

OCCURRENCE OF JUNIPER DWARF MISTLETOE, *Arceuthobium oxycedri* (DC.) M. Bieb. IN BALOCHISTAN PROVINCE, PAKISTAN

Atta Mohammad Sarangzai¹

ABSTRACT

A. oxycedri, occurs from central Spain, across southern Europe, North Africa, the Near East, the Himalayas and western China where it infects *Juniperus* species and other hosts of the family Cupressaceae. In Pakistan, *A. oxycedri* is presently known from a single location, the Ziarat Forest, encompassing an area of approximately 3,500 ha, (4%) of the total forest area of the province. It occurs on much of the upper headwaters of the Chasnak and the Sasnamana valleys of the Ziarat district. In the infested portions of the Chasnak Valley, an estimated 31.76% of the host trees are infected with a mean area dwarf mistletoe rating (DMR) of 1.53 and an estimated 2.03 % annual mortality rate. Nearly 50% of the infected trees have a DMR of 6. On contrast, an estimated 22% of the trees in the Sasnamana Valley are infested with a mean area DMR of 0.52. No recent trees mortality, directly attributable to this parasite was detected in Sasnamana Valley and nearly 50% of the infected trees have a DMR of 1. This parasite was also detected in portions of four adjoining drainages. It is estimated that these infections have been present for at least 25 to 30 years. In either of the two valleys, the host tree in widely scattered and there is only a limited potential for tree-to-tree spread. In the associated areas of these two valleys, the infections occur in relatively well-stocked forests and there is a high potential for tree-to-tree spread.

Key words: *Arceuthobium oxycedri*, dwarf mistletoe, *Juniperus excelsa*, Sasnamana Valley, Balochistan

INTRODUCTION

Arceuthobium oxycedri (DC.) M. Bieb. has the most extensive natural range of all of the dwarf mistletoes. It occurs from central Spain east across the subterranean region of Europe and northern Africa, the Near East, the Himalayas and western China (Tibet) [Hawksworth and Wiens, 1976]. It infects several species of junipers along with other Cupressaceous plants, which have been introduced into its range viz. *Chamaecyparis thyoides*, *Cupressus arizonica*, *C. macrocarpa* and *Thuja orientalis* (Hawksworth and Wiens, 1996) in Ziarat *Juniperus excelsa* forest. An assessment of *A. oxycedri* in the Ziarat Forest was made during the summer of 1999. The objectives of the assessment were to a) identify areas infected with the pest b) estimate the levels of intensity of infection and c) recommend suggestions to reduce losses.

The first report of *A. oxycedri* in the Ziarat forest was made by Beg (1973) who detected this parasite in the Sasnamana valley, northeast of Ziarat. A second report (Jamal and Beg, 1974) suggested that the parasite had been present in the area for long

1 Assistant Professor, Botany Department, University of Balochistan, Quetta – Pakistan.
Email: attamohammads@yahoo.com

time but was overlooked because the aerial shoots mimic the foliage of its host plant. Discussions with local foresters of the Balochistan Forest Department indicate that local people were aware of this plant at least as early as 1920 and routinely collected the aerial shoots for livestock feed. The practice of using mistletoe shoots as fodder might spread the parasite (Zakoullah and Badshah, 1977). An evaluation conducted in 1993 indicated that the area of heaviest infestation was the south side (north facing slope) of the Chasnak valley (Ciesla, 1993). Dwarf mistletoe control was begun in 1978 in the Sasnamana valley which included cutting of heavily infected trees, and pruning infected branches but this control practice was discontinued with concerns that tree cutting would have adverse effects on watershed and other forest values (Sheikh, 1985).

MATERIALS AND METHODS

Surveys were conducted in the Chasnak and Sasnamana valleys of Ziarat forest Balochistan. Sample plots, consisting of groups of 5 to 15 dominant junipers over an area of approximately 0.5 ha, were established throughout the two valleys. Each sample tree was examined for presence of dwarf mistletoe and infected trees were rated using the Howskworth 6 class rating system. Individual tree DMRs were averaged to obtain a plot DMR and area DMR. A mean area DMR was calculated for the portion of each valley. Informal observation was also made on overall forest condition and current status of this parasite in the newly infested areas.

Detection of the infected of trees

The earliest symptoms of infection observed during the study was the development of bursiform shaped swelling at the point of penetration of the host tissue. An attempt was made to estimate an annual rate of tree mortality attributable to *A. oxycedri* by identifying the trees with terminal state of decline or trees with extensive crown dieback, profuse branches and witches brooms formation are the typical external signs which were conspicuous both with in through both the live and dead portions of the crown of the infected trees.

