CAIGE Project 2013-2018 Enhanced delivery of CIMMYT germplasm to Australia:

Wheat Germplasm sent in 2014

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Outputs

- Delivery of elite new wheat lines selected from International Yield Trials and Nurseries, wheat lines selected by Australian wheat breeders during CAIGE visits, and associated data

- Delivery of all special trait germplasm developed under the CIMMYT-GRDC Strategic Alliance Project agreements and associated data

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Milestones

- Annually, 120 new CIMMYT elite germplasm selected from International Trials and Nurseries sent to Australia
- Special trait germplasm developed under various CIMMYT-GRDC Strategic Alliance Projects sent to Australia
- Export of various Australian wheat germplasm to CIMMYT (Mexico/Kenya/Turkey) for utilization by the CIMMYT-GRDC Strategic Alliance Projects
- All phenotypic and genotypic data for the materials delivered to Australia
- Data generated by CIMMYT on Australian wheat germplasm included under various CIMMYT-GRDC Strategic Alliance Projects made available

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Mexico based scientists who contributed to the project in 2014

- **Bread Wheat Improvement and Rust Research group:**
  - **Ravi Singh- Head (Breeding and disease resistance)**
  - **Julio Huerta, Enrique Autrique (Breeding in general)**
  - **Suchismita Mondal (Drought and heat tolerance physiology)**
  - **Govindan Velu and Yuanfeng Hao (Breeding for enhanced Zn and Fe)**
  - **Caixia Lan and Bhoja Basnet (Rusts)**

- **Pathology group:**
  - **Pawan Singh and Xinyao He (STB, SNB, Yellow Spot, Spot Blotch, FHB, KB)**

- **Quality group: Carlos Guzman (end-use quality analysis)**

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Elite lines sent to Australia in 2014

Total 311 lines sent in 2014:

- **166 from International Trials and Nurseries**
- **94 additional lines selected by Aust. Breeders that did not enter in international trials/nurseries**
  - ***125 derived from Mexico-Kenya shuttle***
- **17 lines from Crossing Block that were not sent to Australia previously**
- **34 lines with special traits (*Rht5*, *Rht13B* and high Zn)**

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Elite lines sent to Australia in 2014-Data

- A combined data file for materials sent in 2014 provided to CAIGE coordinator
- Grain yield performance data from six environments (optimally irrigated- flat & bed plantings; high & intermediate drought stress; early and late sown heat stress) in Obregon 2013-14
- Agronomic data- heading, maturity, height, visual scoring
- Phenotypic data for stem rust (Ug99) along with gene postulation, Yellow Rust (Mexico, Kenya, India), Leaf Rust, Septoria tritici, Spot Blotch, Fusarium Head Scab (FHB), Karnal Bunt
- Kernel weight, Test weight & detailed end-use quality data
- GBS marker data also available and can be provided on request

