NOTES ON WHEAT DISEASES IN PORTUGAL

(JOINT CONTRIBUTION FROM THE INSTITUTO ROCHA CABRAL
AND THE ESTAÇÃO AGRARIA NACIONAL)

BY

MATHILDE BENSAÚDE; D. SC.

Very little has been published concerning tbe occurrence, distribution and economic importance of wheat diseases in Portugal. In the hope of acquiring information concerning this important problem, a questionnaire was prepared and sent to farmers during June 1928. In reply to this query abundant material was received from all over the country. The data thus collected show clearly which were, during the past season, the-most serious and widespread wheat diseases of Portugal. The publication of these rough notes may therefore prove useful as a basis for further investigations.

All statements relative to the presence of wheat diseases in various localities are based on careful macro and microscopical examination of specimens, completed in some cases by the study of pure cultures. They are therefore quite reliable. Statements concerning the economic importance of diseases however, are not based on accurate counts or on standard valuations, but only on the personal reckoning of correspondents. They should therefore not be relied on, but taken only as very approximate indications of prevailing-conditions.

The writer wishes to thank Dr. António Monteiro, for kindly identifying the varieties of wheat sent by informants.

District of Viana do Castelo

Main cereal crop: maize. Area of district ; 222.130,00 hectares»

Area of land grown to wheat in 1926-27: 717,55 hectares (1).

Concelho of Valença

Wheat grown by informants (2): Galego = Barbela (*T. vulg.* var. *eryihrospermum* Kcke.).

Bunt, called caria or cego, is said to cause appreciable losses. No specimens were received. Seed is steeped in a 1% copper sulphate solution.

Loose-smut, called morrão, is said to cause also slight damage.

Rusts are apparently all confused under the name of loira. Informants state that this disease is of rare occurrence.

Foot-rot. Traces of a foot-rot apparently produced by *Ophiobolus graminis* was the only disease present on samples received.

Concelho of Monção

Wheat grown by informants: Eijo = Barbela *(T. vulg.* var. *eryihrospermum),* Lobeiro *{T. durum* var. *affine* Kcke) recently acquired in Lisbon.

Bunt is reported and called fungão. No specimens.

Loose-smut is well known by the name of morrão.

Rusts are apparently of small economic importance. Ferrugem is the name used to designate them all, No specimens.

District of Braga

Main cereal crop: maize. Area of district: 269.800,00 hectares.
Area of land grown to wheat: in 1926-27: 790,00 hectares.

Concelho of Vila Verde

Wheat grown by informants: Barbela *(T. vulg.* var. *eryihrospermum).* Informants ignore all wheat diseases.

(1) Figures furnished by the Divisão de Estatística Agrícola. The area of land grown to wheat in 1927-28 had not yet been worked out when these notes were prepared and therefore the area of the preceding year is given.

(2) The first name is the one used by informant. When this is not correct, according to the oficial nomenclature used at Belem, the correct name is added. Between brackets are given the names of the species and botanical variety to which each *agricultural* **variety of wheat belongs.**

Rusts. On specimens received traces of *Puccinia glumarum* were found.

Concelho of Celorico de Basto

Wheat grown by informants: Barbela *(T. vulg.* var. *erythrospermum).*

Bunt is known by the name of morrão and does considerable harm. The specimens received were parasitised by *Tilletia tritici.*

Loose-smut is ignored or confused with the preceding disease.

Rusts are known by the name of ferrugem. Traces of *Puccinia graminis* were observed on specimens.

District of Porto

Main cereal crop: maize. Area of district: 231.210,00 hectares, Area of land grown to wheat in 1926-27: 2.338,12 hectares.

Concelho of Póvoa do Varzim

Wheat grown by informants : Temporão = Barbela, Serôdio = Ribeiro *(T. vulg.* var. *erythrospermum).*

Bunt is not known to informant and is probably confused with the next disease under the name of morrão.

Loose-smut is reported and called morrão.

Rusts, all called ferrugem, are reported as quite harmful at times, but not so during the past season.

Foot-rot. Specimens received show discoloration of roots and lower internodes. Mycelial plates probably of *Ophiobolus graminis* covered the lower part of the culm. Levantamento or fogueira are the names used by farmers for all premature drying of plants, whatever the cause may be.

' *Septoria tritici.* This fungus overran leaves and sheaths of foot-rotted plants.

Concelho of Vila do Conde

Wheat, grown by informants: da Terra ou da Maia = Barbela, Magueija *(T. vulg.* var. *erythrospermum).*

Bunt is well known and called morrão do grão. This disease does little harm since the introduction of seed treatment. No specimens.

Loose-smut, of very frequent occurrence, is called **machio,**

Rusts are known by the name of ferrugem. The one which is most feared, writes informant, appears often late in the season, not long before harvest, and may almost destroy the crops in a few days *(P. graminis).* In June 1928, when specimens were sent, *Puccinia glumarum* was the only rust present.

Foot-rot. This disease has caused considerable losses during the past season. Informant thinks that excess of soil moisture and of nitrogenous fertilizers were responsible for the severe outbreak. *Ophiobolus graminis* was found on specimens. The local name for this malady is espiga branca.

Concelho of Maia

Wheat grown by informants : Cidrão = Barbela, Tremês = Ribeiro *(T. vulg.* var. *erythrospermum).*

Bunt, known by the name of fungão, is quite harmful at times Seed is treated by many farmers with dilute solutions of copper sulphate.

Loose-smut is known to farmers under the name of morrão.

Rusts, which are sometimes quite serious, had not been observed until the beginning of June 1928.

Foot-rot. A premature drying of wheat plants was observed in this region, ob\'iously produced by a foot, or root-rot. On specimens a pink fusarium growth was observed between sheath and culm, at the level of the first node above ground. Whether this fungus was the pathogène or only a secondary invader, is not certain.

Insect-pests. Larvae of a *Lema sp.* were found feeding on the parenchyma of green leaves. The damage done by these pests was considerable.

Concelho of Marco de Canavezes

Wheat grown by informants: Barrozo = Barbela *(T. vulg.* var. *erythrospermum).*

Larvae of a Lema were again very harmful in this locality. No diseases are reported by informants.

Concelho of Gondomar

Wheat grown by informants : Barbela *(T. vulg.* var. *erythrospermum).*

Bunt, called morrão, is known to all farmers. On specimens received *Tilletia tritici* was found. Seed treatment with a copper sulphate solution is praticed and found efficient.

Loose-smut is ignored or confused with the preceding disease.

Rusts are of small economic importance and are known by the name of barro or ruivéca. No specimens.

District of Vila Real

Main cereal crop: rye. Area of district 427.320,00 hectares.

Area of land grown to wheat in 1926-27;: 1.430,45 hectares.

Wheat grown by informants: Barbela *(T. vulg.* var. *erythrospermum).*

Information from this district, was very scarce and incomplete. The only disease reported was morrão. Whether this designates bunt, loose-smut, or both maladies, was not ascertained.

District of Bragança

Main cereal crop: rye. Area of district 651.010,00 hectares.

Area of land grown to wheat in 1926-27: 11.239,69 hectares.

