Common mistletoe (*Viscum album*) is a semi-parasitic shrub able to grow on a number of woody plants. These are mostly deciduous trees and shrubs that are infected by the typical subspecies of *V. album*, that is, *V. album* subsp. *album*. This is the subspecies that most of us are familiar with as it is widely distributed in urbanized areas across Europe and it produces characteristic spherical shrubs on many ornamental trees growing in parks, gardens and along roads. The frequent occurrence of this subspecies close to, and actually within, residential areas earned it in some countries the status of a cultural icon, to a point where individual mistletoe shrubs are planted on ornamental trees and actively protected. The special status of the mistletoe is, however, not a new concept, it moved human imagination for centuries finding its way into myths and beliefs of many cultures, from the magical arrowhead that killed the Baldar, a Norse god, to a Christmas tradition of kissing beneath decorations made of mistletoe twigs.

Common mistletoe has, however, its darker side as it may negatively affect the welfare of the host tree and reduce its vitality. Mistletoe is a semi-parasitic green plant which means that it produces its own carbohydrates through photosynthesis, but all the necessary water and mineral nutrients are absorbed from the host plant via haustoria system extending within infected branch. Thus, the harmful effect of mistletoe infection pertains to the reduction of water and nutrient budgets available to the host plant. However, the resource cost of a mistletoe shrub to a host tree is greater than the cost of a branch of similar biomass. The parasite tissues actively accumulate nutrients to achieve the higher water potential and to ensure that water flows from the host to the parasite and not in the opposite direction. In effect, the mistletoe transpiration is always higher compared to surrounding branches what greatly reduces the efficiency of water use of the host tree. This of course is the most dangerous during drought periods when mistletoe infested trees suffers much more due to exacerbated drought stress.

Another mistletoe subspecies – *V. album* subsp. *austriacum* (pine mistletoe) become in recent years an emerging phytopathological problem in Central Europe. It is well able to kill trees and in doing so to seriously damage entire Scots pine dominated ecosystems extending on the Northern European plain. The observed level of infestation in Scots pine forests reached alarming levels. According to the data gathered in recent surveys by Polish National Forests Holding the total area of affected stands amounted to 23 thousand hectares in 2018. A very year before it was only 1.4 thousand ha. In 2021 the area of damaged conifer stands reached 134.7 thousand ha. Despite the fact that probable reason for such an increase is better visibility of mistletoe shrubs in drought affected crowns (making mistletoe in trees easier to see), these numbers indicate that pine mistletoe is a serious threat to stability of Scots pine forests in Central Europe.

As for now, the suspicion is that factors driving the rapid expansion of pine mistletoe in Central Europe are related to the climate change. Common mistletoe is a highly temperature-dependent species, the pine mistletoe being the most temperature-sensitive among the three widespread mistletoe subspecies. Indeed, the occurrence of mistletoe pollen has been used as one of the climate indicators in paleobotanical studies, and all of the *Viscum* subspecies do not reach the northern and the altitudinal limits of their hosts. It was generally believed that cold summers can be compensated by mild winters, and conversely, areas with strong winters can be colonized if the summer temperatures are proportionately higher. This view has been, however, contested by new data form the Rhone Valley, Switzerland and by peculiar scarcity of mistletoes in some countries with mild oceanic climate such as Great Britain or Denmark. Clearly, the limiting effect of temperature to the pine mistletoe range is more complicated than simple northern and altitudinal margin that moves with climate warming. It is probable that temperature-sensitivity as a trait varies among populations of pine mistletoe.

Thus, the aim of the study described in this proposal is to investigate the biological and environmental factors underlying the rapid mistletoe spread in order to determine whether or not the mistletoe expansion is driven by climate change. This multidisciplinary study has been designed to produce data that will reinforce each other resulting in very comprehensive reconstruction of the recent migration pattern of the pine mistletoe in Central Europe. This will allow to correlate the mistletoe spread with changing weather patterns in Central Europe and to determine whether it is driven by climate change or not. Our experiments will use techniques from the fields of: molecular genetics, dendrochronology, as well as modeling of biological systems. Ultimately, we plan to compile all these data into an online database developed using geographic information system (GIS) tools that will enable to identify new phenomena related to pine mistletoe spread and contribute greatly to the ongoing effort to protect the Central European pine ecosystems.