Next slides give summary of selected traits

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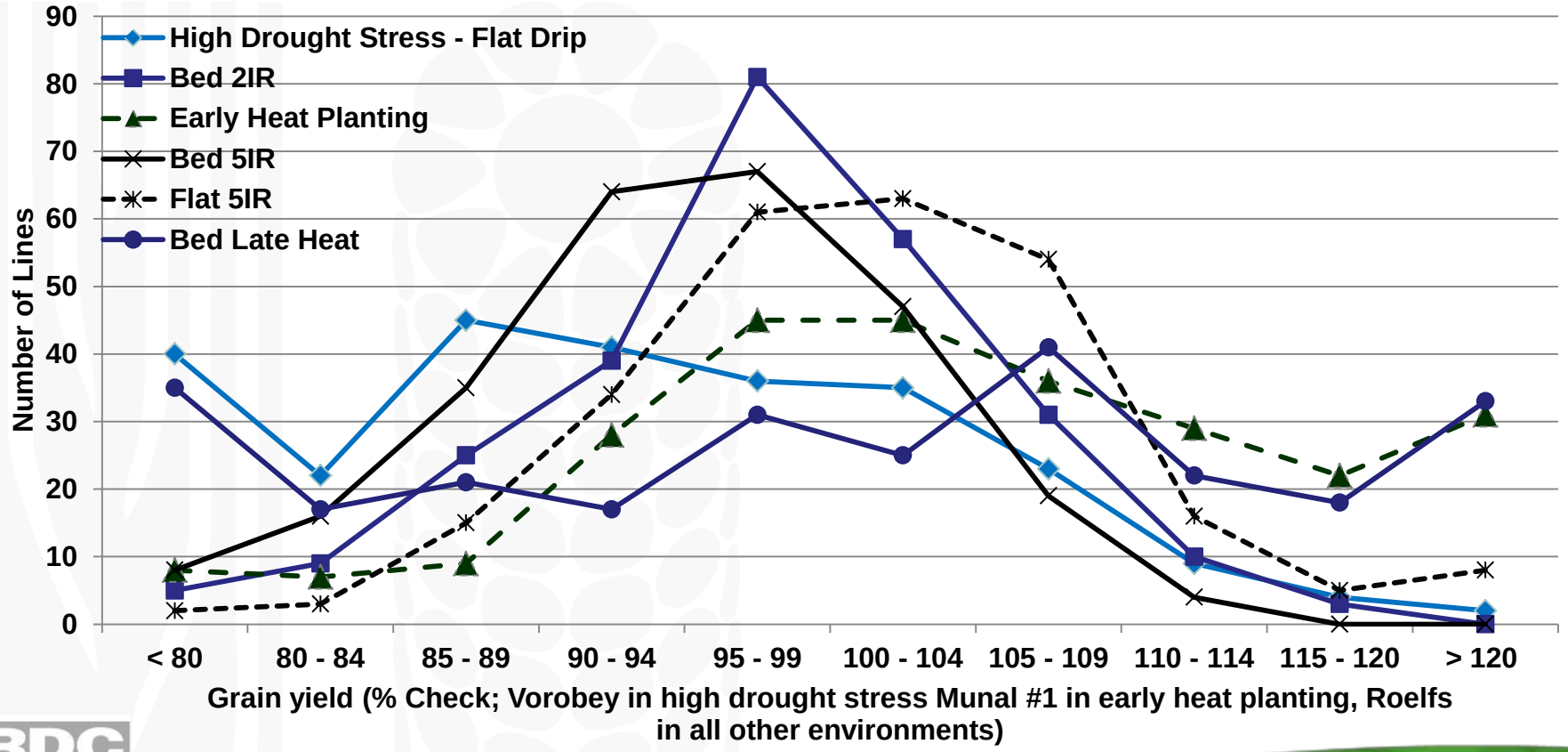
Grain yields of 260 lines under six environments, Cd. Obregon 2013-2014

