For a given elliptic cusp form $f$, we have a 2-dimensional $p$-adic Galois representation $r$ with coefficients in a $p$-adic integer ring. Having $r$ act on $SL(2)$-Lie algebra by adjoint (conjugate action), we get a 3-dimensional representation $Ad$. We describe the formula of the order of the $p$-adic arithmetic cohomology group $Sel(Ad)$ (called the adjoint Selmer group) via the L-value $L(1, Ad)$ and explore the question when the Selmer group is cyclic (having one generator) over the coefficient ring? (Received January 04, 2019)