

Ilyass Maafa<sup>1,2,3\*</sup>, Fatiha Bentata<sup>2</sup>, Mustapha Labhilili<sup>2</sup>, Seïd Ahmed Kemal<sup>3</sup>, Aïcha El Aïssami<sup>1</sup>

<sup>1</sup> Research Center in Plant and Microbial Biotechnologies, Biodiversity and Environment, Faculty of Sciences, Mohammed V University of Rabat, Rabat 10106, Morocco.

<sup>2</sup> Research Unit of Plant Breeding and Conservation of Plant Genetic Resources, National Institute for Agricultural Research, Rabat 10101, Morocco.

<sup>3</sup> International Center for Agricultural Research in the Dry Areas (ICARDA), Agdal, Rabat 10080, Morocco

## Introduction

Septoria tritici blotch (STB) caused by *Zymoseptoria tritici*, is one of the devastating foliar diseases on bread and durum wheat production in Morocco. It causes up to 50% yield losses where susceptible wheat varieties are grown under weather conditions conducive to STB development. Farmers integrate growing moderately resistant varieties with additional sprays with fungicides. There are reports of *Z. tritici* isolates resistant to quinone outside inhibitor (QoIs) : a widely used group of fungicides in wheat disease management (1 & 2). The continuous virulence evolution of *Z. tritici* populations leads to losses of resistance in popular wheat varieties. The objective of this study was to assess if there are changes in the resistance of Moroccan wheat varieties released between 1982-2003 to the current field pathogen populations.



## Materials and Methods

**Wheat varieties:** 25 Durum and 15 bread wheat varieties released from 1982-2003 in Moroccan were evaluated under field conditions. Trials were planted in randomized complete block design with four replications for three consecutive growing seasons (2016 to 2018) at Sidi Allal Tazi (AT), Sidi El Aidi (SEA) and Merchouch (MCH) research stations.

**Disease assessments:** Disease severity was assessed using double digit scale (00-99): The first digit (D1) indicates disease progress in plant height, and the second digit (D2) refers to severity measured as diseased leaf area.

## Results

Analysis of variance indicated the presence of significant ( $P < 0.05$ ) interaction of seasons, locations and wheat varieties for both types.

Table 1 : ANOVA for Durum varieties

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Year	2	2860.09	1430.04	19.54	<.001
Location	2	87094.89	43547.44	595.16	<.001
Var	24	36465.77	1519.41	20.77	<.001
Year.Location	4	3735.99	934.00	12.76	<.001
Year.Var	48	1141.75	23.79	0.33	1.000
Location.Var	48	8696.11	181.17	2.48	<.001
Year.Location.Var	96	3155.85	32.87	0.45	1.000

Table 2 : ANOVA for Bread wheat varieties

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Year	2	23433.64	11716.82	449.98	<.001
Location	2	5455.01	2727.51	104.75	<.001
Var	14	9653.01	689.50	26.48	<.001
Year.Location	4	4300.44	1075.11	41.29	<.001
Year.Var	28	768.41	27.44	1.05	0.393
Location.Var	28	1070.21	38.22	1.47	0.061
Year.Location.Var	56	1864.67	33.30	1.28	0.096

