Management of Seabuckthorn *(Hippophae* Ssp.) Diseases with Organics in Lahaul Valley-A Dry Temperate Zone of Himachal Pradesh

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ABSTRACT

Five organics viz., Bio Sanjivani *Trichoderma viride* 1.0% w/w, Bio Sanjivani *Pseudomonas fluorescens* 0.5% w/w, SUDOCEL (*Pseudomonas fluorescens)*, NIPROT 0.50% WP (*Trichoderma viride)* and BIOSHIELD *(Pseudomonas fluorescens)* were tested against *Fusarium* wilt and powdery mildew diseases of seabuckthorn. The trail on the management of *Fusarium* wilt was conducted during 2013 in seabuckthorn nursery. All the organics were used as seedling drenching after the appearance of leaves. For one replication 100 plants were taken and drenched with desired dose of fungicide and per cent incidence was recorded after one month of drenching. It was observed that the combined use of *Trichoderma viride* 1.0% w/w (Bio Sanjivani) and *Pseudomonas fluorescens* 0.5% w/w (Bio Sanjivani) 5.0 g/L each gave maximum disease control (52.10%) followed by individual application of *Trichoderma viride* 1.0% w/w (Bio Sanjivani) 5.0 g/L (46.96%) and *Trichoderma viride* (NIPROT 0.50%WP) 5.0 g/L (44.35%). Similarly another trial for the management of powdery mildew *(Phyllactinia hippophaes)* was conducted in the gene bank of seabuckthorn plantation at HAREC, Kukumseri. Three plants were taken for each treatment. The 2 sprays were given at the intervals of 15 days in the months of August-September, 2013. Minimum disease severity was recorded in *Trichoderma viride* 1.0% w/w (Bio Sanjivani) + *Pseudomonas fluorescens* 0.5% w/w (Bio Sanjivani) treatment (27.33%) followed by *Trichoderma viride* (30.33%) and *Pseudomonas fluorescens* (33.33%).

Keywords: Seabuckthorn, *Hippophae sp., Trichoderma viride, Pseudomonas fluorescens* diseases management, Lahaul and Spiti and Himachal Pradesh.

INTRODUCTION

Seabuckthorn *(Hippophae* L.) is known as a golden bush because of its wonderful medicinal, nutraceutical and ecological properties. It has nitrogen-fixing properties and can grow on poor soils with some care in initial couple of years. As such, it is capable of improving the soil health and mitigating the widespread soil erosion. Consequently, it has attracted attention of the planners and the environmentalists alike for its systematic plantations in the valleys. Its berries are commonly harvested for juice making, which is very high in vitamin C and has other healthful properties. In cold desert areas of Lahaul and Spiti, three species of *Hippophae* namely *H. rhamnoides* sub sp. *turkestanica, H. salicifolia* and *H. tibetana* are found in various ecological niches. Amongst these species *H. rhamnoides* and *H. salicifolia* are quite common in the Lahaul valley whereas *H. tibetana* is found in some pockets of Spiti valley. Due to long fibrous and tap root system this bush is not only helping in preserving the fragile ecosystem in the cold regions by way of reduced soil erosion but also improving the production of grass growing amidst natural seabuckthorn stands. The grass is a prized commodity throughout Lahaul and Spiti as it is required for the livestock during snow covered winter months when there is no availability of any green grass. As such, planned seabuckthorn orchards with improved temperate grasses planted in between can be very useful to the local

populace. Establishing seabuckthorn orchards to exploit its multifaceted usefulness for the benefit of the masses is beset with problem of prevalent diseases in the naturally growing seabuckthorn plants. Although some insect-pests thriving on seabuckthorn plants in the valleys have been reported recently (Anonymous, 2010; Sharma *et al,* 2010; Sharma and Sharma, 2011). The diseases of seabuckthorn have also been reported by Kumar *et al.* (2011). Keeping in view the economic importance of the diseases, the present study was therefore, carried out against powdery mildew and *Fusarium* wilt of seabuckthorn during 2013 to generate information on potential of biocontrol agents.

MATERIALS AND METHODS

The present study was carried out in Lahaul and Spiti district located within $31^0$44'34" N to $32^0$59'57" N latitude and $76^0$46'29" E to $78^0$41'34" E longitude. In order to assess the efficacy of *Trichoderma viride* 1.0% w/w, *Pseudomonas fluorescens* 0.5%w/w, SUDOCEL *(Pseudomonas fluorescens)*, NIPROT 0.50%WP *(Trichoderma viride),* BIOSHIELD *(Pseudomonas fluorescens),* experiment was conducted under naturally infested farm of Highland Research and Extension Centre, Kukumseri district Lahaul & Spiti (Himachal Pradesh) during *Kharif* 2013 (Temperature 8.8^{o}C -21^{o}C. relative humidity 30.5 - 32.5% and rainfall 10.7 mm during experimentation). Trail on the management of *Fusarium* wilt of seabuckthorn was conducted in the month of May in seabuckthorn nursery. All the organics 5 g/L were used as seedling drenching after the appearance of leaves. For one replication 100 plants were taken and drenched with desired dose of organics and per cent incidence was recorded after one month of drenching. Similarly for powdery mildew three plants were taken for each treatment. The 2 sprays were given at the intervals of 15 days in the months of August-September, 2013. Then disease percent severity was recorded. In check treatment simple water was applied. Disease incidence and disease severity were calculated with the following formulae.

