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Contribution to the inventory of Acarofauna, Entomofauna and Nematofauna of imported or local cereals in Senegal

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Abstract

This study was conducted during the period from December 2021 to February 2022 in the Dakar area. It was conducted to contribute to the inventory of acarofauna, entomofauna and nematofauna of imported or local cereals in Senegal. In this context, sampling was carried out in the markets of Sandaga, Tilène, Gueule Tapée and in village Diofior village. Thus, out of 16 samples of incubated cereal varieties, observation and identification of specimens obtained after sorting and extraction revealed the only presence of insects; mites and nematodes were not found in our stocks. Insects were composed of 961 specimens belonging to the Order Coleoptera (42.87%) with eight species *Oryzaephilus surinamensis* (14.98%), *Cryptolestes ferrugineus* (11.86%), *Rhyzoperta dominica* (8.63%), *Sitophilus oryzae* (5.20%), *Tribolium castaneum* (1.87%), *Prostephanus truncatus*, *Carpophilus sp.* and an unknown species (0.10%); the Order Lepidoptera with a single species *Ephestia cautella* (50.05%); the Order Psocoptera (5.93%), the Order Hymenoptera (0.72) and the Order Hemiptera (0,41). The species found in the last three orders were not identified. Results obtained showed that the local cereals are much more contaminated than imported ones. In addition, it also revealed an important diversity of insects in imported cereals, with a much more marked similarity between Senegal-Mali and China-Thailand.

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Introduction

Cereals are species generally cultivated for their grains whose starchy albumen, reduced to flour, is consumable by humans or domestic animals (Moule, 1971). Because of their energy source and high carbohydrate content, cereals provide 15% of our energy needs (Benhamimed and Chaoui, 2016). In Senegal, for example, as in most Sahel countries, the diet of populations is largely dominated by cereals, mainly millet, sorghum, maize and rice (Niang *et al.*, 2017). These cereals provide basic food for more than 60% of the population (Ba, 2006). However, Senegal's agricultural sector suffers from poor control of water resources, degradation of productive resources including soil, inputs (equipment, seeds, and fertilizers) and the lack of effective agricultural equipment. In other words, insufficient rural infrastructure limits agricultural production (Tendeng *et al.*, 2017). As a result, in June 2013, only 41% of households had stock from their last harvest; which corresponded to about 20 days of consumption. On the other hand, these cereals are subject to many phytosanitary constraints related to arthropods and nematodes. For this reason, much work (Philogen *et al.*, 1989; Ratnadass *et al.*, 1989; Ashamo, 2006) refers to insect attacks and loss of cereal stocks (Guèye *et al.*, 2011). The damage to cereal and pulse stocks caused by these depressing species has been the subject of much work in Africa and is highly harmful in many African countries. Dembelé (2020) has managed to make an inventory of insect pests encountered in the different varieties of rice stored in Senegal. But as a result of all this work (Mallamaire, 1965; Dembelé, 2020) carried out on stored cereals, the study on the inventory of acarofauna, entomofauna and nematofauna of imported or local cereals in Senegal has yet to be discussed, hence the importance of this study. The general objective of this study is to contribute to the knowledge of acarofauna, entomofauna and nematofauna of imported or local cereals in Senegal. This general objective is divided into several specific objectives: (i) identify acarofauna, entomofauna or nematofauna pests of imported or local cereals in Senegal; (ii) compare infestations of imported or local cereals in Senegal; (iii) determine the abundance of the listed species in the different varieties of imported or local cereals in Senegal; (iv) determine the specific diversities between the different countries.

Materials and methods

Overview of the study area

Cereal samples come from department stores in some markets in the Dakar region located in the Cape Verde peninsula limited to the east by the Thiès region, to the west, north and south by the Atlantic Ocean; in the village of Diofior located in the Fatick region 145 km south of Dakar (Fig. 1).

Sampling

A sampling of imported or local grain was conducted from December 10 to 13, 2021. It consisted of buying different varieties of imported or local cereals of different origins. The samples taken were packaged in bags bearing a label with the date of sampling, the name of the locality (for local cereals) and the country of origin (imported cereals). Then, they were sent to the laboratory for incubation. The different varieties of imported or local cereals sampled were grouped in Table 1.

Incubation

Incubation began on 10 December 2021 in the entomology and acarology laboratory of the Department of Animal Biology of the Faculty of Science and Technology (FST) of the Cheikh Anta Diop University of Dakar (UCAD). For this purpose, the 16 cereal varieties sampled were weighed using an electronic scale and distributed in glass jars. Each jar contained 900 g of cereal. A label with the date of sorting, the name of the locality or country of origin and the name of the variety of cereals is affixed. Then these jars were covered by a very small mesh fabric and attached with an elastic to ensure aeration of the medium. Following all this, jars were then left at room temperature (Fig. 2).