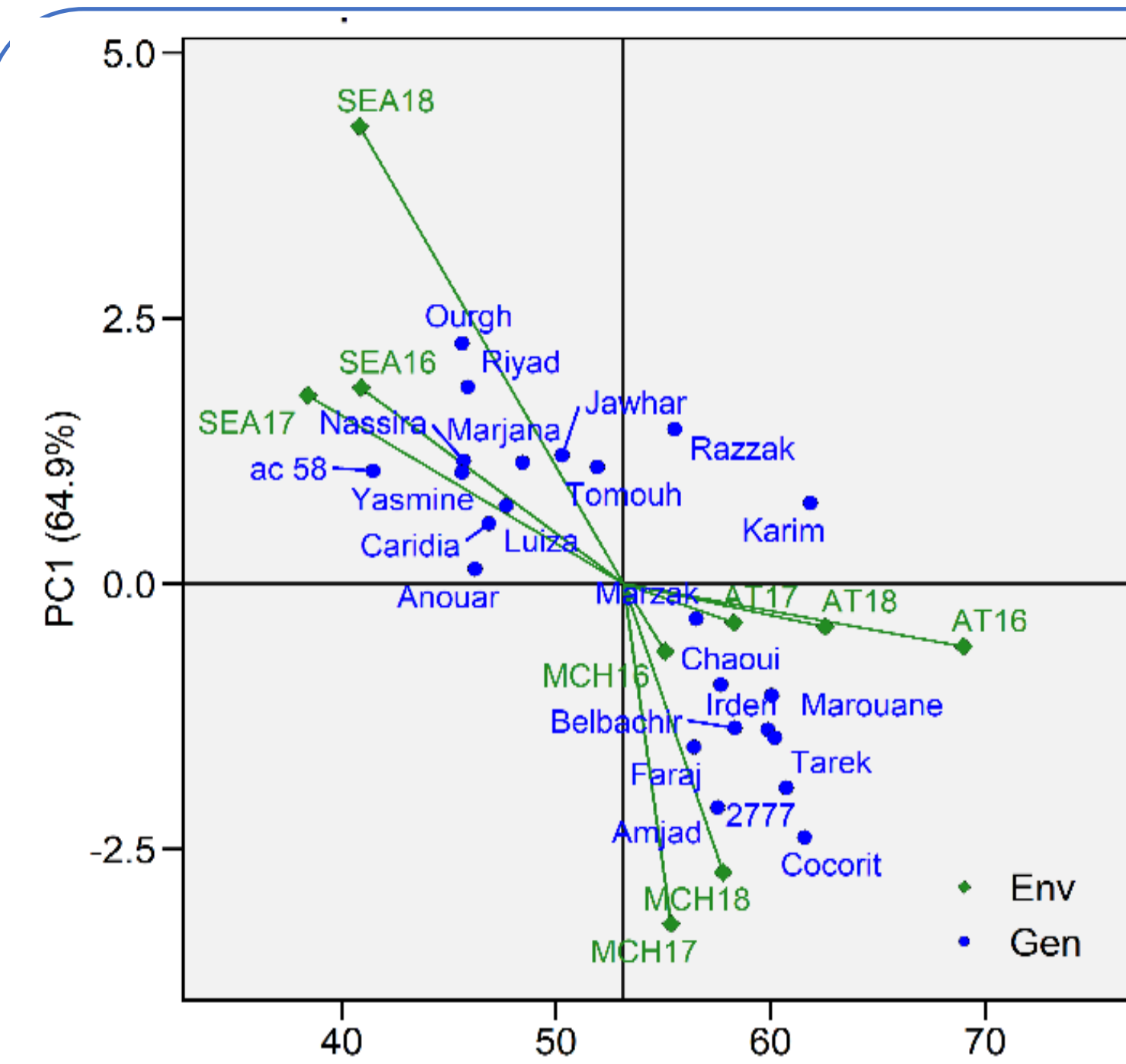


Fig. 1a : Biplot AMMI 1 illustrated the Severity main effect and first principal component (PC1) effects of both genotype and environment of 25 Durum varieties