Many lines had significantly higher yields than checks



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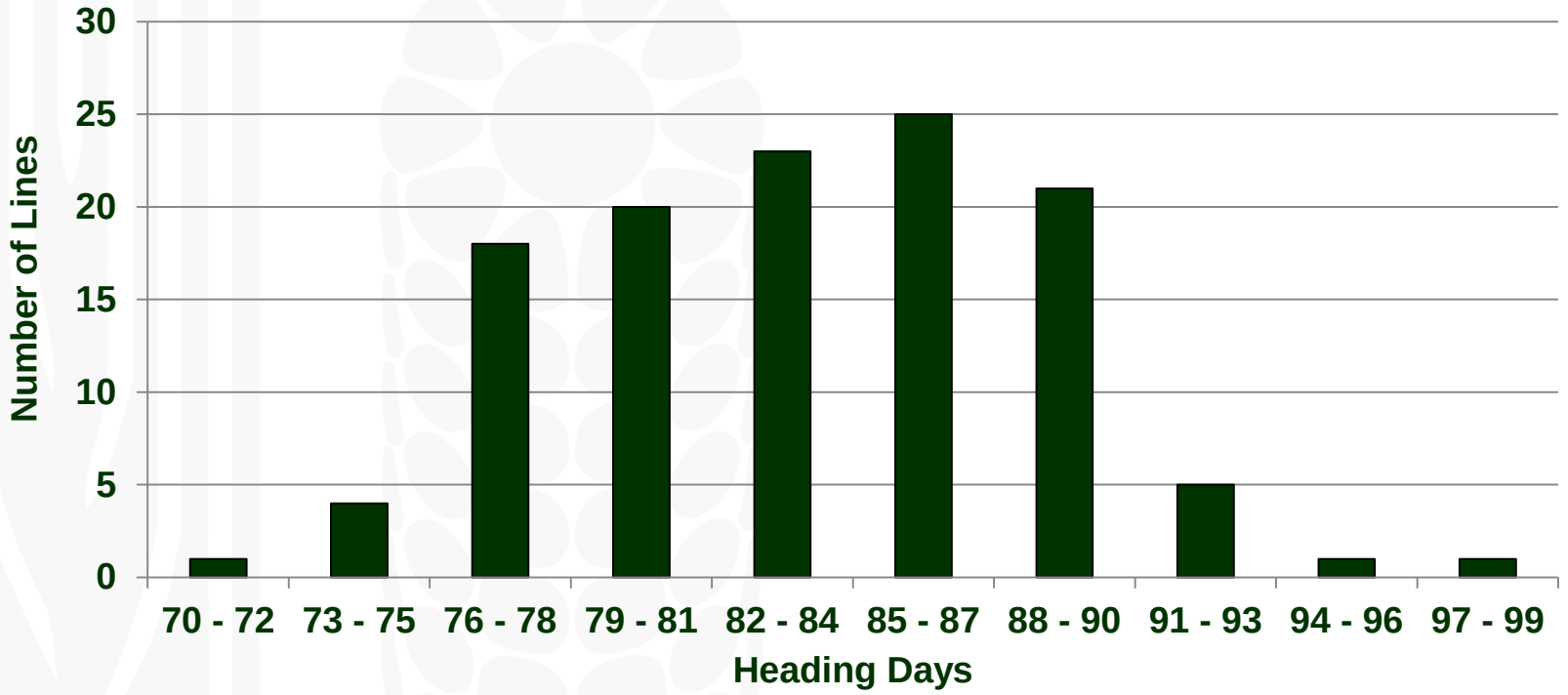
Heading variation in 260 entries