Search for mites, insects and nematodes

Incubation allowed us to track the emergence of mites, insects and nematodes over time and to count the number of specimens for each species. Three sorting and counting were done. The first screening is on December 20 (one week after incubation) and the other two every 30 days, from January 20 to February 20. This was roughly the same length of time that most depressing species found in cereal stocks complete their development cycle. Two methods were used to search for mites, insects and nematodes.

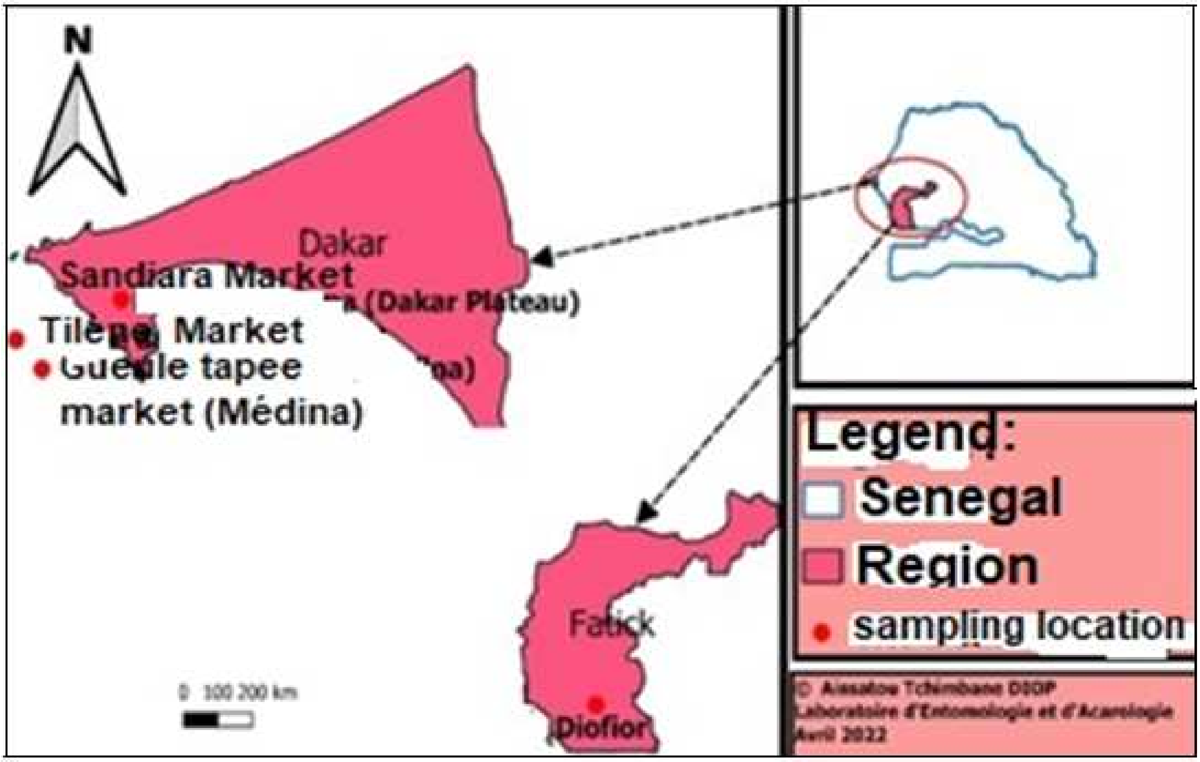

Fig. 1. Sampling locations.

Sorting method for mites, insects and nematodes

The sorting of mites, insects and nematodes took place on December 20, 2021 (one week after incubation), January 20 and one more on February 20, 2022. This method consisted of isolating, in each sample, the specimens found as well as the powder. This was done by sifting the contents of each jar onto a sheet of paper using a wire mesh and/or a wooden sieve. After sieving, the powder thus obtained for each cereal variety was then put in well-closed plastic tubes; and the specimens found in other plastic and glass tubes containing 70° alcohol were used as fixators.

Observation of both the identified specimens and the powder obtained in each jar was carried out the day after sorting, using a binocular magnifying glass, a stereo microscope and an anti-insect magnifying glass. The identity of the species observed was confirmed with identification keys. After isolation of the found specimens, powders were returned to their tubes for the water extraction method.

Extraction method for mites and nematodes

The extraction method for mites and nematodes was completed on February 25, 2022. It consisted of individually using the powder from each cereal variety and pouring it into a 500 ml Erlenmeyer filled with water.

A few minutes later, the contents are filtered using a 100µm mesh micro-sieve (Appendix 9 left). The part collected after filtering was poured into another 100 µm plastic mesh micro sieve, the bottom of which is covered with cellophane paper. The preparation was then placed in a petri dish filled with water and then completely covered by another box (Appendix 6). The device (sieve + petri dish) was placed on a bench, at room temperature. The content was recovered 72 hours later for a binocular observation.

