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THE EFFECTS OF HUMAN UTILIZATION AND FOREST MANAGEMENT ON SPREAD OF *LORANTHUS* GREWINGKII IN ZAGROS FORESTS, IRAN

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ABSTRACT

The spread of Loranthus grewingkii is the certain factor in Zagros forest decline. The present study was conducted to assess the impacts of human utilization (agroforestry systems) and forest management (coppice and high forest). For this purpose, 100 sample plots (10 Ares) based on random systematic method in 200 × 100 m sampling grid were taken in different forest types including natural forest, agroforestry area, coppice and high forest. Tree canopy was classified into three classes of upper, middle and lower parts. Each class was graded as follow: grade zero (without infection), grade 1 (low infection or the time that less than 50% of branches are infected), grade 2 (high infection or the time which more than 50% of branches are infected). The results showed human utilization had significant effects on the presence and spread of Loranthus grewingkii. The high infection up to completely high infection was more in agroforestry area in respect to natural forest. Besides, the Loranthus grewingkii infection in high forest was more than that in coppice.

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KEY WORDS

Loranthus grewingkii, Zagros forest, High forest, Dwarf Mistletoe Rating

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INTRODUCTION

Mistletoes (*Loranthus* spp) are widespread aerial hemi-parasites of trees, ranging from the boreal zone to the tropics [1]. They play a significant role in forest diversity by providing keystone food resources for many animal species due to the availability of their fruit in seasons when other food is scarce [2]. However, the main mistletoe species are considered tree pests in forests and plantations [3, 4]. Because they disturb the water and nutrient balances and reduce photosynthesis and respiration, so debilitating infected trees [5, 6]. Because of the debilitation, extensive mistletoe infection may lead to serious damages of infected trees or even tree death [7, 8]. The presence of mistletoes on host trees has also been observed to be associated with individual tree features such as tree size, biomass and the occurrence of branches of main diameters [9, 10]. Therefore, the distribution and damages of mistletoe plants in the forest is likely to coincide with the distribution of host trees with the most favorable tree characteristics [10]. Watson [2] reported that the distribution of mistletoes is strongly related to the distribution and population of birds. In this regard, the mistletoes seed are germinated on trees from bird's excrement after consuming by birds.

Zagros forests are the second natural forest ecosystem in Iran, and as the most extensive forests have an important role in economic development and guarantee the sustainability of water and soil in the Zagros region [11]. The central Zagros Mountain range is one of the most important sites of oak forest in the west of Iran. Approximately 3 million ha of the forest is covered by different oak species, mainly dominated by *Quercus persica*, *Quercus infectoria* Olive and *Quercus libani Lindl* [12].

Mistletoes have various physiological and morphological effects on their host. The emergence, spread and damages of mistletoes has been reported in different parts of Zagros forest on various tree species such as almond, pear, apple, and oak [13, 14]. However, there was not conducted a comprehensive investigation on pronounce and human utilization on the spread of *Loranthus grewingkii* in Kermanshah province, west of Iran. Therefore, the present study was carried out to assess the effects of human utilization (agro-forestry systems) and forest management (coppice and high forest).

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MATERIALS AND METHODS

Site description

To investigate the effects of human utilization (agro-forestry systems) and forest management (coppice and high forest) on *Loranthus* grewingkii distribution, Haidarbaigi district in Kermanshah province, Zagros forest, was selected **[Figure -1]**.