Concelho of Vinhais

Wheat grown by informants : Barbela, Serôdio = Ribeiro *(T. vulg.* var. *erythrospermum)'.*

Wheat is grown in the more fertile lands of this concelho. In June the crop was heading, and did not yet show disease. Morrão is the only serious malady reported by informants ; whether this word applies to bunt, loose-smut, or both is not known as no samples were sent.

"Rusts are known by the name of ferrugem, and are said to be harmful only once in many years.

Concelho of Alfândega da Fe

Wheat grown by informants : Barbela *(T. vulg.* var. *erythrospermum).*

Informations from this concelho are identical with those received,

from the preceding one. On samples however, mycelial plates of *Ophiobolus graminis* were observed and the ears of foot-rotted plants were overgrown by *Cladosporium herbarum.*

Concelhos of Bragança, Macedo de Cavaleiros, Mogadouro

Wheat grown by informants: Barbela, Ribeiro, Rieti *(T. vulg.* var. *erythrospermum).* Maçaruco *= ? (1), Cascai = ?.

Rusts are unknown to many farmers and familiar to a few under the names of alforra, ferrugem or mela. No specimens.

District of Aveiro

Main cereal crop: maize. Area of district: 275.790,00 hectares. Area of land grown to wheat in 1926-27: 763,93 hectares.

Concelho of Oliveira de Azeméis

Wheat grown by informants: Cedo-Bem = Ribeiro *(T. vulg.* var. *erythrospermum),* Durázio = ?

Bunt is known and feared in all the concelho under the name of machio. *Tilletia tritici* was present on samples.

Loose-smut, called morrão, does little harm.

Rusts are known by the name of ferrugem. *Puccinia graminis* was observed on leaves and sheaths of specimens received in June.

Foot-rot caused by *Ophiobolus graminis* was observed on many plants.

Insect-pests. Pupae of *Phytophaga destructor* Say were found on specimens as well as feeding galleries, through the culms due to the larvae of an undetermined hemipterous insect.

• Concelho da Murtosa

Wheat grown by informants : da Terra = Barbela *(T. vulg.* var. *erythrospermum).*

Bunt is known as morrão or machio and is very widespread wherever seed treatment is omitted. *Tilletia tritici* was found on many plants.

(1) When the specimens received were insufficient for identification, the name used by correspondents alone is given,

Rusts. *Puccinia graminis* and *P. glumarum* were observed on specimens. The local name for these diseases is ferrugem.

Concelho of Albergaria-a-Velha

Wheat'grown by informants : Eijo = Barbela *(T. vulg.* var. *erythrospermum),* Mole = ?

Bunt, here again called machio, is produced by *Tilletia tritici.* Disinfection of the seed with a weak solution of copper sulphate is practiced by many growers.

Rusts. Uredosori of *Puccinia glumarum* were present in great numbers inside glumes, and on the grain of bunted heads.

A foot-rot was very harmful in this vicinity during the past season. On all specimens mycelial plates of *Ophiobolus graminis* were seen.

Concelho of Ílhavo

Wheat grown by informants: Galego = Barbela *(T. vulg.* var. *erythrospermum).*

Bunt is known,as morrão, which name also designates loose-smut. The causal organism is here again *Tilletia tritici.*

Rusts are unreported by informant. *Puccinia graminis* was nevertheless found on specimens.

Concelho of Oliveira do Bairro

Wheat grown by informants : Galego = Barbela, Sacho or Tremês = Ribeiro *(T. vulg.* var. *erythrospermum).*

Bunt and loose-smut are of little importance, and generally known by the name of tabacão. No specimens.

A foot-rot, called arejo by the local farmers, produced a premature turning and drying of unripe wheat plants. Lesions and mycelial growths on all specimens examined indicate that here again *Ophiobolus graminis* was the pathogène.

Concelho of Vagos

Wheat grown by informants: Tremês = Ribeiro *(T. vulg.* var. *erythrospermum),* Americano = ?, Nacional »= ?, Galego ==?.

Bunt is called 'ferrugem. No specimens.

Loose-smut is known as morrão or ferrugem.

Rusts, which cause serious trouble at times, are known as **doença**

amarela. A slight attack of *Puccinia graminis* was observed on sheaths of specimen examined in June.

Foot-rot. Arejo, word which here also designates premature drying of plants and ears, is said to have caused much damage this year. No specimens.

District of Viseu

Main cereal crop : rye. Area of district : 501.870,00 hectares.
Area of land grown to wheat in 1926-27: 2.632,42 hectares.

Concelho of Sinfães

Wheat grown by informants : Barbela *(T. vulg.* var. *erythrospermum).*

Bunt, known as fungão, is reported to cause appreciable damage at times. Seed treatment is not generally practiced. On specimens examined the causal organism was *Tilletia tritici.*

Loose-smut, called morrão, does little harm.

Rusts, called alforra are not considered serious in this locality. Traces of P. *glumarum* **were** found on all bunted heads,

Concelho of Armamar

Wheat grown by informants: Nacional = Barbela *(T. vulg.* var. *erythrospermum).*

Bunt, called fungão, is quite prevalent. No specimens.

Loose-smut, known as morrão, does little harm.

Rusts, known as alforra,, are of little economic importance. On samples received, a slight attack of *Puccinia graminis* was observed,

Foot-rot. Plants attacked by *Ophiobolus graminis* were received.

• Concelho of Tabuaço

Wheat grown by informants : Serôdio or Tremês = Ribeiro and Magueija *(T. vulg.* var. *erythrospermum).*

Bunt is called fungão or morrão and is not an important disease in this concelho. Seed is treated by many farmers with weak solutions of copper sulphate.

Loose-smut called **morrão,** is also of little importance,

Rust epidemics have only been observed in their mildest forms and are ignored by many farmers. The local name for rusts is ferrugem.

Concelho of S. João da Pesqueira

Wheat grown by informants: Barbela *(T. vulg.* var. *erythrospermum).*

Bunt and loose-smut are confused under the name of morrão and are both of small economic importance. Seed is generally treated.

Rust. Alforra is a name apparently given to any mottling and necking of ears and leaves, produced by rusts, *Septoria* sp. or *Cladosporium herbarum.*

Foot-rot. All plants received were heavily infected by *Ophiobolus graminis.*

Concelho of São Pedro do Sul

Wheat grown by informants: Rieti *(T. vulg.* var. *erythrospermum).*

Much damage was caused in this concelho by larvae of a *Lema sp.*

Concelho of Sátam

Wheat grown by informants: Mole = Português *(T. vulg.* var. *erythrospermum).*

Bunt is known as fungão. Seed treatment is generally practiced.

Loose-smut is known as morrão and is considered of small economic importance.

Rusts, called alforra, are seldom very harmful. On specimens received, traces of *Puccinia graminis* were observed on sheaths, leaves and glumes.

Concelho of Mortágua

Wheat grown by informants: Oedo-Bem = Ribeiro, Galego = Barbela *(T. vulg.* var. *erythrospermum),* Rijo de barba loira = ?.

Bunt and loose-smut are both confused under the names fungão or morrão. Bunt did much harm in 1927, but was not prevalent this year. Seed is treated by most farmers with a 1 % solution of copper sulphate. *Tilletia tritici* was found on specimens.