Data processing

The statistical study was carried out using several analytical and synthetic methods.

Parameters studied

Relative abundance

It is defined as the ratio between the number of species i for example (ni) and the total number of individuals of the different species of stand (N) (Blondel, 1979).

$$Pi = ni \times 100/Ni$$

Diversity

The study of pest stand diversity was conducted using many indices:

Shannon Diversity Index

$$H' = -\Sigma Pi Log2 Pi$$

With

H' = diversity index

Pi = relative abundance

The diversity index most commonly used is the Shannon index. It is minimal (H'=0) if all individuals in the stand belong to a single species or if, in a stand, each species is represented by a single individual, except a species that is represented by all other individuals in the "stand" (Dembelé 2020).

Pielou Equity Index or Crew Index (E)

$$E_H = E(H')/(Log2S)$$

With H' = observed value; Log2S = theoretical maximum value; S = specific richness

This index can vary from 0 to 1. It measures only the regularity of diversity in a stand, regardless of the number of species present. It is maximum when the species have identical abundances in the stand or when only one species dominates the whole stand.

Dulmann Similarity Index

$$K = 2c \times 100/(a + b)$$

With a: specific richness of stand 1; b: the specific richness of stand 2; c: number of taxa common to both stands.

Statistical analysis

Data from sample processing is discrete. It has been saved in an Excel spreadsheet. These data were submitted to descriptive statistics and allowed the results to be presented in graphs and tables using Excel software. In addition, various tests have been performed with software R (version R 3. 6. 3), this is the Kruskal and Dunn test.

Results

Different pest species identified in incubated cereal samples

Identification of specimens encountered in samples of incubated cereals

Following observation and identification of the species identified in our samples of incubated cereals, mite and nematode species were not found; only insects were encountered. A total of 961 insect specimens were collected and distributed in 5 orders and 12 families of which 8 were known and 4 were unknown (Table 2).

Table 1. Varieties and Origin of Imported or Locally Sampled Cereals.

Sampled local varieties	Number of samples	Sampled imported varieties	Number of samples
Rice from Diofior	1	Rice from China	1
Rice from Valley	2	Rice India	1
Maize from Kédougou	1	Rice Cambodia	1
Maize of Unknown Origin	1	Rice from Thai	2
Sorghum from Senegal	2	Wheat Brazil	1
		Maize from Argentina	1
		Maize from Mali	1
		Wheat of unknown origin	1

Different species of insect pests identified in imported or local rice

Results gathered in Table 3 show the presence of nine insect pests in the rice samples. Of these insects, six are found in rice from Senegal, 66.66%; five in rice and from Thailand and China, 55.55%; one in India (11.11%); no insect species have been identified in the variety from Cambodia (0%).

Table 2. Different species recorded in samples of incubated cereals.

Orders	Species	Families	Sizes	Percentage %
Coleoptera	*R. dominica*	Bostrichidae	83	8.63
	O. surinamensis	Silvanidae	144	14.98
	S. oryzae	Curculionidae	50	5.20
	C. ferrugineus	Cucujidae	114	11.86
	T. castaneum	Tenebrionidae	18	1.87
	P. truncatus	Bostrichidae	1	0.10
	Carpophilus sp.	Nutidulidea	1	0.10
	NIE.	-	1	0.10
Lepidoptera	*E. cautella*	Pyralidae	481	50.05
Psocoptera	NIE.	-	57	5.93
Hymenoptera	NIE.	-	7	0.72
Hemiptera	NIE.	-	4	0.41
	TOTAL		961	~ 99.95

NIE. Non Identified Species.

Different species of insect pests identified in imported or local maize

A total of eight insect species were identified in the corn samples, including seven species belonging to the Order of Coleoptera and one unidentified species of the Order of Psocoptera (Table 4). The results obtained in Table 4 show that all eight species are found in Senegal maize (100%), four species in the variety coming from Mali (50%), two species for Brazil (25%) and none for Argentina (0%).

In Table 5,we find that our sorghum samples from Senegal are all infested. These species belong mainly to the Order of Coleoptera. They are *R. dominica* (68 individuals), *S. oryzea* (5 individuals), *T. castaneum* (13 individuals), *O. surinamensis* (2 individuals) and a species not identified to the Order of Coleoptera.

We also have unidentified species of Hymenoptera (5 individuals), Hemiptera (2 individuals) and Psocoptera (5 individuals).

Table 3. Insect pests recorded in imported or local rice varieties.