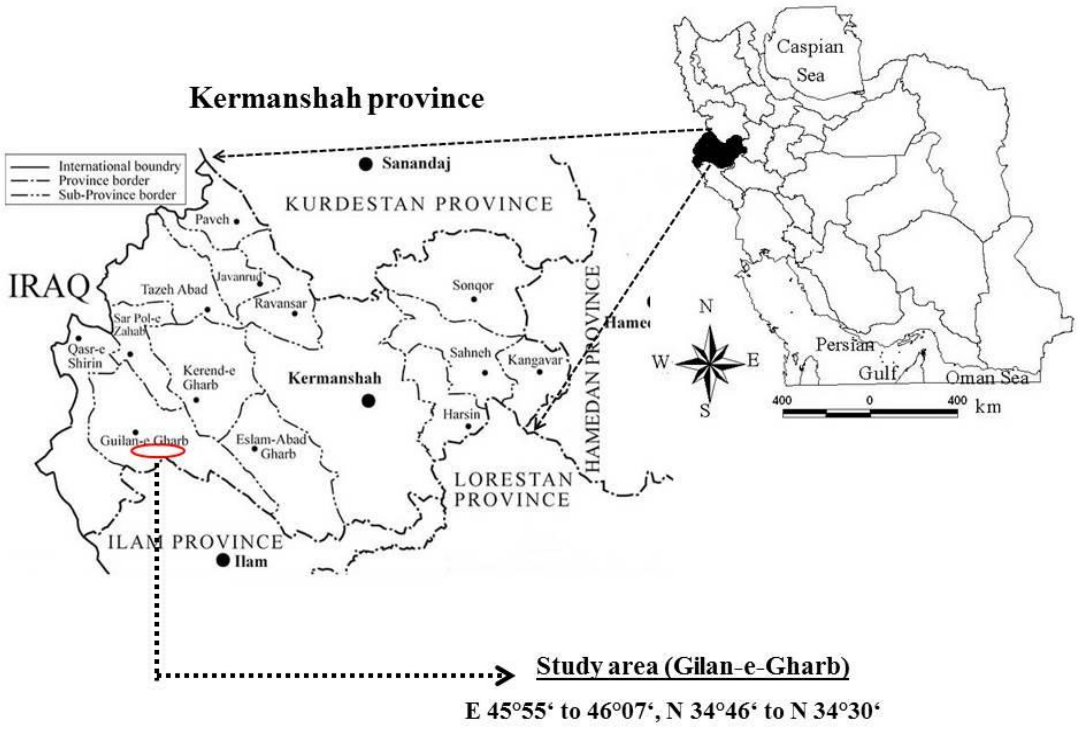

Fig: 1. The location of Gilane-gharb district in Iran

Methods

100 sample plots (10 Ares) based on random systematic method in 200 × 100 m sampling grid were taken. The characteristics of each sample plot including positions of sample plot (UTM etc.), different forest management (high forest and coppice with standards), the infection to *Loranthus* grewingkii based on DMR in three parts of tree crown (upper, middle and lower), the number of *Loranthus* grewingkii masses on branches, branch diameter of host and its distance from the ground were measured. The most common and acceptable method to determine the prevalence of mistletoe is DMR [15]. Dwarf Mistletoe Rating (DMR) method was first applied for just dwarf mistletoe, then it was used for all types of mistletoe [16]. In this method, tree canopy was classified into three classes of upper, middle and lower parts. After that, each part was graded as follow: grade zero (without infection), grade 1 (low infection or the time, which less than 50% of branches are infected), grade 2 (high infection or the time, which more than 50% of branches are infected). The intensity of infection was calculated by the sum of grades. In this method, the highest and lowest infection of mistletoe belonged to grade 6 and 0, respectively [15].

Statistical analysis

The data were submitted to SAS and SPSS. Kolmogorov - Smirnov test was used to assess the normality of data. Besides, independent t-test was applied to compare the intensity of infection with the mistletoe in natural forest, agro-forestry area, and coppice and high forests.

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RESULTS

To investigate the effect of human activities and forest management systems on the infection with *Loranthus grewingkii*, the classification of canopy and grading was applied to the forest stands.

Table 1: Independent t test to compare the infection with *Loranthus grewingkii* in agro-forestry area and natural forest

Parameters of *Loranthus grewingkii*	t	df	p-values
The intensity of *Loranthus grewingkii* infection	3.489	882	0.001
The number of *Loranthus grewingkii* per tree	4.606	882	0.001

The results of **Table-1** shows there was a significant difference between agro-forestry area and natural forest for the infection intensity and the number of *Loranthus grewingkii.*