Rusts are ignored by informants. On sample-plants, however, traces of *Puccinia graminis* were found.

District of Guarda

Main cereal crop: rye. Area of district: 548.220,00 hectares.
Area of land grown to wheat in 1926-27: 5.765,96 hectares.

Concelho of Vila Nova da Fascoa

"Wheat grown by informants : Barbela *(T. vulg.* var. *erythrospermum).*

Bunt and loose-smut are confused under the name of morrão. Seed is usually treated with copper sulphate.

Rusts are not distinguished from each other and are, moreover, confused with other diseases. They are all known as malina. *Puccinia glumarum* was observed on specimens.

Foot-rot. Plants heavily infested by *Ophiobolus graminis* were received. Perithecia observed. The deaf ears of foot-rotted plants were overgrown by *Cladosporium herbarum,* this condition is also called malina by informant.

Concelho of Celorico da Beira

Wheat grown by informants : Galego = Barbela, Tremês = Ribeiro *(T. vulg.* Var. *erythrospermum).*

Bunt is called cheia and often causes heavy damage. Seed treatment is not generally practiced.

Loose-smut is known as morrão, and seems to be the most widespread wheat disease.

Rusts are known under the name of lambra. On specimens sent *Puccinia triticina* and *P. glumarum* were visible on green leaves.

Concelho of Fornos de Algodres

Wheat grown by informants: Rijo or Galego = Barbela, Mole or Tremês = Ribeiro *(T. vulg.* var. *erythrospermum).*

The only disease reported is bunt, known as fungão. The causal organism found in all bunted ears was *Tilletia levis.*

Concelho of Manteigas

Wheat grown by informants : Barbela *(T. vidg.* var. *erythrospermum).*

Bunt is confused by informants with loose-smut.

Loose-smut called morrão, is very widespread.

Rusts, known as ferrugem, are often serious. The plants received in June were still green, and covered with uredosori of *Puccinia graminis.*

Insect-pest. An insect was very harmful to the wheat crop this spring. No specimens were sent, but from the description it seems clear that larvae of Lema are the pest referred to.

District of Castelo Branco

Main cereal crop: rye. Area of district: 668.820,00 hectares.

Area of land grown to wheat in 1926-27: 9.287,72 hectares.

Concelho of Fundão

Wheat grown by informants : Galego Barbado = Barbela *(T. vulg.* var. *erythrospermum),* Asa de corvo *(T. turgidum* var. *judorum,* Al.),

Bunt is known to most growers ; they call it fungão. Seed is generally treated.

Loose-smut is quite prevalent and called morrão.

Rusts, called ferrugem or pimentão, are according to informants rarely of economic importance. *Puccinia glumarum* and *P. graminis* were observed on specimens.

A foot-rot was very harmful during the past season. *Ophiobolus graminis* was found on many specimens.

Concelho of Idanha-a-Nova

Wheat grown by informants: Galego barbado *(T. vulg.* var. *ferrugineum).*

Bunt is unknown to informants, or possibly confused with the-next disease.

Loose-smut, called morrão, is often very troublesome.

Rusts, called ferrugem, are mostly of very slight importance. This year however, during April and May, a serious epidemic broke out. *Puccinia glumarum* was found in abundance on leaves and ears.

Concelho **of** Oleiros

Wheat grown by informants : Trigo = ?

Bunt is here called fungão and is often serious. Seed is dipped, before sowing, in a dilute solution of copper sulphate, or in strong' vinegar. *Tilletia levis* proved to be the causal organism on all specimens examined.

Loose-smut, known as morrão, is sometimes prevalent, but was not noticed during this last season.

Concelho of Proença-a-Nova

"Wheat grown by informants : Barbela *(T. vulg.* var. *erythrospermum).*

Bunt is unknown or confused with the next malady.

Loose-smut is know as machio and does little damage.

Rusts are of small importance. The local name for these diseases is alforra or ferrugem. *Puccinia graminis* was found on plants examined.

Concelho of Castelo Branco

Wheat grown by informants : Tremês = Ribeiro mixed with Barbela *(T. vulg.* var. *erythrospermum),* Galego = Galego barbado *(T. vulg.* var. *ferrugineum).*

Bunt or fungão is not prevalent, now that seed treatment with copper sulphate has been adopted by most farmers.

Loose-smut, called morrão, is rather widespread.

Rusts, known by the name of ferrugem, are feared only during very humid springs, such as the one of]928. *Puccinia glumarum* and *P. graminis*were found on diseased material.

A foot-rot was observed on plants approaching maturity, and on young seedlings. On the first, dark mycelial plates of *Ophiobolus graminis* were found ; on the second, pupae of Hessian fly and a fusarium growth were seen.

District of Coimbra

Main cereal crop: maize. Area of district: 390.720,00 hectares. Area of land grown to wheat in 1926-27: 2.749,89 hectares.

Concelho of Coimhra

No information was received from Coimbra during the past season. In June 1927 however, the writer visited the wheat plots at the

Agricultural School, close to this city and found the plants parasitized by *Puccinia graminis, P. glumarum, P. titricina.* A very severe case of Brown-neck (a disease which will be dealt with in another part of this article) was also observed. Among insect pests, *Phytophaga destructor* was seen in a small number of plants, also larvae, apparently of *Chlorops taeniopus.* This latter insect is, according to an oral communication of Dr. J. S. Fialho, often exccedingly harmful in this vicinity.

Concelho of Penacova

Wheat grown by informants : Trigo = ? *(T. vulg.* var. *ferrugineum),* Barba de lobo *(T. turgidum* var. *jodorum).*

Bunt, known by the name of fungão, is never very harmful, and was not observed by the growers this year.

Loose-smut, called morrão, is much more prevalent.

Rusts, known by **the** name of ferrugem, are often very harmful. No specimens were received.

Foot-rot. *Ophiobolus graminis* with mature perithecia was found on specimens. The disease produced by this fungus is called mêla by the farmers of this locality and is said to have done much harm in 1928.

Concelhos of Goes and Pampilhosa da Serra

Wheat grown by informants **at** Goes : Rijo = Barbela *(T. vulg.* var. *erythrospermum);* **at** Pampilhosa **da** Serra: Tremês = Ribeiro *(T. vulg.* var. *erythrospermum),* Branco *(T. turgidum* var. *lusitanicum,* Kcke.).

Bunt is known in both these localities as fungão.

Loose-smut is often confused with the preceding disease.

Rusts are not reported.

District of Leiria

Main cereal crop: maize. Area of district: 341.180,00 hectares. Area of land grown to wheat: in 1926-27: 7.039,25 hectares.

Concelho of Pombal

Wheat grown by informants : Ribeiro *(T. vulg.* var. *erythrospermum)* and Trigo de barba preta = ?

Bunt, called fungão, is often quite harmful. On samples examined *Tilletia levis* was found. Seed treatment is not generally practiced.

Loose-smut is confused with the preceding disease.

Rusts are generally not feared ; fêrrujão is the local name for them. *Puccinia glumarum* was found on bunted heads.