			Senegal	India	China	Thai	Cambodia
Orders	Species	Families	Sizes	Sizes	Sizes	Sizes	Sizes
Coleoptera	*R. dominica*	Bostrichidae	2	0	0	0	0
	S. oryzea	Curculionidae	2	0	8	33	0
	O. surinamensis	Silvanidae	126	2	5	6	0
	T. castaneum	Tenebrionidae	2	0	0	0	0
	C. ferrugineus	Cucujidae	0	0	0	1	0
	P. truncatus (accidentelle)	Bostrichidae	0	0	1	0	0
Hemiptera	NIE.	-	1	0	0	0	0
Hymenoptera	NIE.	-	0	0	1	1	0
Psocoptera	NIE.	-	2	0	5	18	0
		Total of species	6	1	5	5	0
		Percentage (%)	66.66	11.11	55.55	55.55	0

Different species of insect pests identified in imported wheat

Table 6 shows insect pest species found in imported wheat. In this table, we notice that wheat is 100% insect infested. These are *C. ferrugineus* (38 individuals), R. dominica (11 individuals), unidentified species of Psocoptera (20 individuals) and Hemiptera (1 individual).

Abundance and diversity of insect pests in imported or local cereal varieties

Abundance of identified insect pests

Following the inventory of insects present in the different types of cereals sampled, we calculated the relative abundance of the different species of insect pests encountered in rice, maize, sorghum and wheat according to the country of origin.

Table 4. Insect pests identified in imported or local corn varieties.

			Senegal	Mali	Argentina	Brazil
Orders	Species	Families	Sizes	Sizes	Sizes	Sizes
Coleoptera	*C. ferrugineus*	Cucujidae	3	72	0	0
	O. surinamensis	Silvanidae	1	2	0	0
	T. castaneum	Tenebrionidae	3	0	0	0
	Carpophilus sp.	Nutidulidea	1	0	0	0
	R. dominica	Bostrichidae	1	0	0	1
	S. oryzea	Curculionidae	1	1	0	0
Lepidoptera	*E. cautella*	Pyralidae	481	0	0	0
Psocoptera	NIE.	-	4	1	0	2
		Total of species	8	4	0	2
		Percentage (%)	100	50	0	25

Abundance of insect pests identified in imported or local rice

Fig. 3 shows that among the insect pests found in imported or local rice varieties, *R. dominica* is found only in Senegal rice at a rate of 1.5%. *O. surinamensis* is much more abundant in varieties coming from India (100%) and Senegal (93.3%) than those coming from China (25%), Thailand (10.1%) and Cambodia (0%). For *S. oryzae*, we see that it is more present in the rice of Thailand (56%) and China (40%) than in that Senegal (1.5%). Species *C. ferrugineus*, *T. castaneum* and *P. truncatus* are only recorded in varieties coming from Thailand (1.7%), Senegal (1.5%) and China (5%), respectively. Unidentified species of Psocoptera, they are more common in rice from Thailand (30.5%) and China (25%) than in Senegal (1.5%). More, unidentified species of Hymenoptera have only been found in the Chinese and Thai varieties with a much greater abundance in the variety of China (5%) than in that of Thailand (1.7%).

Finally, we also have unidentified species of Hemiptera present only in the rice of Senegal with 0.7% of abundance.

Table 5. Insect pests recorded in local sorghum.

			Sorghum from Senegal
Orders	Species	Families	Sizes
Coleoptera	*R. dominica*	Bostrichidae	68
	S. oryzea	Curculionidae	5
	NIE.	-	1
	T. castaneum	Tenebrionidae	13
	O. surinamensis	Silvanidae	2
Hymenoptera	NIE.	-	5
Hemiptera	NIE.	-	2
Psocoptera	NIE.	-	5
		Total of species	8
		Percentage (%)	100

Abundance of insect pests identified in imported or local corn

Fig. 4 shows the abundance of insect pests that attack corn from different countries. This figure shows that: *R. dominica* is present only in maize from Brazil and Senegal with respective abundances of 33.3% and 0.2%. Species *O. surinamensis*, *S. oryzae* and *C. ferrugineus* are found only in varieties from Mali and Senegal. In Mali maize, we have in order of abundance, *C. ferrugineus* (94.7%), followed by *O. surinamensis* (2.6%) and *S. oryzae* (1.3%).

While in Senegal, *C. ferrugineus* is the most represented (0.6%) followed by *O. surinamensis* and *S. oryzae* which have an abundance equal to 0.2%. Species *E. cautella*, *T. castaneum* and *Carpophilus sp.* are only recorded on the Senegalese maize variety with respective abundances of 97.1%, 0.6% and 0.2%.

Table 6. Insect pests recorded in imported wheat.