(mean 3 environments, Cd. Obregon 2013-14)

29 days variation in days to heading



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Ug99 resistance of 267 entries, Kenya 2013 & 2014 (Main and off-seasons)

(evaluated when susceptible check Cacuke had necrotic plants following 100 S severity)

70% entries possessed APR and diversity for at least nine race-specific resistance genes

Resistance category	Maximum SR severity (%)	Entries (No.)	Entries (%)	Race-specific genes	Entries (No.)	Entries (%)
Adult plant (acceptable levels):				*Sr13*	5	1.9
Resistant (R)	1-10	9	3.4	*Sr25*	5	1.9
Resistant-Mod. Resistant (R-MR)	15-20	40	15.0	*Sha7&SrTmp*	6	2.2
Moderately Resistant (MR)	30	79	29.6	*SrYanac*	1	0.4
Mod. Res.-Mod. Sus. (MR-MS)	40	53	19.9	*Sr1A.1R*	1	0.4
				SrND643	2	0.7
Inadequate resistance				*SrHuw234*	10	3.7
Moderately Susceptible (MS)	50-60	40	15.0	*SrBau*	15	5.6
				SrTnmu	1	0.4

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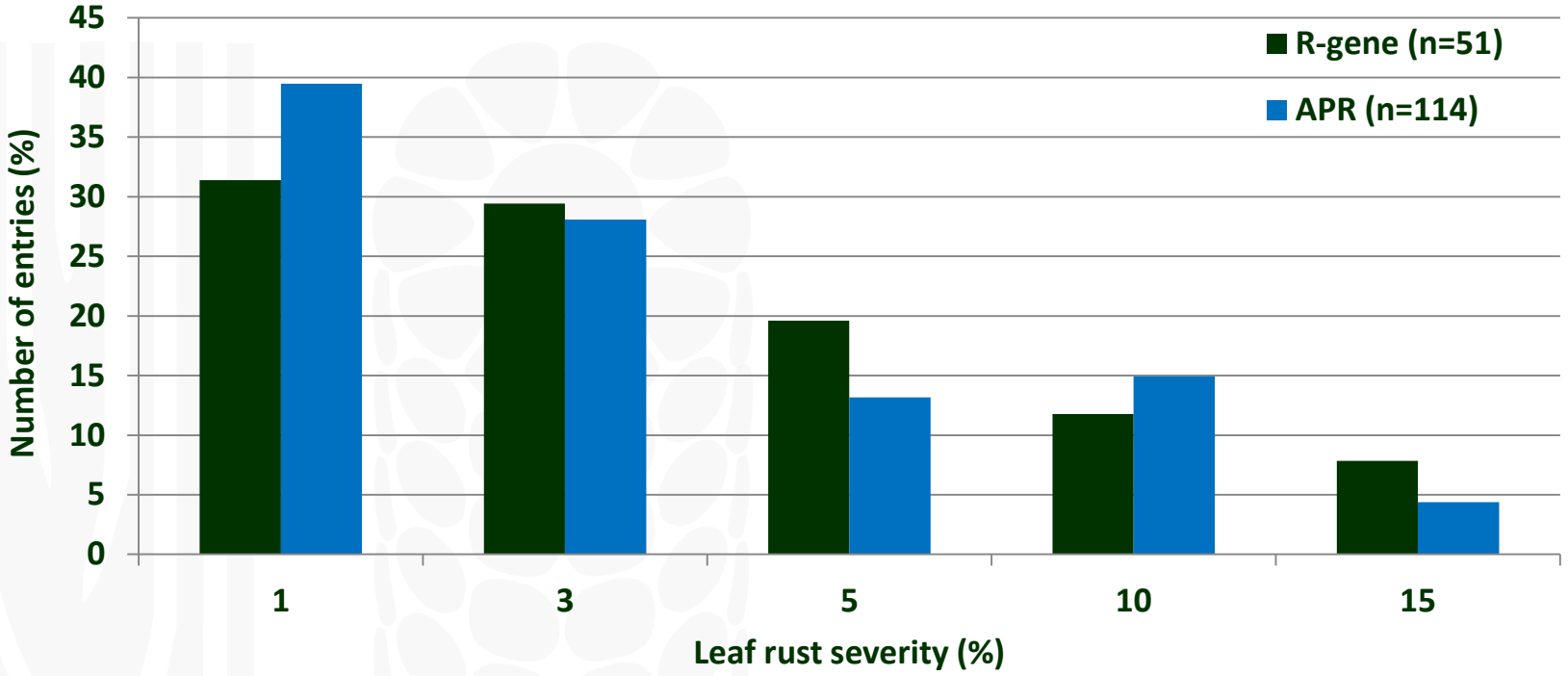
Leaf rust resistance in 51 entries with race-specific resistance genes & 114 with APR (Mean disease severity El Batan 2013 and 2014)

(Data recorded when leaves of susceptible checks became necrotic due to leaf rust)



High levels of leaf rust resistance and no difference in leaf rust severity distribution for entries with APR versus R-genes