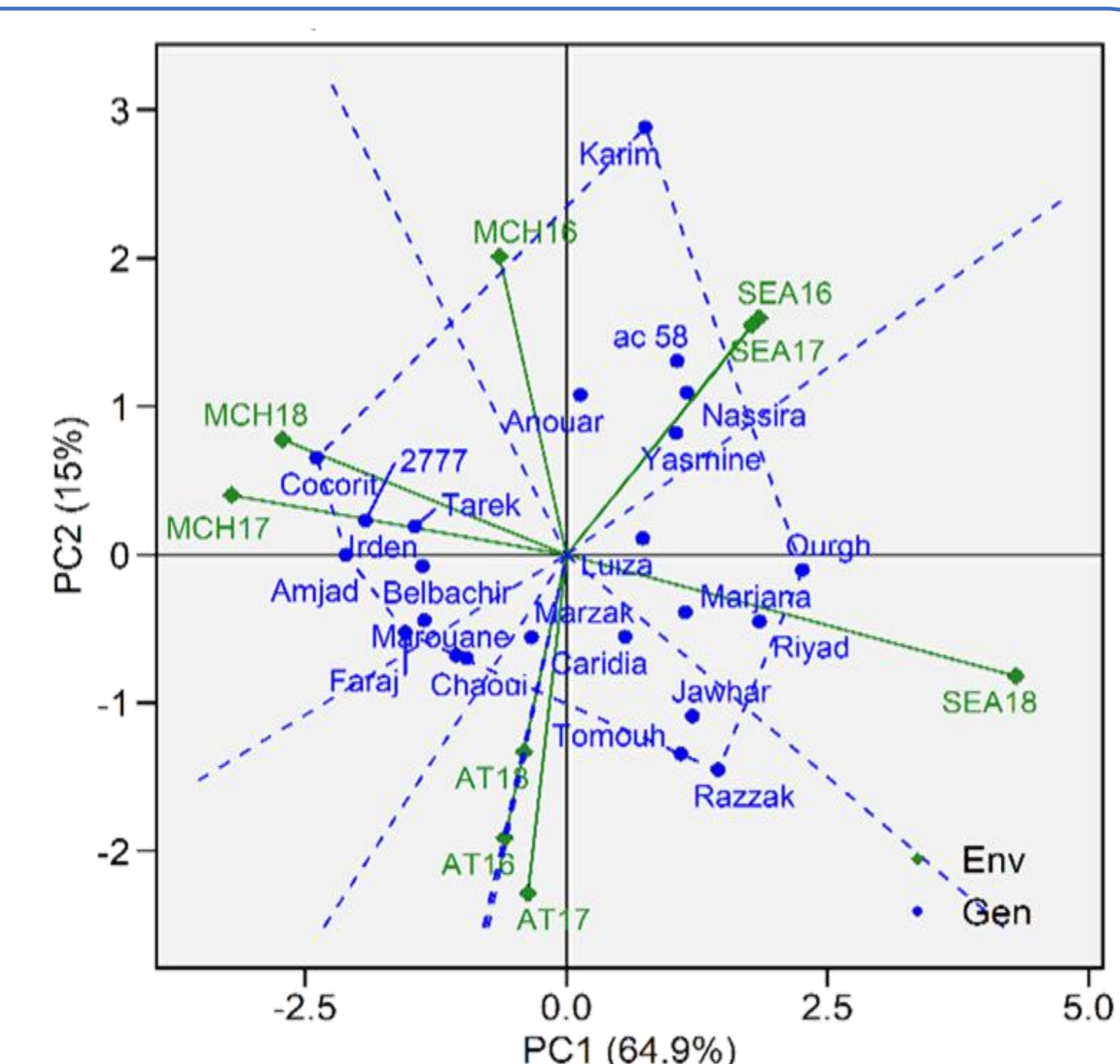


Fig. 1b: Biplot AMMI 2 illustrated the first two principal components (PC1 and PC2) effects of genotypes plus GE interaction effect of 25 Durum varieties

- Disease severity was higher in AT as compared to other stations. (Fig. 1a,b)
- Durum varieties Karim and Cocorit were highly susceptible in all locations and seasons.
- Varieties Luiza, Faraj and Irden remained moderately resistant over seasons and locations.