Concelho of Alcobaça

Wheat grown by informants: Ribeiro *(T. vulg.* var. *erythrospermum),* Branco *(T. turgidum* var. *lusitanicum),* Tremês = Amarelo de barba branca ***(T.*** *durum* var. *affine),* Massarouco = Alexandre ***(T.*** *durum* var. *afric.anum,* Kcke.), Durázio molar (mixture of ***T.*** *durum* var. *reichenbachii,* Kcke. & var. *fastuosum,* Lag.).

Bunt and loose-smut are confused under the names of morrão, fungo or fungão. Both these diseases, or one at least, is widespread and considered harmful by farmers. Seed is steeped in vinegar or iron sulphate. No specimens received.

Rusts, known as ferrugem or ferrugeira, were very harmful this past season. *Puccinia graminis* was found on specimens. Massaroucò is reported as very resistant.

Insect-pests. A large number of plants had deaf ears. This condition was caused by non-identified culm-borers.

Concelho of Nazaré

Wheat grown by informants : Rieti ***(T.*** *vidg.* var. *erythrospermum),* Massarouco branco = ? Barba de lôbo *(T. turgidum y&r.jodurum).*

Bunt, known as fungão, is not very important. Seed is not treated.

Rusts are called alforra. This name is also given to the growth of *Cladosporium herbarum* on deaf ears.

A foot-rot caused heavy losses during the past season. Mycelial plates of *Ophiobolus graminis* were observed on diseased plants.

Insect-pests. *Phytophaga destructor* caused much damage in this locality both to seedling and older plants.

Concelho of Caldas da Rainha

Wheat grown by informants: Gralego = Barbela, Rieti *(T. vulg.*

var. *erythrospermum),* Branco ***(T.*** *turgidum* var. *lusitanicum).* Massarouco = Alexandre *(T. durum* var. *africanum)* Verdial = ?

Bunt and loose-smut are confused by most farmers under the one name morrão. Seed is generally treated with copper sulphate at 1 °/o or 2 %, strong vinegar or lime-sulphur.

Rusts are known as mela, ferrugem amarela, ferrujão, ferrujeira or alforra. These diseases are often serious. *Puccinia graminis* was present on most specimens.

Foot-rot. Mal branco is the name given in this locality to a premature drying of plants and heads which, as samples show, was caused by *Ophiobolus graminis.*

Concelho of Óbidos

Wheat grown by informants-: Rieti *(T. vulg.* var. *erythrospermum),* Ideal, Precoce *(T. vulg.* var. *ferrugineum),* Massarouco *(T. durum* var. *africanum),* Mourisco *(T. durum* var. *niloticum,* Kcke).

Bunt or fungão is sometimes serious but was not observed this year. Seed is usually treated with copper sulphate or vinegar.

Loose-smut, called morrão, is generally very prevalent. Growers believe that seed treatment prevents this disease also.

Rusts are often very harmful. Massarouco is considerd resistant. No diseased specimens were recieved.

District of Santarém

Main cereal crop: wheat. Area of district: 661.940,00 hectares. Area of land grown to wheat in 1926-27: 25.994,87 hectares,

- Concelho of Sardoal

Wheat grown by informants: Branco *(T. turgidum* var. *lusitanicum),* Oachudo *(T. turgidum* var. *pseudocervinum,* Kcke.), Tremês = ?.

Bunt, called fungão, is serious in some seasons. Seed is treated by most growers with weak copper sulphate solutions.

Loose-smut, known as morrão, is reported prevalent.

Rusts are called ferrugem and dreaded by farmers. A strong-attack of *Puccinia graminis* on leaves, culms and heads, was visible on specimens.

Insect-pests. Pupae of *PJiytopliaga destructor* were found in abundance on diseased material.

Concelho of Constância

Wheat grown by informants: Rieti, Ribeiro *(T. vulg.* var. *erythrospermum).*

Bunt is not very prevalent, according to our informants, although seed is not generally treated. The local name for this disease is fungão.

Loose-smut called morrão is observed every year to a greater or lesser degree.

Rusts, known as alforra, are generally of small importance.

Insect-pests. Larvae of *Lema* proved here again to be the growers' worst enemy during last spring.

Concelho of Chamusca **(Quinta do Arrepiado)**

Wheat grown by informants: Ideal *(T. vulg.* var. *ferrugineum),* Mocho de espiga branca *(T. vulg.* var. *lutescens,* AL).

Bunt or fungão is not prevalent. Seed treatment with copper sulphate is often practiced.

Loose-smut is in some seasons quite serious but was very rare in 1928.

Rusts, known by the name of alforra, are of great economic importance. Traces of *Puccinia glumarum* and a recent heavy attack of *P. graminis* were seen on specimens.

Septoria nodorum produced serious damage on wheat grown on newly broken, thin, sandy soil. Growers confuse this disease with rusts.

A foot-rot was very harmful on plants grown on the rich alluvial soils. In the fields situated on the sandy hills, however, where *S. nodorum* was so harmful, only slight traces of foot-rot were observed. Macro and microscopical evidence point to *Ophiobolus graminis* as the pathogène. No perithecia were found.

Concelho of Golegã

Wheat grown by informants: Serôdio = Ribeiro, Rieti (T. *vulg.* var. *erythrospermum),* Temporão de Coruche *(T. vulg.* var. *ferrugineum).*

Bunt is known as fungão and is said to do muck karm in some seasons. Seed is treated witk copper sulphate.

Loose-smut is ignored, probably confused with bunt.

Rusts are not distinguished from each other. The name for all of them is ferrujão or alforra. Damage done by rusts is said to be very great, amounting in humid springs to the total destruction of crops.

Concelho of Rio Maior

Wheat grown by informants : Galego barbado *(T. vulg.* var. *ferrugineum),* Durázio rijo = Lobeiro- *(T. durum* var. *affine),* Massarouco = Alexandre *(T. durum* var. *ofricanum).*

Bunt is known as fungão, The losses produced by this disease . are not heavy. Seed is treated with copper sulphate or vinegar before sowing.

Rusts are not distinguished from each other and are all called ferrugem. Informant reports that this disease is particulary harmful on the spikelets during blossoming time. This suggests the predominance of *Puccinia glumarum* as *P. graminis* becomes prevalent only later in the season. On specimens received in June however, *P. graminis* and *P. triticina* were seen and no traces of *P. glumarum* were found. Massarouco is said to be resistant.

Concelho of Santarém

Wheat grown by informants : Ribeiro *(T. vulg.* var. *erythrospermum),* Temporão de Coruche, Galego barbado ***(T.*** *vulg.* var. *ferrugineum),* Galego rapado ***(T.*** *vulg.* var. *milturum,* AL), Massarouco = Alexandre, Durázio molar *(T. durum* var. *africanum).*

Bunt, called fungão, is sometimes serious in the fields of the smaller farmers who do not treat the seed.

Loose-smut or morrão does considerable damage in some seasons.

Rusts, called alforra or ferrugem, are considered of small importance by most farmers. The staff at the Agricultural School however, say that the losses due to these are much more important than is generally realised by growers. Both Durázio molar and Massarouco are reported as very resistant varieties of wheat.