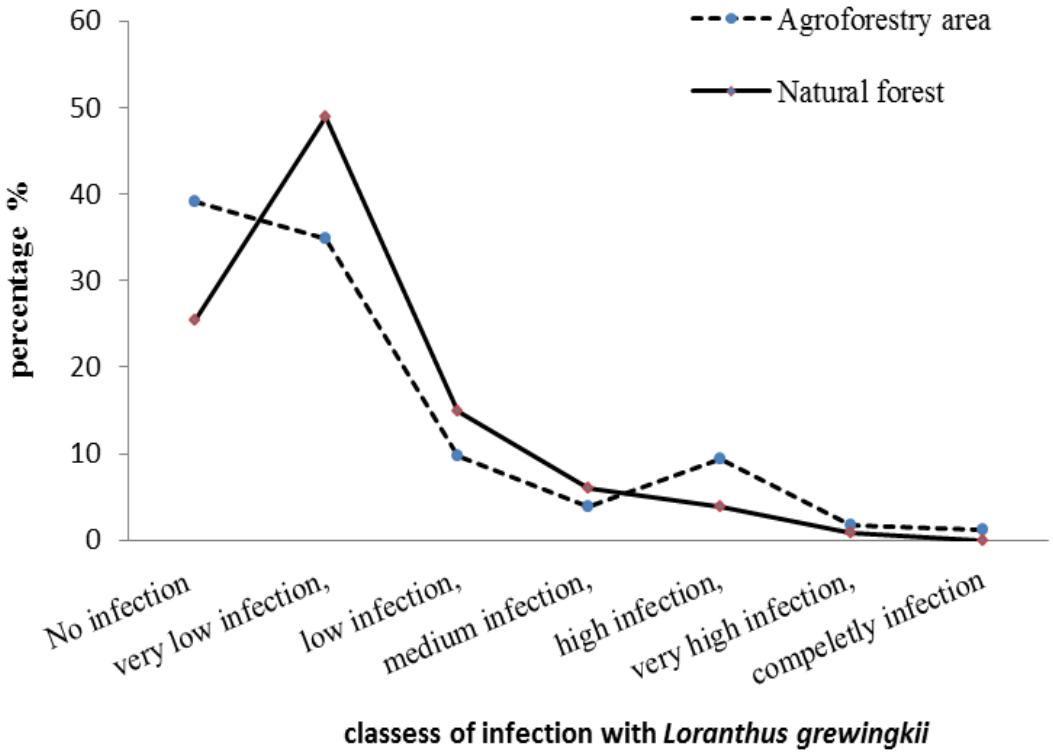

Fig: 2. The comparison of tree percentage based infection of *Loranthus grewingkii* per tree in natural forest and agro-forestry area.

As shown in **Figure- 2**, the tress with high, very high and completely infection in agro-forestry area was more than those in natural forest, while totally the infection with *Loranthus grewingkii* in natural forest was more than agro-forestry area.

As shown in **Figure- 3**, the maximum *Loranthus grewingkii* infection was observed in natural forest was 74.6%.

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The Loranthus grewingkii infection in coppice and high forest

Table: 2. Independent t test to compare the infection intensity and the number of *Loranthus grewingkii* in coppice and high forest

Parameters of *Loranthus grewingkii*	t	df	p-values
The intensity of *Loranthus grewingkii* infection	10.212	882	0.000
The number of *Loranthus grewingkii* per tree	10.026	882	0.001

There was observed a significant difference between coppice and high forest for intensity of infection and the number of *Loranthus grewingkii* **[Table- 2]**.

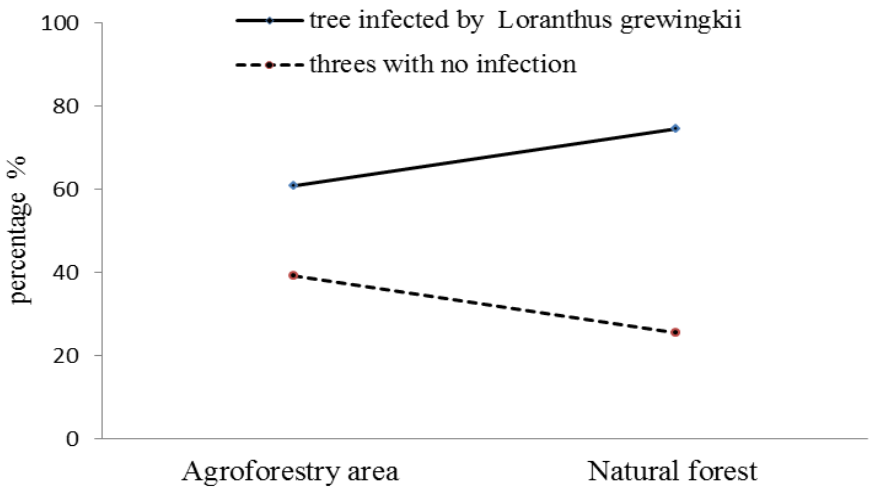

Fig: 3. The comparison of tree infected by *Loranthus grewingkii* and threes with no infection in natural forest and agro-forestry area