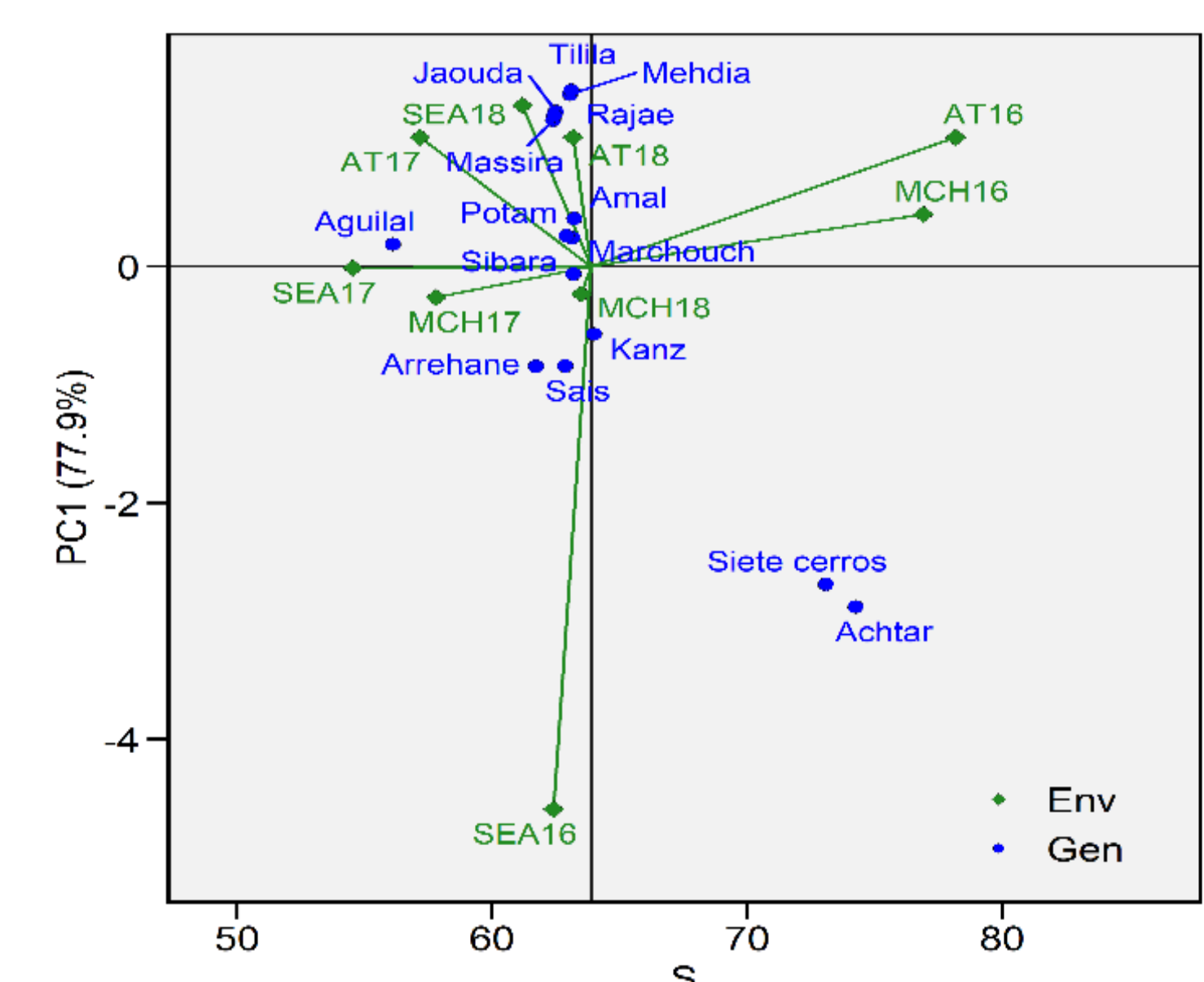


Fig. 2a: Biplot AMMI 1 illustrated the Severity main effect and first principal component (PC1) effects of both genotype and environment of 15 Bread wheat varieties

