Original Research Article

ADVANCES IN SUNFLOWER POWDERY MILDEW AND *Alternariaster*LEAF SPOT MANAGEMENT: EXPLORING THE POTENTIAL OF COMBINED NEW FUNGICIDE MOLECULES

ABSTRACT

The study investigates the efficacy of seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays of various fungicide combinations in managing powdery mildew and *Alternariaster* leaf spot diseases in sunflower. Conducted over three Kharif seasons (2021-2023), the trials consistently demonstrated the superior performance of Fluopyram 17.7% + Tebuconazole 17.7% (400 SC) @ 1 ml/L in reducing disease incidence and severity. In Kharif 2021, this treatment recorded the lowest incidence of *Alternariaster* leaf spot (7.36%) and powdery mildew (4.52%), outperforming other treatments. Similar trends were observed in Kharif 2022 and 2023, with Fluopyram + Tebuconazole maintaining the lowest disease severities (7.39% and 2.95% for powdery mildew, respectively).Notably, the study found no significant differences in yield components across treatments, though the highest yields were consistently recorded in the treatment combining Fluxapyroxad seed treatment with Fluopyram + Tebuconazole foliar spray, achieving yields of 2124.67 kg/ha in Kharif 2022 and 2157.33 kg/ha in Kharif 2023. These results indicate that integrated disease management using these fungicide combinations can effectively control both diseases in sunflower, particularly under humid weather conditions, without adversely affecting crop yield.

Keywords: Sunflower, *Alternariaster* leaf spot, Powderymildew, Disease severity, Fungicides

INTRODUCTION

Sunflower is an important oilseed crop as it contains good quality oil with pleasant flavour and excellent keeping quality when refined. The oil is rich in Linoleic acid (62.5%) and is recommended as dietary constituent to heart patients. Sunflower oil is also used in industrial production of soaps, cosmetics, paints, lubricants, plastics, etc. Its seed cake is an

important by product which is used as concentrates for cattle, pigs, sheep, goat and poultry as it is a protein rich feed (40-50%). Thus, Sunflower being a multipurpose oil seed crop, naturally the demand for crop is increasing tremendously. These demands resulted into extensive cultivation of sunflower over large areas leading to development of diseases in the crop which has considerable impact on grain yield of sunflower.

Diseases are one of the major constraints in successful sunflower cultivation. [1] listed 80 pathogens occurring on sunflower. In Karnataka, the major diseases of sunflower are necrosis virus, *Alternaria* blight, powdery mildew, rust, collar rot and downy mildew. Among these *Alternaria* blight caused by *Alternaria helianthi* (Hansf.) [2] has been considered as a potentially destructive disease in many parts of sunflower growing countries [3] and also in some regions of Karnataka [4]. In India, powderymildew was first reported on sunflower in 2008 [5]. A field survey on powdery mildew in seven districts of Karnataka recorded 30–74 % disease severity [6-7].

Alternaria leaf blight is recognized as a major disease in more humid areas. Favorable weather may result in yield losses up to 62 per cent which occurred during 1988 in Karnataka. The disease occurred with disease incidence as high as 95-100 per cent due to heavy rains during flowering and grain filling stage of the crop [8-9]. Powderymildew is worldwide in distribution, but greatest severity is observed in the tropics, where it advances senescence at the floweringor post floweringstages [10]. (Disease losses due to powdery mildew was reported as much as 70 per cent with significant reduction in oil quantity (17%) and quality (33%) [11].

In both the diseases high inoculum in the field coinciding with favourable environmental conditions lead to early infections causing severe losses. Regarding symptoms, the disease appears in the form of whitish powdery patches in Powdery mildew and as dark necrotic spots in *Alternaria*, on leaves, stem, petioles and also on capitulum. The use of fungicides has become an inevitable method for controlling of the disease in the absence of resistant cultivars over large areas.Often many commonly used fungicides fail to give satisfactory control of the diseases under field conditions, particularly during the humid weather. Therefore, it is essential to find out potent fungicides, which would be effective in

controlling the disease. In the present study, combination fungicide products were used in the field to test the efficacy under natural weather conditions against the two diseases.