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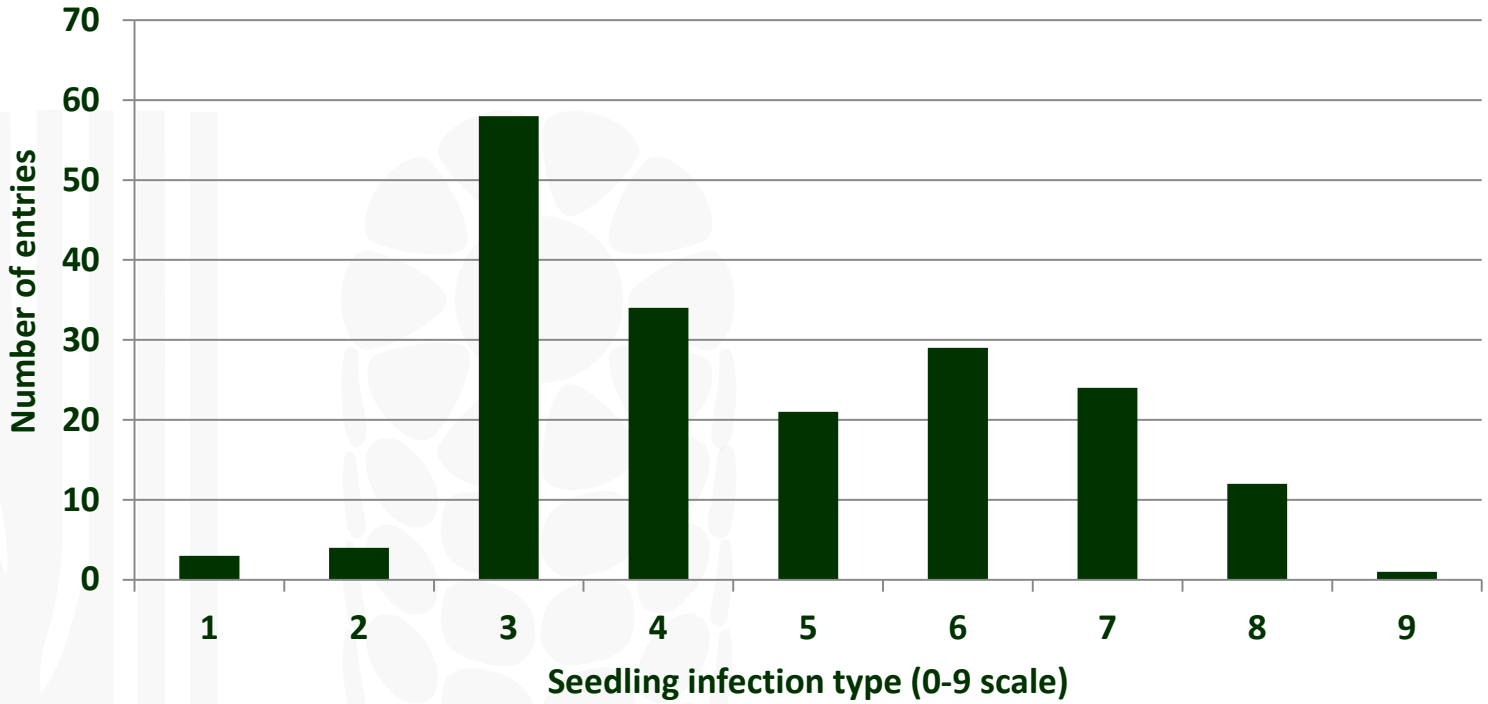
Yellow rust responses of 162 entries in seedling tests in greenhouse with aggressive *Yr31* virulent Mexican isolate Mex08.13



Seedling infection type shows a continuous variation indicating good diversity

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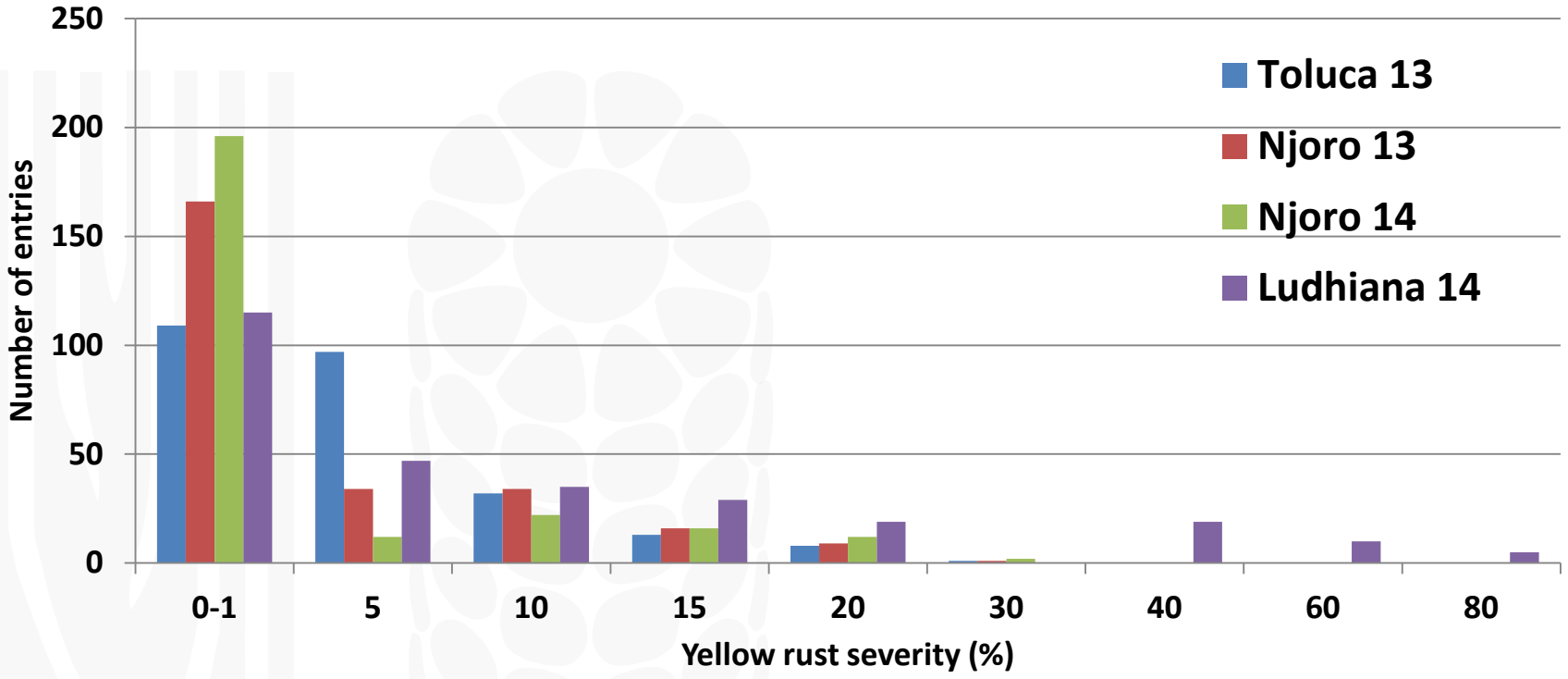
Yellow rust responses of 260 entries with at Toluca (Mexico), Njoro (Kenya) and Ludhiana (India)