Concelho of Cartaxo

Wheat grown by informants : Rieti, Ribeiro ***(T.*** *vulg.* var. ***ery«***

throspermum), Marinheiro = Temporão de Coruche *(T. vulg.* var. *ferrugineum),* Cascalvo *(T. turgidum* var. *lusitanicum),* Cascalvo branco = = Candial *(T. durum* var. *leucurum),* Al.), Massarouco = Alexandre *(T. durum* var. *africanum),* Caneco = ?.

Bunt is called fungão and is of small importance. Seed is treated by some growers with copper sulphate.

Loose-smut, called morrão, is also of small importance.

Rusts are all termed alforra and -are very serious. Probably all three occur. Cascalvo is reported very resistant.

Concelho of Salvaterra de Magos

Wheat grown by informants : Estação, Luso, Rieti *(T. vulg.* var. *erythrospermum),* Ideal, Temporão de Coruche, *(T. vulg.* var. *ferrugineum),* Candial *(T. vulg.* var. *leucurum),* Amarelo de barba bïanca *(T. durum* var. *affine),* Rijo = Raspinegro *(T. durum* var. *apulicum).*

Bunt, called morrão, is sometimes serious but was very scarce this year. Seed is treated with 1,5 % copper sulphate or with Caffaro dust.

Loose-smut is known as fungão and is also of small importance.

Rusts are known. One is called colorau, another alforra ; colorau being considered less harmful than alforra. Whether alforra is the name given to *Septoria nodorum* and colorau to rusts, or whether colorau is the name of one rust and alforra of another, has not been ascertained. Whatever the case may be, these diseases are considered very serious. Specimens received were severely attacked by *Puccinia graminis* and *P. glumarum. P. triticina* was also found.

Septoria nodorum was observed on most specimens of wheat and particularly on plants of Luso. Whether this wheat is more sensitive to the disease than other varieties, or whether it was grown under conditions predisposing it to the invasion of the parasite, is not known.

Foot-rôt. *Ophiobolus graminis* was found on plants sent by various informants. They all complained of serious losses occasioned by the sudden drying of patches of immature plants throughout the fields.

Concelho of Benavente (Samora Correia)

Wheat grown **by** informants : Tremês ribeiro == Ribeiro, Rieti

***(T.** vulg.* var. *erythrospermum);* Ideal *(T. vulg.* var. *ferrugineum),* Mocho de espiga branca *(T. vulg.* var. *lutescens),* Tremês = Amarelo de barba branca *(T. durum* var. *affine),* Anafil = ?.

Bunt known as fungão, is very harmful in some seasons. Seed is dipped in a dilute solution of copper sulphate.

Loose-smut, called morrão, causes losses which are sometimes quite serious.

Rusts are called alforra or moléstia negra and are considered very harmful. It is probable that not only rusts are understood under these terms but also other diseases, such as the blackening caused by *Septoria nodorum* and that produced on empty ears by the growth of *Cladosporium herbarum.*

Foot-rot. Mycelium of *Ophiobolus graminis* and of a *lusarium sp.* was observed at the base of diseased plants, between sheath and culm.

Concelho of Coruche **(Quinta Grande)**

Wheat grown by informants : Rieti *(T. vulg.* var. *erythrospermum)* on rich alluvial land; Mocho de espiga branca *(T. vulg.* var. *lutescens)* on the poorer soils.

Bunt is known as fungão and was not seen this year. Seed is treated with a copper sulphate solution at 1,5 %.

Loose-smut called morrão, was not noticed this season.

Rust are confused under the names of *alforra* or *manga* and considered very dangerous. *Cladosporium herbarum* is also called *alfoi~ra.* The writer visited this locality on the 6 th. of June, about two weeks before harvest. An epidemic of *Puccinia graminis* was just starting and a sprinkling of *P. triticina* was also observed throughout the fields. No traces of *P. glumarum* were to be seen.

Foot-rot. At Quinta Grande during the past season the most severe disease without any doubt was a foot and root-rot produced by *Ophiobolus graminis.* In the lower fields, where drainage was worse, about two thirds of the wheat plants had died. In the ones where water-logging was not so severe, one third to one fourth of the wheat plants were drying, and many ears of apparently healthy plants were not filling normally. The bailiff stated that he has observed this disease every year but that it is usually not as prevalent as during the past season. Mycelial plates of *Ophioholus graminis* were also found on *Lolium temulentum* L., growing among the wheat.

Septoria nodorum. A slight discoloration produced by this fungus was observed on glumes and nodes of some plants.

District of Lisbon

(Including the newly created district of Setúbal)

Main cereal crop : wheat. Area of district : 830.470,00.
Area of land grown to wheat in 1926-27: 53.458,01 hectares.

Concelho of Torres Vedras

Wheat grown by informants : Ideal *(T. vidg.* var. *ferrugineum),* Amarelo de barba preta *(T. durum* var. *MelanOpus,* Kcke), Massarouco = Alexandre *(T. durum* var. *africanum),* Cascai = ? .

Bunt, called fungão, is of very slight economic importance.

Loose-smut, called machio, was only noticed on Ideal.

Rust are known under the name of alforra and are generally of small importance; however during the past season the infection on Ideal was quite serious.

A foot-rot was in this locality, as in many others, the most severe disease during the past season. Mycelial plates of *Ophiobolus graminis* were found on all specimens. The farmers in this locality have very correct notions concerning this disease, which they call pêco. They know that this malady is soil-borne and that it can live over for several years. As disease control they practice a three years rotation with oats and legumes.

Concelho of Alenquer

Wheat grown by informants : Precoce = *(T. vulg.* var. *ferrugineum),* Canoco *(T. turgidum* var. *melanatherum),* Branco and Cascalvo *(T. turgidum* var. *lusitanicum),* Massaroquinho = Alexandre *(T. durum* var. *africanum).*

Bunt, called fungão, is of very small economic importance. Seed is treated with a solution of copper sulphate at 1 %.

Loose-smut, called morrão, is known in the locality but this year was only observed on Branco and Precoce.

Rusts, called alforra, are considered very important by growers. *Puccinia glumarum* was found on sheaths and in glumes of Precoce, *P. titricina* on leaves of Branco,

Foot-rot caused much damage during the past season, the pathogène here again being *Ophiobolus graminis. Cladosporium herbarum* on empty ears of foot-rotted plants is confused by growers with teleutosori of *Puccinia graminis.*

Concelho of Azambuja

Wheat grown by informants : Ideal ***(T.*** *vulg.* var. *ferrugineum),* Massarouco = Alexandre *(T. durum* var. *africanum).*

Bunt, called morrão, has not much importance in this locality, seed is treated with a solution of copper sulphate at 1 %.

Loose-smut, called fungão, does also little damage.

Rusts are all confused under the names of alforra or mêla.

Foot-rot. A disease of the crown and root of plants, not observed before by informant, was very severe this last season. No specimens sent.

Concelho of Arruda dos Vinhos

Wheat grown by informants : Temporão de Coruche *(T. vulg.* var. *ferrugineum),* Massarouco = Alexandre *(T. durum* var. *africanum).*

' Bunt is of small importance. Seed is dipped in a solution of copper sulphate at 1 % or else treated with Caffaro dust.

Loose-smut is also of rare occurrence.

Rusts, called alforra, are said to be seldom serious.