			Imported wheat
Orders	Species	Families	Sizes
Coleoptera	*R. dominica*	Bostrichidae	11
	C. ferrugineus	Cucujidae	38
Hemiptera	NIE.	-	1
Psocoptera	NIE	-	20
		Total of species	4
		Percentage (%)	100

We also have unidentified species of Psocoptera present in all maize samples except Argentina, with an abundance of (66.6%) in the variety coming from Brazil, (1.3%) for Mali and (0.8%) for Senegal. Fig. 5 shows the p-values of the different insect species found in imported or local maize varieties. Thus, we can see among them that only the p-value of *C. ferrugineus* is significant (p= 0.04) and this significance is noted between Senegal and Mali.

This could be related to trade between these two countries or to their closeness.

Table 7. Diversity of insect pests recorded in rice varieties.

Types of rice	S	Indexes			
		Shannon(H)	Equitability (EH)	Dulmann (K)	
Senegal	6	0.503	0.194	Senegal-China	54.54
India	1	0	0	Senegal-India	28.57
China	5	1.96	0.844	Senegal-Thai	54.54
Thai	5	1.522	0.655	Chine-Thai	80
Cambodia	0	0	0	China-India	33.33
				India-Thai	33.33

Abundance of insect pests identified in imported wheat or local sorghum

Fig. 6 shows the abundance of insect pests found in local sorghum and imported wheat.

For Senegal sorghum, surveyed insects are: *R. dominica*, *T. castaneum*, *S. oryzae*, *O. surinamensis*, *C. ferrugineus* and an unidentified species of Coleoptera. Among these insect species, *R. dominica* is the most abundant (67.3%) followed by *T. castaneum* (12.8%), *S. oryzae*, unidentified species of Psocoptera and Hymenoptera (4.9%). While *O. surinamensis*, unidentified species of Hemiptera and unidentified species of Coleoptera attack the least with respective abundances of 1.9% for the first two and 0.9% for the last. Concerning wheat, it is most attacked by *C. ferrugineus* with an abundance of 54.2% followed by unidentified species of Psocoptera (28.5%), *R. dominica* (15.7%) and unidentified species of Hemiptera (1.4%). For imported wheat, *C. ferrugineus* is the most abundant. This is in congruence with the results of Aoues *et al.* (2017). So the presence of these species in imported wheat could be due to an infestation of grains during storage or at the country of origin level.

Table 8. Diversity of insect pests recorded in corn varieties.

Types of maize	S	Indexes			
		Shannon (H)	Equitability (EH)	Dulmann (K)	
Senegal	8	0.251	0.083	Senegal-Mali	66.66
Mali	4	0.353	0.176	Senegal-Brazil	40
Brazil	2	0.918	0.918	Mali-Brazil	33.33
Argentina	0	0	0		

Diversity of insect pests recorded in imported or local rice

Table 7 shows the diversity of rice pests by country of origin. The table shows that the specific richness for rice in Senegal is greater (6) than that of China and Thailand (5), India (1) and Cambodia (0). Indeed, the Shannon index and the equity index are higher in rice from China (1.96) and Thailand (1.522), low in Senegal (0.503) and nil in India and Cambodia. The values found for rice from China (1.96) is close to the theoretical maximum value which is equal to 2. As for the calculation of the Dulmann index, it is much more pronounced in the varieties coming from China and Thailand (80%) than those from other countries.

Fig. 2. Glass jars filled and closed by a very small mesh fabric and attached with an elastic band.

Diversity of insect pests recorded in imported or local corn

Table 8 shows the diversity of insect pests in corn. It shows that specific abundance is much higher in Senegal (8) than in Mali (4), Brazil (2) and Argentina (0). Regarding the Shannon and equitability indices, they are higher for the variety from Brazil (0.918) and Mali (0.176) than that of Senegal (0.083). Indeed, these values are low compared to the theoretical maximum value which is equal to 2. As for the value of the Dulmann index, we find that it is more important between the varieties of Senegal-Mali (66.66%) than between those of Senegal-Brazil (40%) and Mali-Brazil (33, 33%).

Discussion

The results of the inventory show that most of the insect pests of stored cereals are beetles. This is in line with Delobel and Tran (1993) and Ngamo and Hance (2007). Thus, the absence of mites and nematodes was noted throughout the study. This shows that the samples studied were not contaminated by these types of crop pests. Rice samples from Senegal are much more infested than imported ones. Indeed, this heavy infestation of Senegal's rice could be explained by the poor treatment of grains before storage. Contamination of imported samples could be linked to poor storage from the country of origin or to conditions of transport by boat. The absence of insects in Cambodia's rice could be justified by good grain storage, or by their treatment with pesticides.

