On the equation $1^k + 2^k + \ldots + x^k = y^n$ for fixed x

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(joint work with A. Bérczes, L. Hajdu and T. Miyazaki)

We provide all solutions of the title equation in positive integers x,k,y,n with $1 \leq x < 25$ and $n \geq 3$. For these values of the parameters, our result gives an affirmative answer to a related, classical conjecture of Schäffer. In our proofs we combine several tools: Baker's method (in particular, sharp bounds for the linear combinations of logarithms of two algebraic numbers), polynomial-exponential congruences and computational methods.