(data recorded when susceptible checks had dead leaves following 100% YR severity)



A majority of entries have high to adequate resistance to aggressive (WA type) pathotypes in Mexico, Kenya and India

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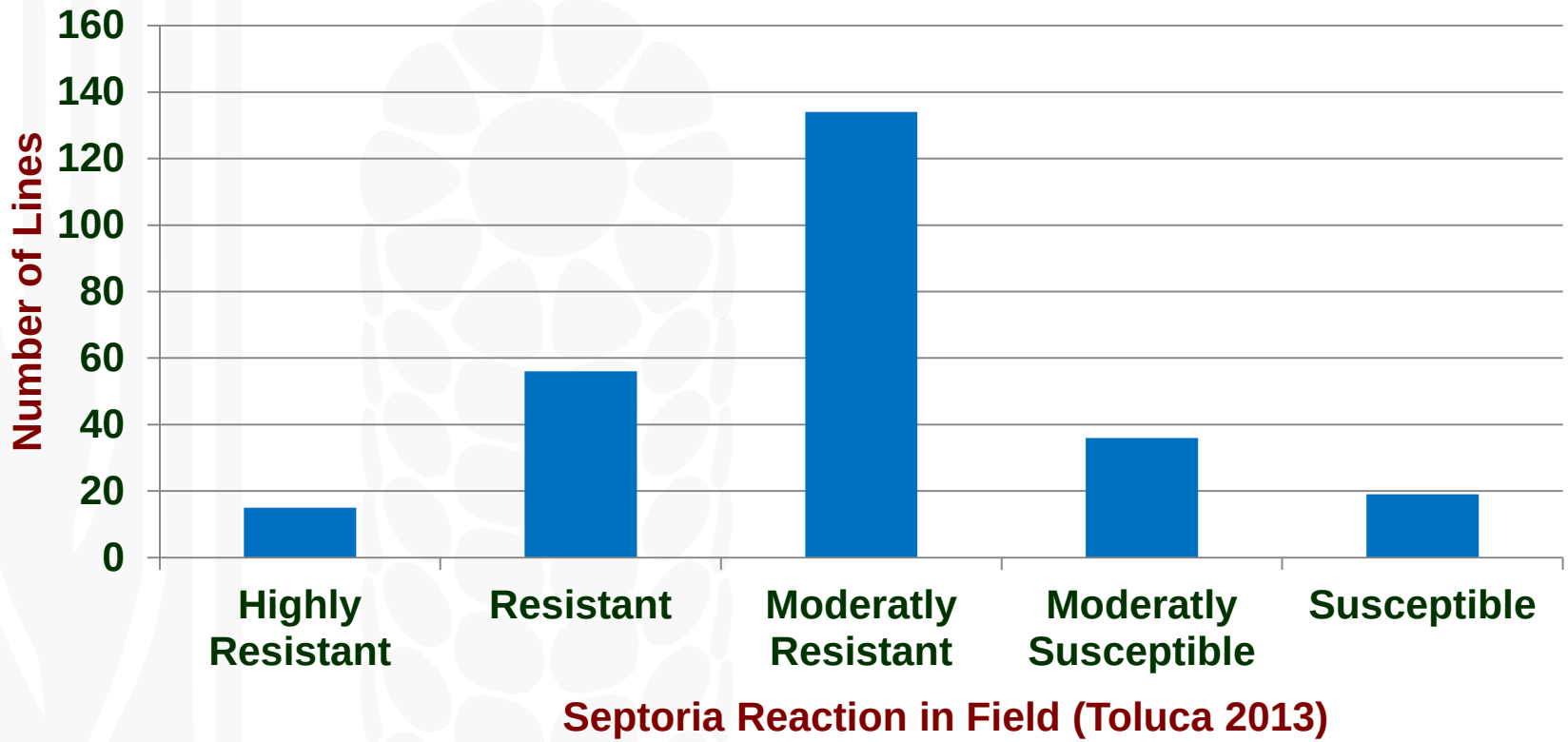
Septoria tritici blotch resistance in 260 entries