RESULTS AND DISCUSSION

Chasnak and Sasnamana Valleys

Of a total of 25 sample plots, containing 238 sample trees were established in the Chasnak Valley. Proportion of infected trees was 31.76% with an area DMR of 1.53 (Table-1). Nearly one half of the infected trees occurring in the plots had a DMR rating of 6 (Fig. 1).

Dwarf mistletoes infestations were detected in the upper portions of both the Chasnak Aghbargai and Chasnak Aghbarg forks of the Chasnak Valley (Fig. 2). Infested areas are typically spotty and are often interspersed with areas where *A. oxycedri* is absent. In many instances individual trees may be heavily infected (DMR = 4-6). These trees appear to have died over a long period of time.

Seventeen plots, containing 166 trees, were established in the Sasnamana Valley. Of these, nine plots with 86 trees, either contained infected trees or had infected trees in close proximity. Twenty two percent of the trees infested areas were infected with a mean DMR of 0.52 (Table-1). The infested area in the Sasnamana Valley in the vicinity of a spring known as Khawas Nika. There is extensive old tree mortality concentrated in a relatively small area. On the other hand in an arid climate, rate of decay of dead trees by fungi and other agents is slow and dead trees tend to remain standing for extended periods (30 to 50 years).

Table-1 indicated that the Chasnak Valley nearly had half of the infected trees and possessed a DMR of 6.0 and there is a high incidence of infected trees in DMR class 4 and 5. Just the opposite is true in the Sasnamana Valley where nearly half of the infected trees were DMR class 1 and correspondingly lower proportions of trees occurred in the more severe DMR classes (Fig. 1). Differences in infection intensity could be due to stand condition. The more open forests of the Chasnak valley may limit tree-to-tree spread of the dwarf mistletoe. This can result in extremely heavy infections on individual trees with little or no infection of neighboring trees. The possible explanation for the difference in intensity of infection is the fact that dwarf mistletoe control was conducted in the Sasnamana valley between 1978 and 1983 (Sheikh, 1985)

The number of dead and dying trees infected with dwarf mistletoe low. Assuming that all of the trees classified as in a state of terminal decline would die during a single growing season, this would indicate an annual mortality rate of 2.03% in the Chasnak Valley. Although this may appear to be a relatively low rate, when projected over time it represents a loss of approximately 50% of the forest over a period of 35 years, providing that mortality is constant and there is no replacement due to natural regeneration. There was no discernable pattern of infestation relative to slope, aspect or topographic position.

Forest condition

The forest of the Chasnak valley consists of scattered patches of *J. excelsa* woodland on the mountain slopes only. The level areas and large tributaries serve as natural barriers to tree-to-tree spread of dwarf mistletoe. As the terrain becomes steeper and rockier, the junipers become more scattered. The area with the best stocking is located on benches on the north-facing sides of the Chasnak Aghbarai and Chasnak Aghbarag, two of the three major streams in this valley.

The juniper forest in the Chasnak valley is in generally poor condition. This is partially due to the harsh, arid environment and heavy use by local residents for fuel wood and overgrazing lower slopes of the southwest aspect of the Sasnamana area is relatively gentle with higher stocking levels than those encountered in the Chasnak Valley. The northeast-facing slopes and steep rocky and consists of few relatively level areas where stocking is to some extent is drier. This valley is more heavily populated than the Sasnamana valley with permanent human settlements. In this valley there is also a scattering of tent camps of nomadic herders at the forest.

Due to the heavier human population; the juniper forest in the Sasnamana Valley appears to be less severely degraded than the Chasnak Valley. This may be the result of higher level of stocking and somewhat better growing conditions.

Other Areas of Infestation

In addition to the Chasnak and Sasnamana Valley, *A. oxycedri* was detected in four sites; the upper headwater of the Narai, Salam and Ziarat Valleys and Salik Skhobai on the dividing ridge between the Sasnamana and Ziarat Valleys. All areas of *A. oxycedri* infestation detected beyond the Chasnak and Sasnamana Valleys are well developed and contain large, robust dwarf mesquite plants. It is estimated that these areas have been infected for at least 25 to 30 years. All appear to be extensions of the main area of infestation in the Chasnak and Sasnamana valleys.

The more or less contiguous character of the infestation suggests the role of birds and small mammals in the overland dispersal of seeds is not known (Zakaulah and Badshah, 1977).