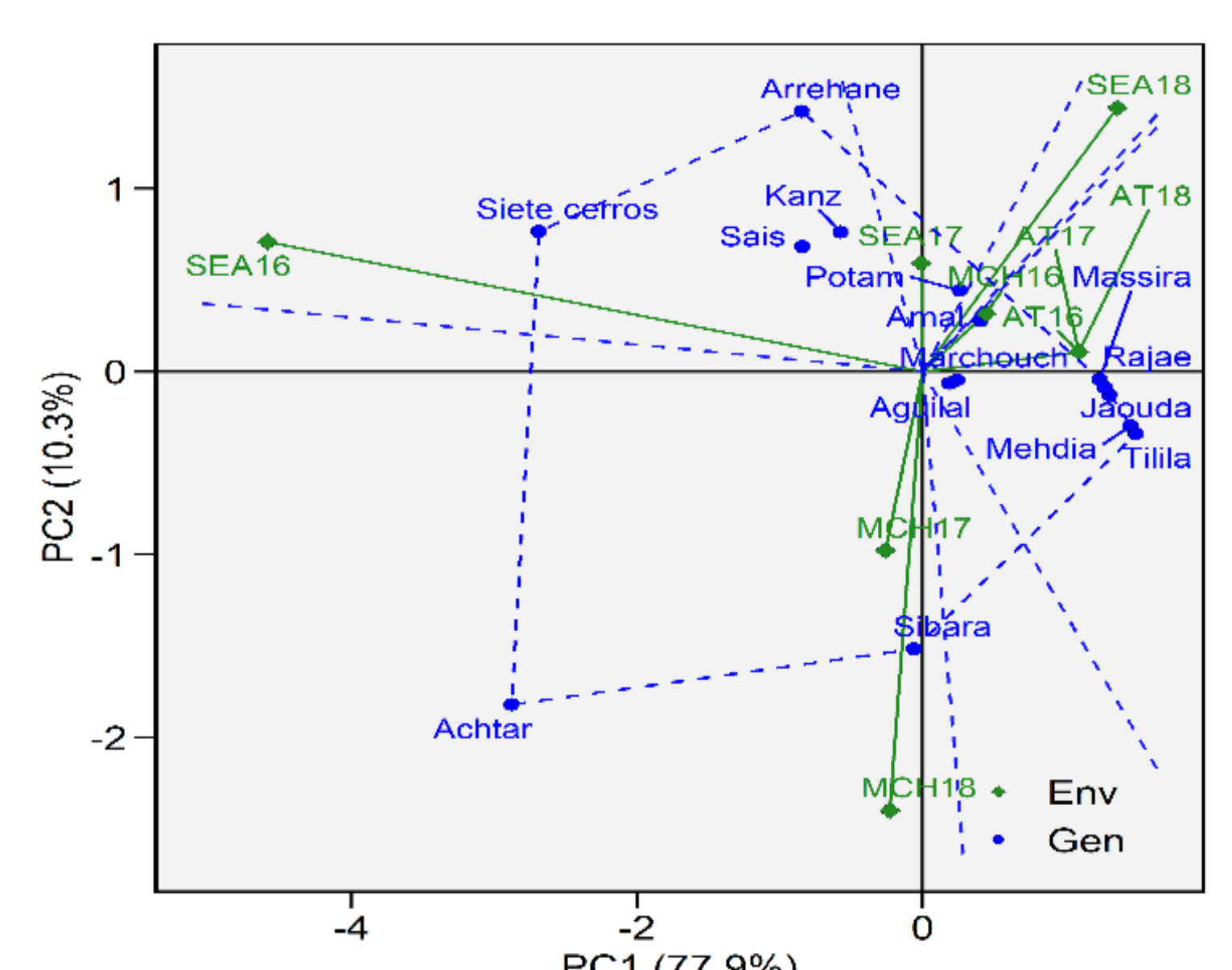


Fig. 2b: Biplot AMMI 2 illustrated the first two principal components (PC1 and PC2) effects of genotypes plus GE interaction effect of 15 Bread wheat varieties

- Bread wheat varieties Achtar and Siete cerros showed high susceptibility in all locations and seasons ( Fig. 2a,b).
- Arrehane and Aguila varieties were moderately resistant to STB across locations and years.

## Conclusion

- Bread wheat varieties were more susceptible than durum in all locations and seasons
- The popular moderately resistant bread wheat (Achtar) and durum (Karim) varieties were highly susceptible across locations and seasons.
- More efforts should be done to develop bread and durum wheat varieties resistant to the current virulent population of *Z. tritici*.
- Sidi Allal Tazi station can be a testing site of breeding lines of bread and durum wheat.

## References

- (1) Siah et al. 2014. QoI resistance and mitochondrial genetic structure of *Zymoseptoria tritici* in Morocco *Plant Disease*, DOI: <http://dx.doi.org/10.1094/PDIS-10-13-1057-RE>
- (2) Chedli et al. 2020. Screening for resistance of Tunisian, Moroccan and Algerian wheat cultivars to *Zymoseptoria tritici* in Northern Tunisia . *Journal of Plant Pathology*, DOI: <http://dx.doi.org/10.1007/s42161-020-00563-w>