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The purpose of this work is to investigate the spectrum and fine spectrum of triangular band matrices where the bands are taken as convergent sequences. This kind of matrices can be expressed as a sum of a triangular Toeplitz operator and a compact operator. Our method employs some results of linear difference equations and compact perturbation theory. In this context, a result regarding the location of the roots of a polynomial with respect to the unit circle is derived which is useful to identify the point spectrum of the operator. As a consequence of our result, a class of compact operator is also obtained such that, not only the spectrum but also the fine spectrum of a triangular Toeplitz operator remains invariant under the perturbation given from this class. (Received July 24, 2017)