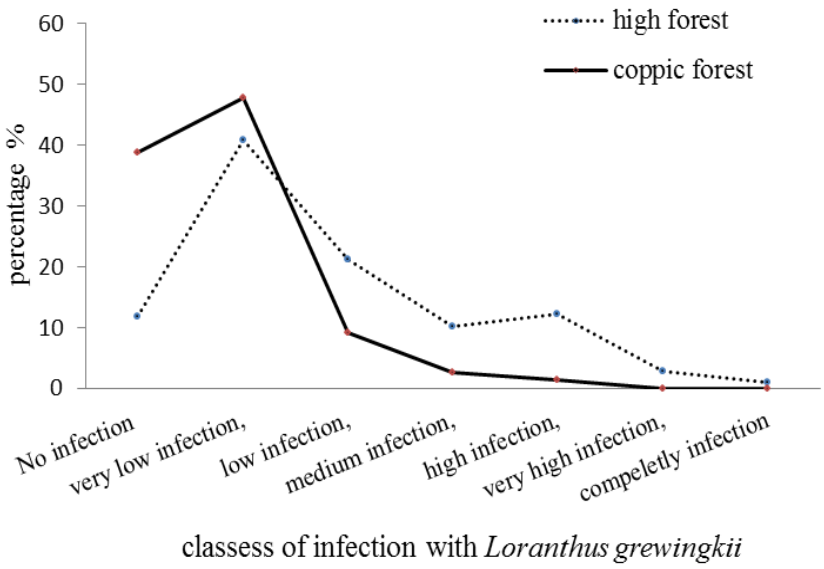

Fig: 4.The comparison of the number and percentage of trees in classes of infection with *Loranthus grewingkii* in coppice and high forest

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As shown in **Figure-4**, the low, medium, high, very high, and completely high infection in high forest was more than those in coppice. However, the very low and without infection in coppice was more than those in high forest. 88.2 % of high forest trees were infected with *Loranthus grewingkii*, while this value was obtained as 61% in coppice.

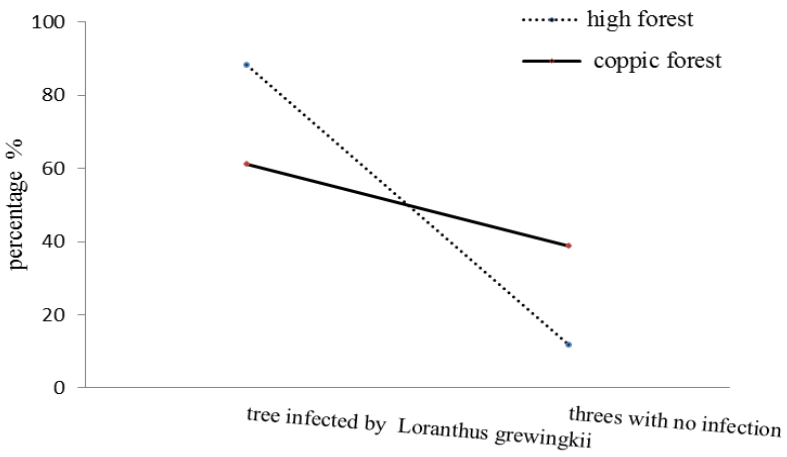

Fig: 5.The comparison of tree infected by *Loranthus grewingkii* and threes with no infection in in coppice and high forest

DISCUSSION

The forests of Kermanshah province were located in center of Zagros region, which cover 600000 ha of Zagros forest. In recent years, the emergence and spread of *Loranthus grewingkii* has been considered as the main factor of forest decline in Zagros region.

Agro-forestry and the presence of Loranthus grewingkii

The results showed trees ranging high infection to completely infection in agro-forestry area were more than that in natural forest, whereas the tress with low and medium infection were mostly located in natural forest. The maximum trees infected with *Loranthus grewingkii* were observed in natural forest **[Figure- 3]**. The results of independent t test indicated a significant difference for infection intensity and the number of *Loranthus grewingkii* infection per tree between agro-forestry area and natural forest so that the infection in natural forest was more than that in agro-forestry area **[Table- 1]**. In this regard, different authors reported that human activity and utilization are the main factors on the presence of mistletoes, which are accordance with our findings [17-19].

Loranthus grewingkii in coppice and high forest

The *Loranthus grewingkii* infection from low up to completely high in high forest was more than that in coppice, while trees with very low and without infection was more observed in coppice in comparison to high forest **[Figure- 4]**. High forest is the most appropriate place for regeneration and development of *Loranthus grewingkii* so that 88.2 % of this parasite was observed in high forest **[Table- 2]**. The type of forest stand is an important factor to determine the distribution of *Loranthus grewingkii*. Azizi [20] reported that tress with high diameter and high forest are more appropriate to presence of semi-parasite, which their findings support our results.

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CONFLICT OF INTEREST
Author declares no conflict of interest.

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