Table-1. Comparison of *Arceuthobium oxycedri* infection on *Juniperus excelsa*, Chasnak and Sasnamana Valley of Ziarat Forest, Balochistan Province Pakistan

Area	Plots established	Plots in infested area	% infection	Mean DMR
Chasnak	25	15	31.76	1.53
Sasnamana	15	9	22.00	0.52

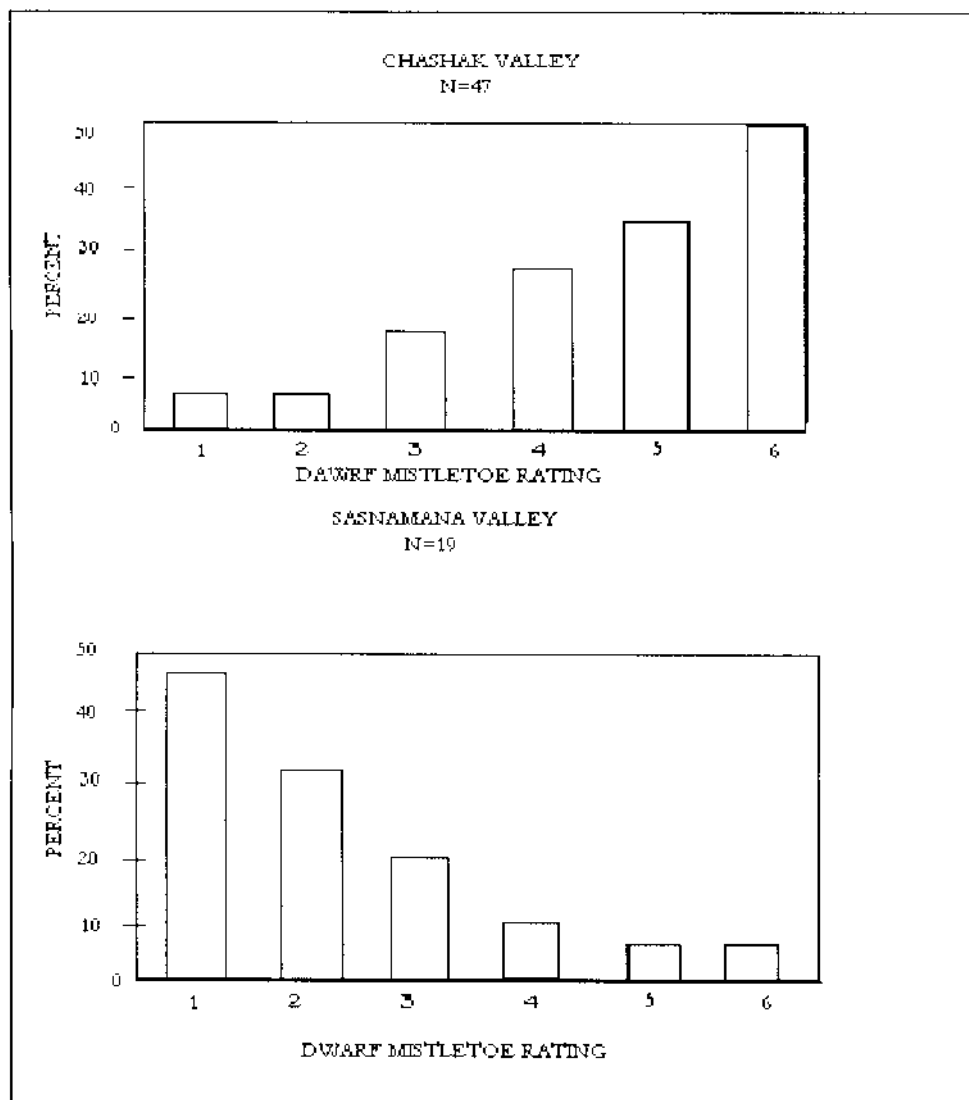


Fig. 1. Frequency distribution of dwarf mistletoe infected trees by DMR, Chasnak and Sasnamana Valleys, Balochistan Province, Pakistan.



Fig: Large globose plants of *Arceuthobium oxycedri* on *Juniperus excelsa* of Chasnak Valley, Ziarat, Balochistan.

CONCLUSIONS

Arceuthobium oxycedri infestation in the Ziarat forest presently encompasses a more or less contiguous area of approximately 3,500 ha, representing about (4 %) of the total area of juniper cover in the area. In the absence of biological and chemical treatment, pruning and cutting of the heavily infected trees/ and their branches is the only cultural remedy.

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