A.....A.....A.....A.....A.....C.....A.....C.....A.....T.....T.....C.....T.....G.....C .....TC.....T.....A.....C.....T.....C.....A.....C.....T.....A.....A.....A.....A.....A.....C.....A.....C.....A.....T.....T.....C.....T.....G.....C </pre>
U51734_Turnagra_capensis FJ821134_Pachycephala_pectoralis EF592236_Pachycephala_schlegelii FJ821133_Pachycephala_olivacea EF592238_Pachycephala_simplex EF592239_Pachycephala_soror	570      580      590      600      610      620      630      640      650      660      670      680      690      700 <pre> ATTCCACCCATACTACTCTATCAAAGACATCTTGATTCGCACTAATACTTATTCTCACTCACTACTCTCGCCCTGTCCTCGCCAAACCTCTAGGAGACCCAGAAAACTTACCCGGCTAACCCCTTAGCCACACCTC .....T.....C.....T.....C.....T.....C.....T.....C.....A.....T.....A.....T.....A.....TG.....A.....T.....C.....A.....A.....C.....T.....AT.....C .....C.....T.....C.....T.....C.....T.....C.....A.....T.....C.....A.....A.....T.....A.....C.....T.....C.....A.....T.....C.....C.....T.....T .....C.....G.....T.....C.....T.....C.....C.....T.....C.....A.....T.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A .....T.....C.....T.....T.....T.....T.....C.....T.....C.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A .....T.....T.....C.....T.....C.....T.....T.....C.....T.....C.....A.....T.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A </pre>
U51734_Turnagra_capensis FJ821134_Pachycephala_pectoralis EF592236_Pachycephala_schlegelii FJ821133_Pachycephala_olivacea EF592238_Pachycephala_simplex EF592239_Pachycephala_soror	710      720      730      740      750      760      770      780      790      800      810      820      830      840 <pre> CCCATATCAAACAGAATGATACTTCTATTGCCATACGCCATTCTCGATCTATTCTAAACAAACTAGGAGGTGTACTAGGCCCTAGCTGCCCTAGCTCCTAAATCCTATTCTTAATCCCTACTCCACACATCCAAACAG .....T.....T.....T.....C.....G.....T.....T.....C.....G.....T.....T.....T.....T.....T.....T.....T.....T.....T.....T.....T.....T.....T.....T .....A.....A.....C.....T.....C.....T.....C.....C.....C.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A .....A.....A.....C.....T.....C.....T.....C.....C.....C.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A.....A </pre>
U51734_Turnagra_capensis FJ821134_Pachycephala_pectoralis EF592236_Pachycephala_schlegelii FJ821133_Pachycephala_olivacea EF592238_Pachycephala_simplex EF592239_Pachycephala_soror	850      860      870      880      890      900      910      920 <pre> CGGTCAATAACTTTGCCACTATCCCAAATCCTCTTGTGACCTTAGTAGCAAACCTCCTAATCCTAACATGAGTAGGAAGC .....C.....G.....C.....A.....A.....C.....A.....A.....T.....C.....A.....C.....GG.....C.....T.....T.....T.....T .....C.....G.....C.....A.....A.....A.....A.....G.....T.....C.....A.....C.....A.....A.....T.....T.....T.....T.....T </pre>

**Figure S2.** Phylogenetic relationships obtained from the re-analysis of Christidis et al.'s dataset. A: Bayesian inference; B: maximum likelihood; C: maximum parsimony; D: neighbour-joining. The support values are posterior probabilities (in the Bayesian inference, threshold 0.90) or bootstrap (in the other cases, threshold 70%).





**Figure S3.** The majority rule consensus tree obtained from the mixed-model Bayesian analysis of the reduced dataset. The posterior probability values (threshold 0.90) are indicated at the node.