MATERIAL AND METHODS

Management of the diseases was carried out in the experimental plot located at Zonal Agriculture Research Station, GKVK, University of Agriculture Sciences, Bangalore, Karnataka during the late *Kharif*-Early *Rabi* season. The trials were carried out for three seasons 2021,2022 and 2023. Seven treatments were laid out with three replications. The trial was carried out in RCBD design with plot size of 4.2X3.0M^2. The susceptible Hybrid KBSH 44 was sown after seed treatment as mentioned in the treatments layout and spray was taken during the initiation of disease symptoms. Two sprays were given at fortnight interval for the effective disease reduction.Observations were carried out on the per cent disease severity, seed yield and B:C ratio.Disease severity was rated based on the scale provided (IIOR, Hyderabad technical compendium). Periodically observations were recorded based on the lesion symptoms and gradedfollowing the standard scale.Disease scoring (0-9 scale) for *Alternariaster* leaf spot, similarly Powdery mildew severity is recorded by scoring the per cent leaf area covered by the disease on leaves and on upper portion of leaves through visual observation using a rating scale of 0-9 scale**(Table 1 and Table 2).** Seed yield for each treatment (three replications) was averaged and converted to per hectare. Benefit cost ratio was calculated based on the excess cost incurred due to spraying and more seed yield reflected in terms of benefit.

RESULT

Seed treatment with Fluxapyroxad FS @ 1.5g/kg seed followed by foliar sprays with different combined fungicides was carried out to study their effect on powdery mildew and *Alternariaster* leaf spot disease.

During *Kharif* 2021 seed treatment with fluxapyroxad FS @ 1.5g/kg seed followed by foliar spray with Fluopyram 17.7% + Tebuconazole17.7% (400 SC) @ 1 ml/L recorded lowest incidence of *Alternariaster* leaf spot disease (7.36%) followed by T2 - Seed treatment with Fluxapyroxad FS @ 1.5g/kg seed followed by foliar sprays with Azoxystrobin 18.2% +

Difenconazole 11.4% SC @1ml /L – 11.23% **(Table 3).** Powdery mildew was also lowest in Treatment 1 (4.52%) followed by Treatment 6 (7.19%) – spray of Myclobutanil 10% WP @ 0.5 g /L.

The trial was conducted during *Kharif* 2022 with RBD design having 7 treatments and 3 replications was with Fluxapyroxad FS @ 1.5 g/kg seed treatment followed by spraying after the disease started with respective chemicals. Spraying with Fluopyram 17.7%+ Tebuconazole17.7% (400 SC) @ 1 ml/L was the best treatment revealing good management of the disease with PDI of 7.39% followed by spray with Myclobutanil 10% WP @ 0.5 g /L (9.49%)**(Table 4)**in powdery mildew reduction. Whereas, treatment 1 was also effective against *Alternaria* leaf spot with reduced disease severity of 4.28 per cent and the next best treatment was spray with Azoxystrobin 18.2% + Difenconazole 11.4% SC @1ml /L (9.32%).

Trial conducted during *Kharif* 2023 recorded lowest disease severity of leaf spot (7.66%) and powdery mildew (2.95%) in seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays with Fluopyram 17.7%+ Tebuconazole17.7% (400 SC) @ 1 ml/L. This was followed by seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays with Myclobutanil 10% WP @ 0.5 g /L (4.69%) for powdery mildew and in leaf spot Azoxystrobin 18.2% + Difenconazole 11.4% SC @1ml /L (9.47%)**(Table 5).**

The trial conducted for three seasons revealed the efficient management of the severely emerging diseases in sunflower using the new fungicide combined molecules. Fluopyram 17.7%+ Tebuconazole 17.7% (400 SC) recorded the lowest severity of both the diseases over three season trials. Two sprays of the fungicide molecules at fortnight interval was sufficient to manage both the diseases in the dryland crop during humid weather conditions.

