suggesting differences in life history adaptations of sympatric species, and highlighting the within-
location variability in environmental conditions in equatorial tropics that may influence differences
in disease risk and hence immune responses. Red-capped Larks had elevated nitric oxide during
breeding (chick-feeding) which coincided with periods of higher Tmax, which raises the possibility
that high Tmax provided conducive environment for growth, development and reproduction of
microorganisms and parasites. Additionally, different immune indices of conspecifics differed
inconsistently among locations with different climates and regardless of breeding phase. Nitric
oxide, agglutination and haptoglobin were associated with higher Tmax and were more robust under
warmer conditions, while lysis was associated with rainy conditions and was enhanced in the low
temperature environment. We interpreted this to be an indication that different immune indices
were differently influenced by environmental conditions.

This thesis places variation in environmental conditions – food availability, rainfall, Tmin and
Tmax – as the central elements around which reproduction, nestling growth and immune function
varies. Although Chapter 2 did not reveal evidence of nesting activities being related to any of
the biotic and abiotic environmental factors in the three environments, we found that nestlings in
chapter 3 had higher body mass at hatching, suggesting conditions for breeding for females were
favorable during this periods, and grew better during periods with more rain. We conclude that for
these larks, breeding is not triggered by any particular biotic or abiotic factor (that we measured)
but that breeding success (i.e., reaching chick feeding or even fledging) is. Whether or not a
breeding attempt is successful is partly determined by a combination of environmental conditions.

This thesis also supports the proposition that equatorial tropical birds, exhibiting a slow pace-of-
life strategy, optimize survival (investment in immune function) over reproduction (small clutch
sizes). Further, our findings contradict the generalized temperate and arctic zone bias concept of
reproduction-induced immunosuppression and justifies why more of such research should be
conducted in the tropics. Future further studies should, 1) investigate and compare factors that
influence the timing of breeding in these two lark species by narrowing the scale of investigation
to the territory level, and by including female body condition, nest-predation pressure and social
factors as possible candidates, 2) investigate whether up-regulation of nitric oxide during breeding
was as a result of breeding activities or of changes in temperature (Tmin and/or Tmax), 3) investigate
how among-and-within-location dynamics of environmental variation influence variation in
pathogen and parasite pressure in these environments and their potential influence on the variation
in immune function, and 4) to test whether equatorial tropical birds optimize survival over
reproduction, a future study should aim to experimentally vary the reproductive workload (e.g.,
increased clutch size) of one of the two sympatric species (Red-capped or Rufous-napped Larks)
and compare the resulting investment in immune function of both.

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