Concelho of Vila Franca de **Xira (Telial)**

Wheat grown by informants : Massarouco = Alexandre *(I. durum* var. *africanum),* Mourisco mole = ?.

Bunt, called morrão or fole, is quite important in the locality.

Loose-smut, called fungão, is often very prevalent.

Rusts, called alforra, are sometimes very important. Massarouco is said to be resistant.

Conoelho of Lisbon

(Fields of the Experimental Station at Belem)

Wheat grown: a large collection of pure lines of Portuguese and foreign strains of *Triticum vulgare, T. compactum, T. pyramidale, I. polonicum, T. turgidum, T. durum, T. monococcum* and *T. dicoccum.*

Bunt is of very rare occurrence in the station, so that it is not necessary to treat the seed.

Loose-smut seldom infects as much as 1 % of the ears.

Rusts. *Puccinia glumarum, P. triticina* and *P. graminis* are all three prevalent. In 1927 *P. triticina* developped very early during the latter half of March and April. *P. glumarum* appeared after the 15th. of April, and *P. graminis* after the 10th. of May. During 1928 *P. glumarum* was very widespread and quite harmfuld during April and May; *P. triticina* and *P. graminis* only appeared at the end of May. A great difference in the résistance to rusts of different varieties, and sometimes even lines of wheat was observed, which will be reported in another paper.

Septoria tritici, during the winter months, produces a certain amount of leaf blotching and later overruns culms and leaves of all weakened etiolated plants of very early sowings and those parasitised by *Ophiobolus graminis.* On a few varieties of wheat *(T. pyramidale* var. *recognitum,* Perc. and another closely related variety) however, this fungus is found persistently even later in the season and on vigorously growing plants and causes a premature drying of leaves, which brings about shrivelling of the grain.

Septoria nodorum. A few discoloured glumes and nodes parasitised by this fungus were observed in some of the plots.

Brown-Neck (1) is a non-parasitic disease characterised by a darkening of the glumes and rachis and parts of the culm of certain plants. The dark blotche's on this last named organ are generally situated on the last interno de just below the head, hence the name given to this disease. Once however, the writer observed the discoloration of entire culms in a plot of Ribeiro wheat grown in a very humid field at Coimbra. This disease has been observed by the writer only on strains of bread wheat and particularly on strains of Ribeiro. Brown-Neck does not seem to injure the plants, except possibly in very severe cases such as the one observed at Coimbra.

Foot-rots. Two different fungi caused foot-rots in the experimental fields: *Ophiobolus graminis,* of which only traces were seen during 1927, caused very heavy losses in 1928. The plants of the earliest sowings were most severely damaged. Mature perithecia were found in increasing numbers from the 28th. of March until harvest. *Fusarium cidmorum* was isolated from roots and culms of dried plants

(1) R. H. BifTen. *Annual Report* of 1926. *Journ. Roy. Agric. Soc. England,* 187: 347-351. 1927,

with, deaf ears during the month of June 1927 and after harvest 1928. It is to be noted that in almost every plant invaded by this fungus, traces of *Ophiobolus graminis* or of *Phytophaga destructor* were also observed.

Insect-pests. While inspecting the plants the writer's attention was called incidentally to the existence of a few important insect parasites of wheat. The Hessian fly *(Phytophaga destructor)* in 1927 destroyed almost entirely all plots of wheat sown during February and March. Strains of durum wheats and particularly Medeah (var. *coerulescens,* Bayle) and Javardo (var. *lybicum),* proved to be exceptionally resistant to this pest. In the damp season of 1928 the damage done was not so severe. An aphis is often found, during autumn, winter and early spring on the green parts of the wheat plants (1). Larvae of a hymenopterous insect were often observed boring through nodes and internodes of wheat culms in spring and early summer.

Concelho of Aldeia Galega (Charneca dos Pegões)

Wheat grown by informants : Mocho de espiga branca *(T. vulg.* var. *lutescens),.*

The crop was grown on sandy soil, never cultivated before and was badly attacked by *Septoria nodorum* in the spring. Many tillers were killed, so that most plants produced at the utmost only one or two ears. These were small and contained shrivelled grain. The nodes, the rachis and glumes were dark brown and covered with picnidia. *Lolium temulentum* L. growing among the wheat was also severely infected. Farmers in this vicinity hold that «black crops» are often produced on newly broken land.

Conoelho of Seixal (Aldeia de Paio Pires)

Wheat grown by informants : Rieti *(T. vulg.* var. *erythrospermum),* Mocho de espiga branca *(T. vulg.* var. *lutescens).*

Bunt is not known to informant.

. Loose-smut, called morrão, does little harm.

Rusts are all known as alforra and are said to be of small econo-

(1) According to M.r E. Speyer, to whom specimens were sent, *Toxoptera graminum* Eond is the species in question.

inic importance. Specimens of both varieties of wheat were slightly attacked by *Puccinia graminis.*

Septoria nodorum produced a slight discoloration of the glumes in Mocho de espiga branca.

Concelho of Setúbal

Wheat grown by informants: Trigo moJe= Mocho de espiga branca *(T. vulg.* var. *lutescens),* Rijo == Durázio *(T. durum* var. *melanopus),* Tremês = Amarelo de barba branca *(T. durum* var. *affine).*

Bunt, called fungão, does very little harm. Seed is usually treated with a solution of copper sulphate or strong vinegar.

Loose-smut is known but not prevalent.

Rusts, known as alforra only produce heavy losses once in a while. Traces of *Puccinia triticina* were observed on specimens.

Concelho of Alcácer do Sal

Wheat grown by informants : Rieti, Tremês == Ribeiro *(T. vulg.* var. *erythrospermum),* Rijo de barba preta = Durázio *(T. durum* var. *melanopus),* Rijo russo = Taganrog *(T. durum* var. *affine).*

Bunt, called fungão, is often troublesome. Seed is treated with copper sulphate or with Caffaro dust.

Loose-smut or morrão does little harm.

Rusts are all known under the name of aiforra and seem to be very serious. According to informant, the losses due to rusts amount in average seasons to 20 or 30% of the total crop, whereas in a bad year as much as 50 or 60% of the crop is destroyed.

Concelho of Grândola

Wheat grown by informants : Mocho de espiga branca *(T. vulg.* var. *lutescens),* Preto-amarelo — Durázio *(T. durum* var. *melanopus),* Tremesinho — ?.

Bunt, known as fungão, is not important in the locality. Before sowing, seed is dipped in a weak solution of copper sulphate.

Loose-smut is known as morrão. Growers believe that the copper sulphate treatment controls this disease also.

Rusts, called alforra, are considered very serious, but as informant applies this name also to the symptoms produced by *Septoria*

nodorum, it is difficult to say to what extent this is so. Tremezinho and Preto-amarelo are considered very resistant.

District of Portalegre

Main cereal crop: wheat. Area of district: 623.060,00 hectares. Area of land grown to wheat in 1926-27: 71.688,27 hectares.

Concelho of Gavião

Whea| grown by informants: Galego = Barbela *(T. vulg.* var. *erythrospermum),* Galego = Temporão de Coruche *(T. vulg.* var. *ferrugineum),* Mocho = Galego rapado *(T. viág.* var. *milturum).*

Bunt, known in this locality as fungão, is not very serious. Seed is mostly treated with copper sulphate.