Significant difference was not noticed in yield component among the different treatments. But highest yield was recorded in T1 - Seed treatment with fluxapyroxad FS @ 1.5g/kg seed followed by foliar spray with fluopyram 17.7%+ tebuconazole17.7% (400 SC) @ 1 ml/L (2124.67 kg/ha) during *Kharif* 2022 and *Kharif* 2021 (2153 kg/ha) compared to control. Similarly, during *Kharif* 2023 not much difference among the treatments was recorded in seed yield and highest was in treatment 1 (2157.33kg/ha)**(Table 3).**

DISCUSSION

The fungicide management of foliar diseases for the last decade, has been based on the use of demethylation inhibitors (DMI, Group 3), Triazole fungicides, and quinone outside inhibitors (Qol or Strobilurins, Group 11 fungicides. Visual leaf disease assessments and UAV remote sensing data showed that Fluxapyroxad treatments at doses of 125 cc and 150 cc per 100 kg of wheat seed can reduce the percentage of infected wheat plants caused by foliar fungal pathogens (*Pyrenophora tritici-repentis* and *Septoria* spp.) at wheat growth stages GS23-25 and GS30-31. Fluxapyroxad seed treatment fungicide has a long period of protection effects against the leaf blotch diseases complex caused by Septoria spp. and *P. tritici-repentis*. Its application was observed to be effective against leaf blotch diseases up to wheat growth stage GS31 [12].

This shows that fluxapyroxad was an effective fungicide for seed treatment in sunflower by protecting it upto 30-45 days after sowing from the fungal diseases. Fluopyram, a new succinate dehydrogenase inhibiting fungicide (SDHI), registered for use in pistachio for the control of *Alternaria* late blight (ALB) as products premixed with demethylation inhibitor (DMI) tebuconazole was effective against strains showing Boscalid resistance[13]. *Alternaria* leaf spot, maximum per cent disease control occurred when the apple crop was sprayed with Fluopyram 200 + Tebuconazole 200 SC at a concentration of 0.0625 per cent (94.55 %) followed by Fluopyram 200 + Tebuconazole 200 SC at 0.05 per cent (89.42%) concentration and 0.0375 per cent (86.55 %), respectively [14].

Fluopyram 200 +Tebuconazole 200 – 400 SC at 750 ml/ha concentration were found to be significantly superior over control with incidence of powdery mildew (25.10%) and postharvest disease incidence (15.00%) as compared to other chemical treatments in mango crop. The efficacy of the product, Fluopyram 200 + Tebuconazole 200 SC (Luna Experience), against powdery mildew in pepper was found to be 89 per cent in Timorex Gold assay efficacy against *Leveillulataurica*, for safe use against powdery mildew [15-16].The fungicide product Fluopyram + Tebuconazole (400 SC) tested in many commercial crops were highlyefficient and had safety. Hence, it can be used against Alternaria leaf spot and powdery mildew in sunflower with high disease management efficiency giving good results on yield factor also. Use of such product in large scale under dryland cultivation of food crops in India paves way for ease in disease management at single go for long term.

CONCLUSION

The study demonstrates that seed treatment with Fluxapyroxad FS @ 1.5 g/kg followed by foliar sprays with Fluopyram 17.7% + Tebuconazole 17.7% (400 SC) @ 1 ml/L effectively manages powdery mildew and *Alternariaster* leaf spot diseases in sunflower across multiple Kharif seasons. This treatment consistently recorded the lowest disease incidence and severity, outperforming other fungicide combinations. Additionally, the highest seed yields were obtained with this treatment, indicating its efficiency in disease control without negatively impacting crop yield. Two foliar sprays at a fortnight interval were sufficient to manage these diseases under humid weather conditions. Further research could explore the long-term sustainability and environmental impact of these fungicide treatments. Additionally, integrating these chemical treatments with other disease management practices, such as biological control and resistant sunflower varieties, could enhance overall disease management and reduce dependency on chemical fungicides.