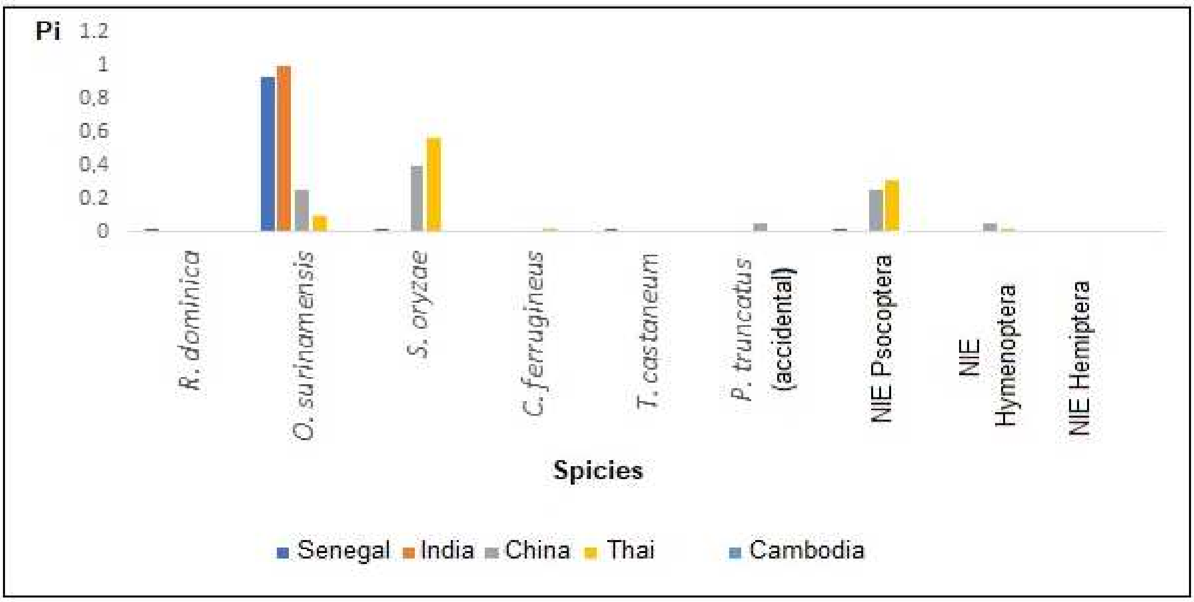

Fig. 3. Abundance (Pi) of rice insect pests in different countries.

The presence of insects in corn samples is consistent with the work of Huchet (2016). Samples of maize from Senegal are more contaminated than those imported. Indeed, this high contamination of Senegal's maize could be explained by the poor treatment of the grains before storage. Infestation of imported samples could be related to poor conservation from the country of origin or to conditions of transport by boat. The absence of insects in corn from Argentina could be justified by good grain storage, pesticide treatment, or varietal resistance.

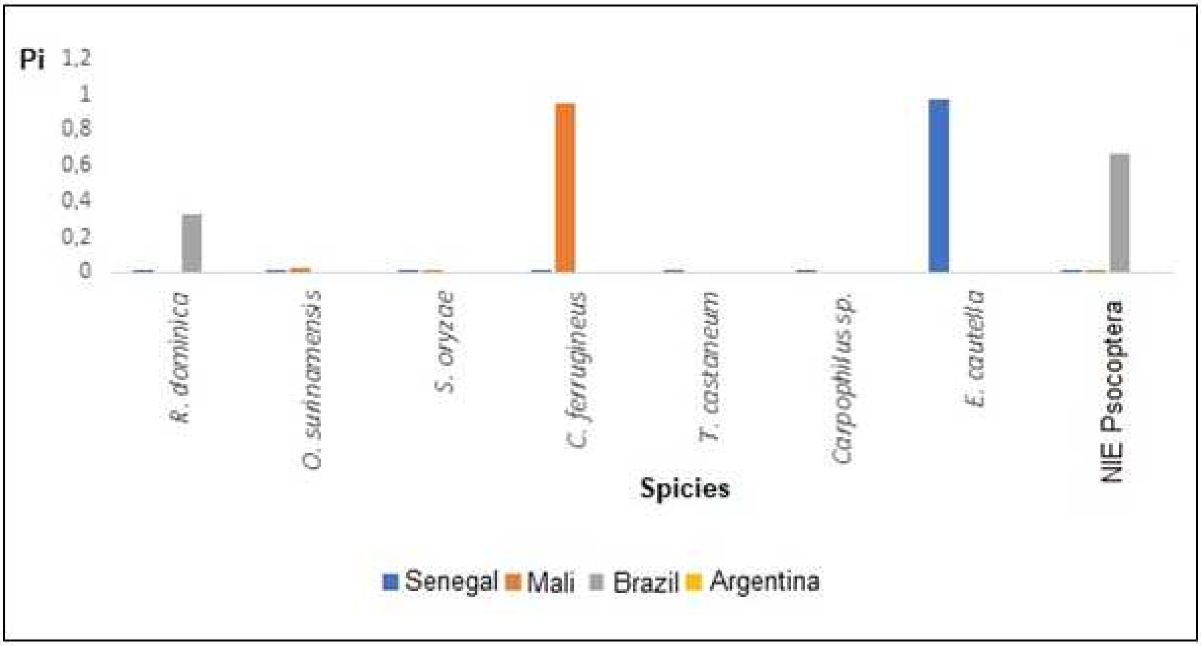

Fig. 4. Abundance (Pi) of insect pests of maize in different countries.