**Table S1.** Primer pairs used for the amplification and sequencing of *Turnagra capensis*. ND3 and GAPDH were amplified using the standard primers, see Methods. [1]: Irestedt et al. 2002; [2]: Allen & Omland 2003 (see the main text for the full references).

cytb-F179	GCATCTACCTACACATYGGCCGAG	cytb-R388	TCTACTGAGAATCCTCCTCAGGCTCA
CbT-F264	ACCCTAATAGCAACTGCCTCGTA	cytb-R493	GATCCTGTTCTGTGGAGGAAGGT
cytb-F463	CTCATCGCAGACCTAACACTAGTCCA	cytb-R655	TTGGCTGGTGTGAAYTTTCTGGGTC
cytb-F622	ACYCTAGCMCTATTYTCCCCAA	cytb-R782	AGGACTAGGACGGAGGCAGGCTA
CbT-F733	ACGCCATCCTCGATCCATCCCCAA	OscH1	AATGGGTGTTCTACTGGTGGCT
ND2-ExtF	AGCTATCGGGCCCATAACCCGAA	ND2-R328	AGAAATCAGAAGTGGAAATGG
ND2f-F241	ACCGGRCAATRGAYATYACYCA	ND2f-R586	TGAGGAGGGTGAGTTAGGGTTGTA
ND2f-F540	CTTCTCCTCYATYTCNCACYTRGG	ND2-R811	CWRCTGGRGCTATBTCYTGTTAGT
ND2-F772	AACAGGATTCTMCCAAARTGACTCAT	ND2-ExtR	TTGAAGGCCCTTCGGTTAGGTGA
IRBP-F200	ACAAGCTGGAGGGCAATGTTGGCTA	IRBP-R460	CCCAACACCTTGGCAGTGTCCA
IRBP-F427	TACAATCGKCCCTCCAACACACCACCA	IRBP-R665	CTCACAGATCGTGACACAGGAACCA
IRBP-F807	GCCTGGCACCMTWAGCCRCTCA	IRBP-R2	AAGACAGTATCCACCAAAGGCATGCAGCA
ZENK2-ExtF	ACGACGCRCTGCCACCGATA	ZENK2-R256	AGGACTGGGCTGNGATTCAAGGRRAA
ZENK2-F220	GCTGCACCAACRTTCCCAATTCCA	ZENK2-R491	TCTTGGGAGCCAGTCTGNNTAGCAA
ZENK2-F442	ACCAGAGCACAGCAGCCTCCCTCA	ZENK2-R709	GCATGCAAATGCGGCACTGGAA
ZENK2-F678	GCACATThCGCATCCACACGGGACA	ZENK2-R949	GGTGGCGATGGAGGAAGGGTAGGA
ZENK2-F905	CAACTGCTTCCCAATTCTGCCTA	ZENK2-ExtR	TCTGAAAGTGTGAGGTACCTGTGA
Myo2 [1]	GCCACCAAGCACAAGATCCC	Myo-R206	GGATATTACACATACCAATTGCATA
Myo-F146	GTGTACAAGCAGKAGGAGGCACAG	Myo-R359	GCTTAATCTAAAATTGTATGTCCCTT
Myo-F250	CAGCYYATGCATGCCTGGAAACTG	Myo3-R481	TGATCTGCTTATGACCTT
Myo-F431	GCAGTCTTAATGGATGAGGCAGACA	Myo-R589	TCCGAGGTAATTCAAGGTCTTGCTGAA
Myo-F547	CAGACTCCTTGACATACTAGACCTCA	Myo3F [1]	AAGTCATTATCAAGGTCTTGCTGAA
OD6 [2]	GACTCCAAAGCAGTTGTCGTCTCAGTGT	ODC-R255	TGTACATCCACTTCAACGTGGAA
ODC-F202	ACTAATTTGCCAAATAGCAAGTGATA	ODC-R320	ACACTTCATTCAAGGTCTTGCCACAAC
ODC-F296	CCGCTGTGTTCGATATGGGAGTA	ODC-R506	ATTGAGCTRCARTTTAGTGCAT
ODC-F469	AGCTTACTTTGACCAGCTTGGCAA	OD8R [2]	ATTGGTGGTGGCTCCCTGGCTCTGAAGA
PEPCK-ExtF	CATGAGATCTGAAGCAACAGCAGCT	PEPCK-intR	AACTCCCTGTCAAGGCTCTGGCA
PEPCK-intF	ATCCCTTAGGTGGCAAGCATACAGA	PEPCK-R452	GAAACAATACARGCATTATCCTTGA
PEPCK-F379	CATTTAAGCTGTTGACCTGAGAT	PEPCK-ExtR2	AGTTGTAGCCAAGAAAGGCCTCA