ETHICAL STATEMENT

All the experimental procedures involving only on plant species were conducted following the University of Agricultural Science, Bangalore institutional guidelines. There are no human and animal subjects/trials conducted in this article and informed consent is not applicable.

REFERENCES

1. Gulya TJ, Rashid KY, Masirevic SM. Sunflower diseases, Sunflower Technology and Production. Agron. Monogr.35, ASA, CSSA, and SSSA, Madison, WI, 1997; 21–65.
2. Tubaki K, Nishihara N. Alternaria helianthi (Hansf.) comb. nov. Trans Br Mycol Soc, 1969; 53: 147–149.
3. Allen SJ, Brown JF, Kochman JK. Effect of temperature, dew period and light on the growth and development of Alternaria helianthi. Phytopathol, 1983; 73: 893-896.
4. Shankergoud I, Shadakshari YG, Parameshwarappa KG, Chandranath HT, Katti P, Mesta RK. Sunflower and castor research in Karnataka-an overview. University of Agricultural Sciences, Dharwad, 2006; 41.

5. Baiswar P, Kumar R, Chandra S, Ngachan SV. First report of powdery mildew on Mexican sunflower in India. 2009.

6. Rao SC, Sujatha M, Karuna K, Varaprasad K. Powdery mildew disease in sunflower: A review. The Indian Society of Oilseeds Research, 2006; p. 111.

7. Dinesh B, Kulkarni S, Harlapur SI, Benagi VI, Mallapur CP. Karnataka J Agric. Sci., 2010; 23: 521–523.

8. Karuna K, Jagadish KS, Geetha KN, Shadakshari YG. Evaluation of efficacy of chemical fungicides and a plant product for the management of Alternaria blight of sunflower. Indian Phytopath, 2012; 65: 305-306.

9. Reddy KP, Rao SC, Kirti PB, Sujatha M. Development of a scoring scale for powdery mildew (Golovinomycescichoracearum (DC.) VP Heluta) disease and identification of resistance sources in cultivated and wild sunflowers. Euphytica, 2013; 190: 385-399.

10. Zimmer DE, Hoes JA. Diseases. In: Carter JF (ed) Sunflower Science and Technology. Agronomy Monograph, 1978; 19: 225-262. ASA, CSSA, and SSSA, Madison, WI.

11. Kolte SJ. Sunflower diseases, Diseases of Annual Edible Oilseeds Crops, III, CRC Press, Florida, 1985; 194 pp.

12. Vagelas I, Cavalaris C, Karapetsi L, Koukidis C, Servis D, Madesis P. Protective effects of Systiva® seed treatment fungicide for the control of winter wheat foliar diseases caused at early stages due to climate change. Agronomy, 2022; 12(9): 2000.

13. Avenot HF, van den Biggelaar H, Morgan DP, Michailides TJ. Fungicidal activity of fluopyram for suppression of Alternaria species pathogenic on California pistachio. Resistant Pest Management Newsletter, Fall 2012; 22(1): 10-14.

14. Verma S, Khosla K. Chemical management of marssonina leaf blotch and alternaria leaf spot diseases of apple in Himachal Pradesh. International Journal of Chemical Studies, 2018; 6(4): 3316-3319.

15. Patil PD, Raut RA, Karande RA, Haldavanekar PC. Bio-efficacy and

phytotoxicity study of fungicide fluopyram 200+ tebuconazole 200–400SC against powdery mildew and postharvest diseases of mango. Int J Chem Stud, 2017; 5: 667-670.

16. Arici ŞE, Özkaya R. Evaluation of biofungicides in the control against powdery mildew disease [Leveillulataurica (Lev.) Arm.] in pepper. KahramanmaraşSütçü İmam ÜniversitesiTarımveDoğaDergisi, 2022; 25(2): 274-281.