Large proportion of entries show high to moderate resistance in Mexico

Sources of resistance diverse, include synthetic wheats and mostly quantitative



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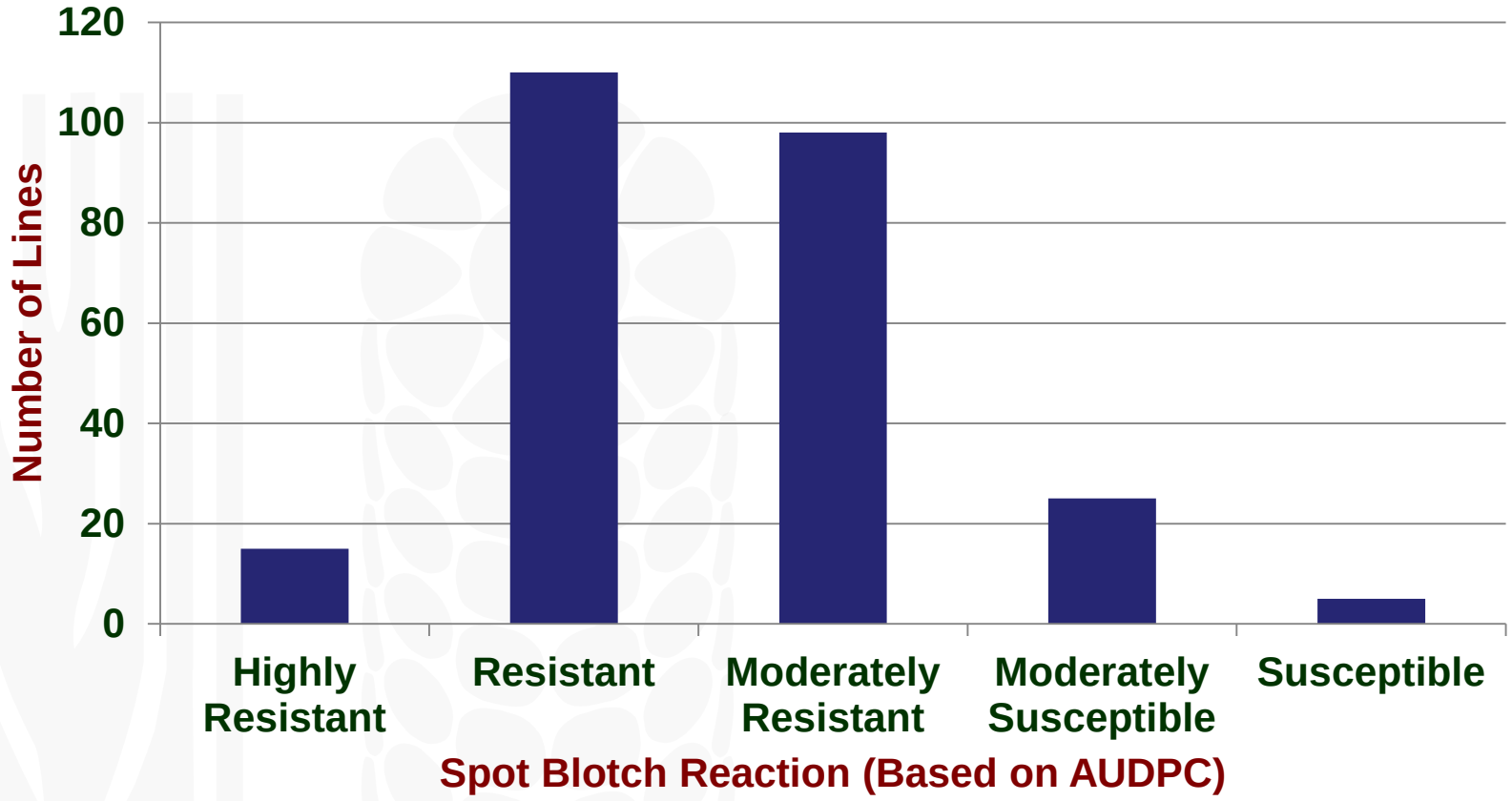
Spot Blotch Resistance in 260 Entries