The infestation observed in sorghum in Senegal could be justified by the improper treatment of grain before storage. This analysis suggests that wheat imported into Senegal is heavily contaminated by insects.

Among the species encountered, *Oryzaephilus surinamensis* found in rice samples is the dominant species. This result is consistent with Gnimagnon (2012), Chougourou *et al.* (2017) and Zinha (2013). The second most represented species is *Sitophilus oryzea*, which is more abundant in rice in Thailand than in other countries. This result corroborates that of Dembelé (2020). Thus, the presence of this species in Thai rice imported into Senegal may be due to an infestation during import by boats according to Mallamaire (1965), or at the time of storage.

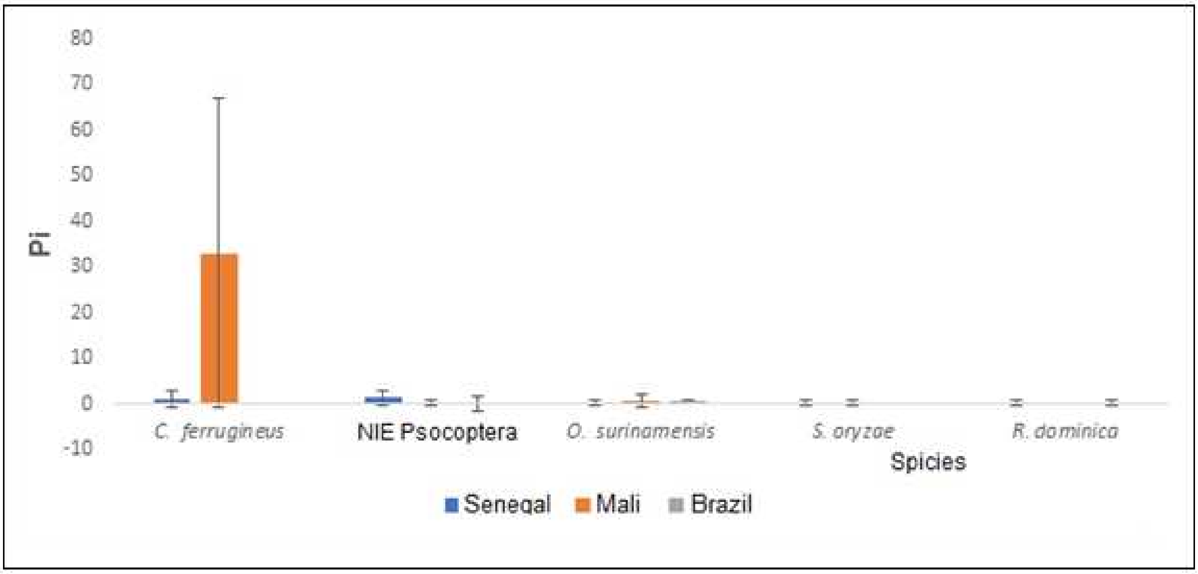

Fig. 5. Average insect pests of maize in different countries.

The species *Rhyzoperta dominica* and *Tribolium castaneum* found in Senegal rice and *Cryptolestes ferrugineus* found in Thailand rice are less common in the samples. This result is similar to those of Chougourou *et al.* (2017). The presence of *Prostephanus truncatus* in Chinese rice does not support the findings of Guèye *et al.*, 2010. Its occurrence could be justified by an infestation during storage as it was encountered only once during our sorting. The presence of unidentified Psocoptera species in rice samples is in accordance with the results of Fraval (2008) which show that these species are considered cereal depressants. In addition, unidentified species of Hemiptera and Hymenoptera have been recorded in the rice varieties of Senegal and Thailand. This result is similar to those of Huchet (2016) and Ncibi (2020). The results showed that the most representative insect species in imported or local corn samples are *Ephestia cautella* and *C. ferrugineus*. These results are contradictory to those of Chougourou *et al.*, 2017 and Durant (2018) who showed in their studies that the species *S. oryzea*, *S. zeamais* and *C. ferrugineus* are the most abundant in corn. This discrepancy could be explained by the fact that the study areas are not the same or by a difference in sample size. Less common species in corn are *S. oryzae*, *R. dominica*, *O. surinamensis*, *T. castaneum*, *Carpophilus sp.* and unidentified species of Psocoptera. However, most of these pests are found in maize in Senegal and Mali. This could be due to grain contamination during storage, migration of its species, or infestation during transport. The absence of an infestation noted in Argentine corn may be justified by proper grain treatment or by the safety measures taken during importation. Analysis of the results shows that the most abundant insect species recorded in sorghum in Senegal are: *R. dominica* and *T. castaneum*. These results are not similar to those of Nanfack *et al.* (2015) who show in their study that the main pest of sorghum was *C. ferrugineus*. These results could be explained by differences in study areas, differences in sample sizes, and differential contamination of grain prior to or at storage.