Loose-smut, called morrão, is of little importance and is often confused with the preceding disease.

Rusts, known by the name of ferrugem, produce once in a while serious epidemics, but hardly ever entire crop-failure.

Concelho of Niza

Wheat grown by informants: Galego = Barbela, *(T. vulg.* var. *erythrospermum).*

Bunt is called machio, fungão or fumilho and is generally of small importance. The causal organism found on all specimens was *Tilletia levis.* Seed is dipped in a solution of copper sulphate.

Loose-smut is called morrão, and is also generally of small importance.

Rusts are known in the locality as alforra, ferrugem, ferrujão or vermelhão. In bad years, in some localities of this concelho, the wheat crop is almost destroyed by these diseases. Specimens were heavily infected with *Puccinia glumarum* and *P. graminis.*

Foot-rot. During the past season great losses were due to the premature drying of plants in patches, here and there, throughout the fields. Informant writes that this malady had not been observed before and wonders whether it existed and remained unobserved in the past, or whether it is of recent introduction. Mycelium and perithecia of *Ophiobolus graminis* were found on specimens examined.

Concelho of Marvão (Salvador da Arramanha)

Wheat grown by informants: Rieti *(T. vulg.* var. *erythrospermum).*

Bunt, known as fumilho, is often quite serious.

Loose-smut or morrão was not observed this year.

Rusts, known by the same names as in the preceding concelho, are only serious in rainy years.

A foot-rot produced by *Ophiobolus graminis* was in this locality also the most severe disease during the past season.

Cqncelho of Crato

Wheat grown by informants: G-alego = Barbela *{T. vulg.* var. *erythrospermum),* Durázio *(T. durum* var. *melanopus* var. *africanum).*

Bunt, known as fungão, is not serious. Seed is tieated by informant with a solution of copper sulphate at 4 °/o.

Loose-smut, called morrão, is not very prevalent.

Rusts, called alforra, are often extremely serious.

Concelho of Portalegre

Wheat grown by informants: Galego = Barbela, Rieti *(T. vulg.* var. *erythrospermum),* Galego = Galego barbado, Belém *(T. vulg.* vaf. *ferrugineum),* Mocho = Galego rapado *(T. vulg.* var. *milturum).*

Bunt, known as fungão, is not serious, probably because in this locality care is taken in using only clean wheat for seed. This moreover is treated with a solution of copper sulphate before sowing.

Loose-smut, known as morrão, is of small economic importance.

Alforra is the name generally. applied to rusts. Some growers however, also apply this term to the premature drying of plants produced by foot-rots. On specimens received *Puccinia glumarum* was observed on sheaths and glumes, and *Ophiobolus graminis* on roots and crowns of plants.

Concelho of Alter do Chão

Wheat grown by informants: Temporão de Coruche *(T. vulg. var. ferrugineum),* Marques *(T. durum* var. *apulicum),* Galego = ?.

Bunt, known as fungão or ferrugem, is of rare occurrence. Seed is pickled in a weak solution of blue-stone. This treatment is supposed to prevent loose-smut as well as bunt.

Loose-smut is not widespread.

Rusts are considered extremely harmful to the wheat crop. The usual names employed are alforra or mera. *Puccinia graminis* and *P. glumarum* were present on specimens. The most resistant wheat is said to be Marquês.

A foot-rot produced an early dryiug of plants and a shrivelled condition of the kernels. Farmers did not notice the lesions on roots and lower internodes, and attributed the damage to rusts. On specimens mycelial plates of *Ophiobolus graminis* were found.

Concelho of A viz

Wheat grown by informants: Ribeiro fino = Ribeiro, Rieti *(T. vulg.* var. *erythrospermum),* Ideal *(T. vulg.* var. *ferrugineum),* Marques *(T. durum* var. *apulicum),* Tremês rijo = Amarelo de barba branca ***(T.*** *durum* var. *affine).*

Bunt, called ferrugem, fungão or morrão, used to be harmful in the past, but is much less prevalent now that seed is treated with copper sulphate.

Loose-smut is confused with the preceding disease.

Rusts, called alforra, are, according to informants, of great importance. During the past season many fields were left unharvested because the crop was too much damaged by rusts to be of any use. A severe attack of *Puccinia graminis* was observed on specimens received.

Foot-rot. The premature drying of plants caused by a diseased condition of the roots, leaves and culms was reported. No specimens were however received.

Concelho of Souzel

Wheat grown by informants : Rieti *(T. vulg.* var. *erythrospermum),* Ideal ***(T.*** *vulg.* var. *ferrugineum),* Mocho de espiga branca *(T. vulg.* var. *lutescens),* Marquês *(T. durum* var. *apulicum),* Durázio *(T. durum* var. *melanopus).*

Bunt, known as fungão or ferrugem, is sometimes very important. Seed is treated with copper sulphate or with Caffaro dust.

Rusts, called alforra, are said to have been very serious this season. On specimens however, only a foot-rot was observed.

Concelho of Fronteira

Wheat grown by informants : Ribeiro *(T. vulg.* var. *erythrospermum),* Belém *(T. vulg.* var. *ferrugineum),* Marquês or Barba preta *(T. durum* var. *apulicum).*

Bunt is known as ferrugem or morrão. This disease does not appear every year, but when it does is sometimes quite harmful. Seed is treated with copper sulfate, by a few farmers only.

Loose-smut is often confused with bunt.

Rusts, called alforra or mela, are said to be very serious in humid seasons such as 1928. According to some informants the crop, during this last year, lost through rusts 50 to,100°/o of its value. On specimens the writer found signs of an early very heavy attack of *Puccinia glumarum* and recently formed uredo and teleutosori of *P. graminis.*

Concelho of Monforte

Wheat grown by informants: Rieti, Barbela *(T. vulg.* var. *erythrospermum),* Temporão de Coruche *(T. vulg.* var. *ferrugineum),* Candial *(T. durum* var. *leucurum),* Marquês *(T. durum* var. *apulicum).*

Bunt, called ferrugem, is sometimes quite serious. Most growers treat the seed with copper sulphate.

Loose-smut, called morrão, is not very prevalent.

Rusts, called alforra, are sometimes very harmful. *Puccinia graminis* was observed on specimens.

Concelho of Elvas

Wheat grown by informants : Rieti, Ribeiro *(T. vulg.* var. *erythrospermum),* G-alego = Galego barbado, Ideal, Temporão de Coruche *(T. vulg.* var. *ferrugineum),* Mocho de espiga branca *(T. vulg.* var. *lutescens),* Tremês rijo = Amarelo de barba branca *(T. durum* var. *affine),* Candial branco, Lobeiro *(T. durum* var. *leucurum),* Mourisco = ?

Bunt, known as ferrugem, is said to be very widespread. Owners of large estates treat the seed by sprinkling it with solutions of copper sulphate, stronger than those used elsewhere (5 to 7%). As in this region wheat is often sown in the dust, wet treatments are frequently harmful. It is expected that copper carbonate and organic compounds of mercury, which are now being introduced for

dry treatments, will prove very useful in this concelho. *Tilletia levis* was found on specimens examined.

