Plants have some defense systems for many environmental stresses such as infection by pathogens, UV irradiation and exposure to heavy metals. The production of phytoalexins that induce growth inhibition of microorganisms and plants is one of the defense systems in plants. In rice, production of many types of phytoalexins is induced when the rice leaves and suspension-cultured cells are exposed to UV irradiation and treated with heavy metals, respectively. Momolactones are well known as rice diterpenoid phytoalexins and biosynthesized from GGDP via syn-copalyl diphosphete and 9βH-pimara-7,15-diene. Recently, our research group demonstrated that the moss Hypnum plumaeforme produces momilactoneA and B. We are interested in the biosynthesis and physiological roles of momilactones in Hypnum moss since rice and mosses are evolutionally different species. In this research, we cloned cDNAs encoding diterpene cyclases involved in the momilactone biosynthesis and ent-kaurene biosynthesis, the precursor of gibberellin plant hormone in flowering plants. The cDNA library was prepared from gametophores (the aerial parts) of the Hypnum moss and homology-based PCR experiments successfully cloned a possible cDNA encoding a bifunctional diterpene cyclase (DTC, HpDTC1). We also analyzed all expression genes in the gametophores by a next-generation sequencer (Illumina Highseq 2000). Another candidate cDNA encoding a DTC was found from RNA-seq data and cloned from the library (HpDTC2). Bacterial expression and function analysis of both clones result that recombinant HpDTC1 and HpDTC2 enzymes were determined as ent-pimara-9,15-diene synthase and 9βH-pimara-7,15-diene synthase, respectively. Miyazaki et al. showed that ent-kaurene biosynthetic gene is expressed during protonemal growth in a model moss, Physcomitrella patens. GC-MS analysis of diterpene hydrocarbons extracted from both gametophore and protonemal cells of the Hypnum moss indicated that ent-kaurene was detected from only the extracts of the protonemal cells as the single hydrocarbon product. Based on the results of GC-MS analysis, we cloned a new DTC cDNA from the protonemal cells and analyzed the function as a bifunctional ent-kaurene synthase (HpDTC3). Our current studies on identification and characteristics of cytochrome P450 monooxygenases responsible for the moss momilactones biosynthesis are in progress.