The results obtained after calculating the Shannon index of species present in rice samples according to the countries reveal a much more diversified stand in the imported rice samples than in that of Senegal. These results are contradictory to those of Dembelé (2020). This could be justified by a difference in the study area or sample size. The strong similarity observed between the Chinese and Thai varieties, following the calculation of the Dulmann index, could be related to their proximity or the same conditions of preservation of the grains.

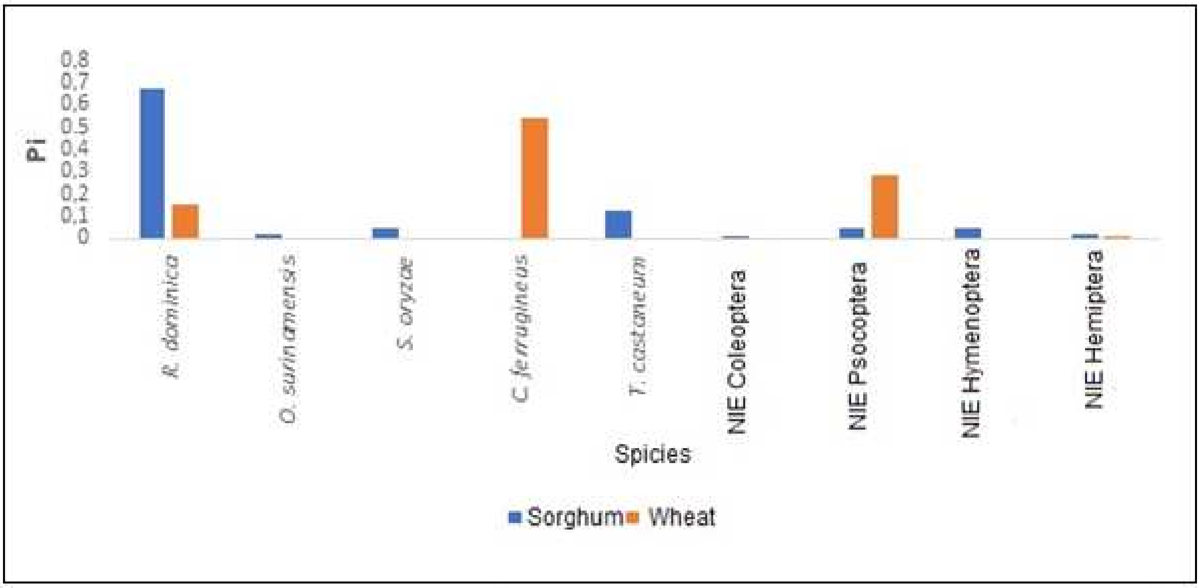

Fig. 6. Abundance (Pi) of insect pests of local sorghum and imported wheat.

The Shannon Index reveals a low diversity of insect species found in corn varieties in Senegal and Mali compared to those found in corn from other countries. This low diversity noted in maize from Senegal and Mali could be connected with a non-homogeneous distribution of insects found in these two varieties. Moreover, the strong similarity revealed by the calculation of the Dulmann index between Senegal and Mali could be correlated to cereal imports, insect migration, proximity or the same grain storage conditions.

Conclusion

Our contribution to the inventory of acarofaune, entomofaune and nematofaune from imported or local cereals in Senegal shows that these are much more threatened by insects than by mites and nematodes that were not identified in this study. Thus five orders of depredators have been identified in the cereal samples: the Order of Coleoptera (the most abundant), Lepidoptera, Psocoptera, Hymenoptera and Hemiptera. Results have shown that local cereals (Senegal) are more contaminated than imported ones. Among the identified insect species in the local samples we have: *Oryzaephilus surinamensis*, *Ephestia cautella* and *Rhyzoperta dominica* respectively more abundant in rice, maize and sorghum.

As for imported cereals, *Oryzaephilus surinamensis* is more abundant in rice; for corn and wheat, we have *Cryptolestes ferrugineus* which dominates.

The study of the diversity of insects surveyed reveals that imported cereal samples have a much more diverse stand than local cereal samples. As for the similarity of these depredators, it is much more marked between the variety of China and that of Thailand, in the case of rice; and between the variety of Senegal and that coming from Mali in for maize.

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