Table 1: Severity of Powdery Mildew Disease Measured by Percentage Leaf Area Coverage and Visual Rating Scale (0-9) on Upper Portion of Leaves

Score	Reaction	Leafareacovered
0	Immune	Nosymptomsontheleaf
1	Highlyresistant (HR)	Small,circular,scatteredbrownspotscovering1%orless oftheleafarea
3	Resistant(R)	Spotsenlarging,darkbrownincolourcovering1-10%of leafarea
5	Moderately resistant/ Moderatelysusceptible (MR/MS)	Spotsenlarging,darkbrownincolour,targetlikeappearance covering11-25%of leafarea
7	Susceptible(S)	Spotsdarkbrown,coalescingwithtargetlikeappearance covering26-50%of leafarea
9	Highlysusceptible (HS)	Spotsuniformlydarkbrown,coalescingcovering51%or aboveofleaf area

Table 2: Powdery Mildew Severity Scoring System Based on Leaf Area Coverage and Disease Reaction

Score	Reaction	Leafareacovered
0	Immune	Nosymptomsontheleaf
1	Highlyresistant (HR)	Powderymildewspeckscovering1%or lessleafarea.
3	Resistant(R)	Powderylesionscovering1-10%of leaf area.
5	Moderately resistant/ Moderatelysusceptible (MR/MS)	Enlargedpowderylesionscovering11-25%ofleaf area.
7	Susceptible(S)	Powderylesionscoalescetoformbigpatchescovering 26-50%ofleaf area.
9	Highlysusceptible (HS)	Powderypatchescovering:51%ormoreofleafarea anddefoliationoccur

Table 3: Effect of Different Fungicide Treatments on *Alternariaster* Leaf Spot, Powdery Mildew, Seed Yield, and Benefit-Cost Ratio in Sunflower (During *Kharif* 2021)

Trt. No.	**Treatment**	***Alternariaster* leaf spot (%)**	**Powdery mildew** (%)	**Seed yield (Kg/ha)**	**B:C ratio**
T_1	Seed treatment with fluxapyroxad FS @ 1.5g/kg seed followed by foliar sprays with fluopyram 17.7%+ tebuconazole17.7% (400 SC) @ 1 ml/L (First spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	7.36	4.52	2153	0.74
T_2	Seed treatment with fluxapyroxad FS @ 1.5g/kg seed followed by foliar sprays with azoxystrobin 18.2% + difenconazole 11.4% SC @1ml /L (First spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	11.23	16.8	2113	0.73
T_3	Seed treatment with fluxapyroxad FS @ 1.5g/kg seed followed by foliar sprays with boscalid 25.2% + pyraclostrobin 12.8% WG @ 1g/L (First spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	12.29	9.42	2010	0.70
T_4	Seed treatment with fluxapyroxad FS @ 1.5g/kg seed followed by foliar spray with dimethomorph 12% + pyraclostrobin 6.7% @1.5 g/L (First spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	18.75	11.52	2197	0.68
T_5	Seed treatment with fluxapyroxad FS @ 1.5g/kg seed followed by foliar spray with picoxystrobin 7.05%+ propiconazole 11.71% SC @ 2 g/L (First spray at the onset of incidence or 45 days	14.68	10.1	1973	0.71

	after sowing and second spray 15 days after 1st spray)				
T_6	Seed treatment with fluxapyroxad FS @ 1.5g/kg seed followed by foliar sprays with myclobutanil 10% WP @ 0.5 g /L (First spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	20.42	7.19	1865	0.68
T_7	Control	23.98	22.12	1688	-
	CV(%)	5.66	2.19	12.56	
	SEm+/-	0.98	0.73	0.745	
	CD@5%	0.507	9.93	1.439	

