In this thesis we study exact general relativistic space-times generated by a black hole and an additional source of gravity, while restricting to two classes of static and axially symmetric solutions: the Majumdar—Papapetrou solution for a couple (in general, a multiple system) of extremally charged black holes and the „superposition" of a Schwarzschild black hole with the Bach—Weyl thin ring. We follow the effect of the additional source on the geometry of black-hole space-time on the behaviour of important invariants, in particular of the simplest scalars obtained from the Riemann and possibly also Ricci tensor. We have plotted the invariants both outside and inside the black hole; in the case of a Schwarzschild black hole with ring, we found, to this end, an extension of the metric below the horizon. It turns out that the external source may affect the geometry inside the black hole considerably, even in the vicinity of singularity, although the singularity itself remains point-like in both solutions studied here.