Implications of the index of a fixed point subgroups

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Let G be a finite group and A be a subgroup of the automorphism group $Aut(G)$ of G. In this work, we studied the influence of the index of fixed point subgroup of A in G on the structure of G.

When A is cyclic, we proved the following:

(1) $[G, A]$ is solvable if this index is squarefree and the orders of G and A are coprime.

(2) G is solvable if the index of the centralizer of each x in $H - G$ is squarefree where H denotes the semidirect product of G by A.