Table 4: Effect of Different Fungicide Treatments on *Alternariaster* Leaf Spot, Powdery Mildew, Seed Yield, and Benefit-Cost Ratio in Sunflower (During *Kharif* 2022)

Treatments		**Powdery mildew *(%)***	***Alternariaster* leaf spot (%)**	**Seed yield (kg/ha)**	**B:C ratio**
T_1	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays with Fluopyram 17.7%+ Tebuconazole17.7% (400 SC) @ 1 ml/L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	7.39 (15.68)	4.28 (11.89)	2124.67 (46.10)	0.85
T_2	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays with Azoxystrobin 18.2% + Difenconazole 11.4% SC @1ml /L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	14.72 (22.48)	9.32 (17.75)	2096.33 (45.79)	0.81
T_3	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays with	21.19	18.60	2036.67	0.64

	Boscalid 25.2% + Pyraclostrobin 12.8% WG @ 1g/L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	(27.40)	(25.54)	(45.13)	
T_4	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar spray with Dimethomorph 12% + Pyraclostrobin 6.7% @1.5 g/L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	20.80 (27.12)	19.64 (26.31)	2011.33 (44.85)	0.68
T_5	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar spray with Picoxystrobin 7.05%+ Propiconazole 11.71% SC @ 2 g/L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	15.75 (23.35)	16.97 (24.31)	2066.67 (45.47)	0.80
T_6	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays with Myclobutanil 10% WP @ 0.5 g /L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	9.49 (19.77)	12.33 (20.51)	2068.33 (45.48)	0.79
T_7	Control	28.79 (30.52)	25.19 (30.10)	1873.33 (43.28)	
	CV (%)	8.538	7.77	17.168	
	CD @ 5%	2.532	2.137	96.783	
	Sem (+/-)	0.896	0.744	38.584	

Table 5: Effect of Different Fungicide Treatments on *Alternariaster* Leaf Spot, Powdery Mildew, Seed Yield, and Benefit-Cost Ratio in Sunflower (During *Kharif* 2023)

Treatments		**Powdery mildew *(%)***	***Alternariaster* leaf spot (%)**	**Seed yield (kg/ha)**	**B:C ratio**
T_1	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays with Fluopyram 17.7%+ Tebuconazole17.7% (400 SC) @ 1 ml/L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	2.95 (9.86)	7.66 (16.02)	2157.33 (46.10)	0.90
T_2	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays with Azoxystrobin 18.2% + Difenconazole 11.4% SC @1ml /L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	6.66 (14.92)	9.47 (17.81)	2119.67 (45.79)	0.86
T_3	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays with Boscalid 25.2% + Pyraclostrobin 12.8% WG @ 1g/L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	17.44 (24.65)	16.63 (24.03)	2049.33 (45.13)	0.63
T_4	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar spray with Dimethomorph 12% + Pyraclostrobin 6.7% @1.5 g/L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	20.14 (26.65)	20.95 (27.23)	2027.33 (44.85)	0.65
T_5	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar spray with Picoxystrobin 7.05%+ Propiconazole 11.71% SC @ 2 g/L (first spray at the onset of incidence or 45 days after sowing	12.42 (20.58)	15.70 (23.28)	2076.67 (45.47)	0.71

	and second spray 15 days after 1st spray)				
T_6	Seed treatment with Fluxapyroxad FS @ 1.5 g/kg seed followed by foliar sprays with Myclobutanil 10% WP @ 0.5 g /L (first spray at the onset of incidence or 45 days after sowing and second spray 15 days after 1st spray)	4.69 (12.41)	22.07 (28.01)	2105.00 (45.48)	0.84
T_7	Control	27.99 (31.93)	30.93 (33.78)	1938.33 (43.28)	
	CV (%)	6.835	10.452	16.802	
	CD @ 5%	1.910	3.019	152.488	
	Sem (+/-)	0.678	1.046	53.074	

Note: values in parenthesis are arcsin transformed