Many resistant & moderately resistant entries based on adult plant evaluation in Agua Fria 2013-2014



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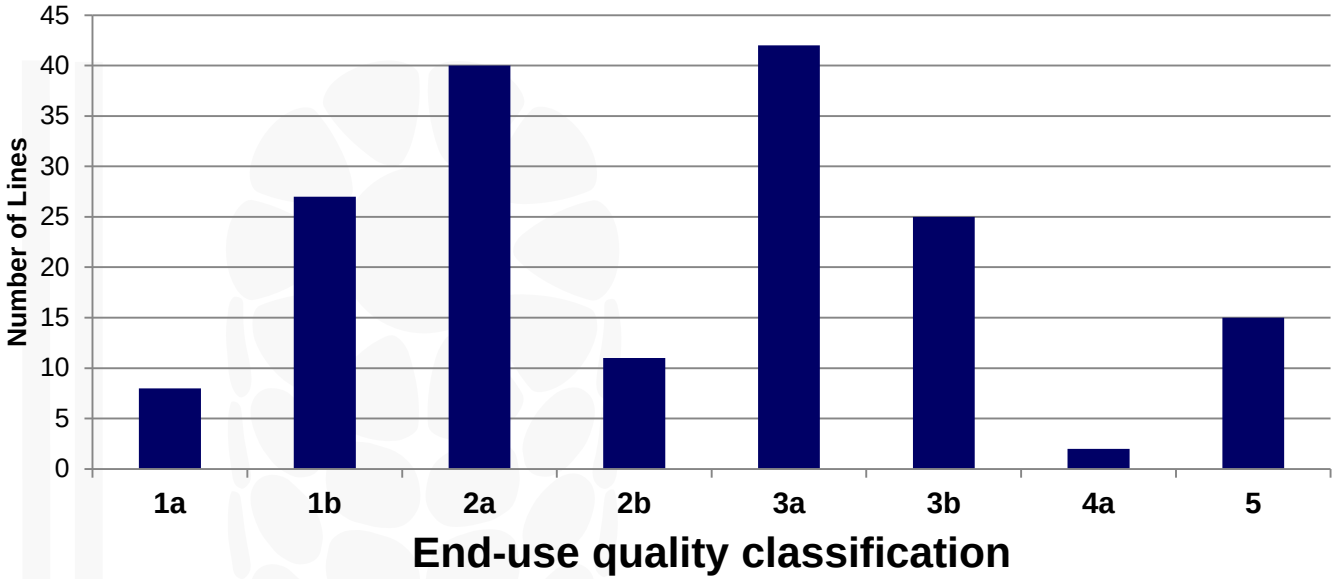
End-use quality (CIMMYT classification) of 170 entries grown under optimally irrigated environment in Obregon 2013-14

Quality profile significantly increased in new germplasm



- **Most entries either good for industrial or flat bread products (quality types 1a-4a).**
- **Very significant reduction in tenacious wheat types (quality type 5) in new germplasm (only 15% entries)**

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Conclusion

- Exchange of germplasm and information is going well under CAIGE project
- Significant progress towards enhancing grain yields under irrigated, drought and heat stress environments is evident
- Good progress in building APR to Ug99 stem rust. New diversity for race-specific resistance genes also incorporated.
- Stripe rust, leaf rust and resistance to various leaf spotting diseases significantly enhanced
- End-use quality improved in new germplasm, which should aid the utilization of CIMMYT germplasm by Australian breeding programs

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