Disease incidence (PDI) (%) = No. of diseased plants / Total no. of plants assessed * 100

Disease severity = Infected tissue area / Total tissue area * 100

RESULTS AND DISCUSSION

In the present investigation, the efficacy of seven treatments evaluated at HAREC, Kukumseri against seabuckthorn diseases during *Kharif* season 2013. The results of the present study revealed that all the treatments were found effective in managing the seabuckthorn diseases. Among the treatments employed against *Fusarium* wilt (Table 1) it has been observed that when both the bioagents (Bio Sanjivani) *T. viride* and *P. fluorescens* were applied together gave highest disease control (52.10%) as compared to individual application. It is due to the facts that *T. viride* and *P. fluorescens* colonized on emerging roots, provided protection to them and reduced pre-emergence mortality. Soil drenching with Bio Sanjivani *Trichoderma viride* 1.0% w/w and Bio Sanjivani *Pseudomonas fluorescens* 0.5% w/w resulted 20.33% and 22.33% disease incidence, respectively as compared to 38.33% in control treatment. Another treatment NIPROT 0.50%WP *(Trichoderma viride),* BIOSHIELD *(Pseudomonas fluorescens* and SUDOCEL *(Pseudomonas fluorescens)* also gave the significant results 44.35%, 39.13% and 35.33% disease control, respectively.

Similarly results obtained from bioagents against powdery mildew are presented in Table 2. The perusal studies revealed that integrated two sprays of T *viride* and P *fluorescens* (Bio Sanjivani) at 15 days interval resulted maximum diseases control (50.65%) followed by 45.23% in individual application of Bio Sanjivani *Trichoderma viride* 1.0% w/w 5g/L and Bio Sanjivani *Pseudomonas fluorescens* 0.5% w/w (39.81%). Other treatments T3, T4 and T 5 also gave the significant results. Different species of *Trichoderma* are known to produce different kinds of enzymes and active antimicrobial metabolites which have a significant role in biocontrol activity like cell wall degradation,

biotic and abiotic stress tolerance, hyphal growth, antagonistic activity and biodegradation of pesticidal residues.

Table 1. Management of *Fusarium (Fusarium* sp.) wilt of seabuckthorn with organic fungicides

Treatment	Dose g/L	Incidence(%)	Disease control (%)
T1 = Bio Sanjivani *Trichoderma viride* 1.0% w/w	5.0	20.33(26.76)	46.96
T2 = Bio Sanjivani *Pseudomonas fluorescens* 0.5% w/w	5.0	22.33(28.12)	41.74
T3 = SUDOCEL *(Pseudomonas fluorescens)*	5.0	24.66(29.75)	35.66
T4 = NIPROT 0.50% WP *(Trichoderma viride)*	5.0	21.33(27.46)	44.35
T5 = BIOSHIELD *(Pseudomonas fluorescens)*	5.0	23.33(28.84)	39.13
T6 = T1+T2	5.0+5.0	18.36(25.31)	52.10
T7 = Control		38.33(38.22)	-
CD (0.05%)		3.70	-

The figures in parenthesis are arc sine transformed values

Pseudomonas flourescens in disease management under field conditions has been greatly attributed to the development of rhizospheric competent. Shamanskaya (2009) had reported *Verticillium* and *Fusarium* fungi from commercial seabuckthorn plantations at Barnaul, Russia. Besides this, the author had also reported endomycosis of fruits caused by saprophytic micro-flora of various species including *Trichoderma viridae, Alternaria alternate, Aspergillus niger, Penicillium* sp. and *Aureobasidium pullulang.* In China, *Fusarium sporotrichiella* is the most common fungus reported to infesting large berry cultivars of seabuckthorn (Luo *et al.,* 2008).

Table 2. Management of Powdery mildew *(Phyllactinia hippophaes)* of seabuckthorn with organic fungicides.

Treatment	Dose (g/L)	Severity (%)	Disease control (%)
T1= Bio Sanjivani *Trichoderma viride* 1.0% w/w	5.0	30.33(33.38)	45.23
T2= Bio Sanjivani *Pseudomonasfluorescens* 0.5% w/w	5.0	33.33(35.23)	39.81
T3= SUDOCEL *(Pseudomonas fluorescens)*	5.0	35.66(36.64)	35.60
T4= NIPROT 0.50% WP *(Trichoderma viride)*	5.0	36.33(37.03)	34.39
T5= BIOSHIELD *(Pseudomonas fluorescens)*	5.0	38.33(38.22)	30.78
T6= T1+T2	5.0+5.0	27.33(31.49)	50.65
T7= Control		55.38(48.07)	-
CD (0.05%)		3.40	-

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