Loose-smut is reported of small economic importance.

Rusts. Epidemics are not observed every year, but in wet seasons, such as the last, they produce very serious losses. In April and May 1928 *Puccinia glumarum* prevailed and crops of the varieties most sensitive to this rust were badly damaged. Later, in June, *P. graminis* spread throughout the fields and worked more havoc even than the first epidemic. A slight attack of *P. triticina* was also observed.

Foot-rot. At the end of April the writer found in many wheat fields around Elvas numerous patches of dying plants- attacked by *Ophiobolus graminis.* In the plots of the experimental station at Elvas where wheat had not been grown before, no traces of this diseas were evident.

Insect-pests. In the experimental plots a certain number of seedlings of all sowings (September to January) were killed by larvae of the Hessian fly.

District of Évora

Main cereal crop: wheat. Area of district: 739.950,00 hectares.
Area of land grown to wheat in 1926-27: 88.109,80 hectares.

Concelho of Arraiolos

Wheat grown by informants : Rieti, Barbela *(T. vulg.* var. *erythrospermum),* Ideal *(T. vulg.* var. *ferrugineum),* Gentil rosso *(T. vulg.* var. *alborubrum),* Amarelo de barba branca *(T. durum* var. *affine),* Rijo = Raspinegro *(T. durum* var. *apulicum),* Australiano = ?.

Bunt is serious when seed is not treated.

Loose-smut, called morrão or sometimes ferrugem, was found in about 5 °/o of the ears in some fields.

Rusts are extremely harmful in some years. On many specimens received the interior of glumes and surface of seed Was covered with *Puccinia glumarum;* a more recent and not very severe attack of P. *graminis* was apparent on leaves and sheaths.

Foot-rot. Informants complain that heavy losses were caused by the sudden drying of plants in fields, particularly in the poorly drained ones. No specimens.

Concelho of Borba

Wheat grown by informants: Rieti, Galego = Barbela *(T. vulg.* var. *erythrospermum),* Galego = Galego barbado *(T. vulg.* var. *ferrugineum),* Pragana preta = a mixture of wheats in which Raspinegro *(T. durum* var. *apulieum)* predominates.

Bunt called morrão, is said to destroy in most seasons about 5% of the ears. Seed is only treated by a few growers. *Tilletia levis* was found on specimens.

Loose-smut, called fungão, is less prevalent than bunt.

Rusts, known by the name of alforra, are very serious, often destroying as much as 50°/o of the crop. On material received, both *Puccinia glumarum* and *P. graminis* were observed. Rieti is often, but not always, more resistant than other wheats.

A foot-rot. *Ophiobolus graminis* was found on specimens from this locality.

Concelho of Évora (Experimental station)

Wheat grown: Barbela, Rieti (T. *vulg.* var. *erythrospermum),* Temporão de Coruche, Ideal-(T. *vulg.* var. *ferrugineum),* Mocho de Espiga branca *(T. vulg.* var. *lutescens),* Lobeiro *(T. durum* var. *affine),* Anafil rijo = Raspinegro *(T. durum* var. *apulicum),* Kanred.

Bunt is of rare occurrence in the experimental station, where seed is always treated.

Loose-smut is not prevalent.

Rusts are only serious during rainy spring seasons. *Puccinia glumarum* and *P. graminis* were both found on material examined.

Kanred wheat has proved resistant during the last three seasons.

District of Boja

Main cereal crop: wheat. Area of district: 1.025.490,00 hectares.

Area of land grown to wheat in 1926-27: 122.900,96 hectares.

Concelho of Cuba

Wheat grown by informants: Rieti, Ribeiro, Carlota Strampeli *(T. vulg.* var. *erythrospermum),* Ribeiro = Amarelo de barba branca, Lobeiro, Russo == Taganrog *T. durum* var.» *affine),* Preto = Amarelo

de barba preta *(T. durum* var. *leucomelon),* Tremês preto = Javardo *(T. durum* var. *lybicum),* Argelino *(T. durum* var. *melanopus),* Palhinha = ?.

Bunt and loose-smut are both called morrão and evidently confused by most farmers. *Bunt* is probably the most prevalent. On specimens received *Tilletia levis* was found présent.

Rusts,' called alforra, were very predominant last season. In most years however, they appear only in small patches in the fields and do little damage. An intense attack of *Puccinia glumarum* and *P. graminis* was noted on specimens examined. Carlota Strampeli was very resistant.

Concelho of Ferreira do Alentejo

This concelho constitutes one of the most important wheat sections of Portugal; information received was however very scarce. Most wheats mentioned in the preceding concelho are also grown here.

The writer only received a few specimens of Lobeiro *(T. durum* var. *affine)* covered with *Puccinia graminis.*

Conoelho of Beja

The varieties of wheat grown are the same as in the concelho of Cuba.

Bunt, called morrão, is severe when no preventive measure is applied. Seed is dipped by many farmers in a 1 °/o copper sulphate solution.

Loose-smut, called fungão, is not prevalent.

Rusts are called alforra. The importance of these diseases is such, writes one informant, that we consider them the main factor in crop failure. On specimens received an intense attack of *Puccinia graminis* was observed. Carlota Strampeli held its own very well.

Concelho of Serpa

Wheat grown, by informants : Barbela, Rieti *(T. vulg.* var. *erythrospermum),* Ideal *(T. vulg.* var. *ferrugineum),* Mocho de Espiga branca *(T. vulg.* var. *lutescens),* Lobeiro *(T. durum* var. *affine),* Rijo = Durázio *(T. durum* var. *melanopus).*

Bunt, known as morrão, is quite serious in the higher lands, which belong mostly to small farmers who do not treat the seed.

Loose-smut, known as fungão, is not very prevalent.

Rusts are more or less important every season, but very particularly so this year. *Puccinia gluniarurn* was observed on specimens.

Septoria nodorum infected heavily a crop of Barbela wheat grown on poor soil, on the higher land.

Concelho of Odemira

Wheat grown by informants: Mourisco ruivo = Vermelho fino *(T. durum* var. *murciense).*

Bunt is very serious. Seed is not treated in the locality.

Loose-smut is ignored by informant.

Rusts, called alforra, are very harmful. This year the crop of many growers in the concelho was totally destroyed. Specimens were heavily infested with *Puccinia graminis.*

Concelho of Moura (Safara)

Wheat grown by informants : Barbela *(T. vulg.* var. *erythrospermum),* Lobeiro *(T. durum var. affine),* Argelino *(T. durum* var. *melanopus).*

Bunt, known as morrão, does little harm. Before sowing, seed is steeped in a solution of copper sulphate.

Loose-smut, called tição, is not very prevalent.

Rusts, all confused under the name of alforra, have been very harmful during the past season. *Puccinia glumarum* was found on glumes and grain of Barbela and Lobeiro wheat, *P. graminis* on heads and leaves of the same varieties and on Argelino.

Concelho of Barrancos

Wheat grown by informants : Barbela *(T. vulg.* var. *erythrospermum),* Pelão = Mocho de espiga branca *(T. vulg.* var. *lutescens),* Eijo anafil *(T. durum* var. *africanum).*

Bunt, called tição, is often quite prevalent. Seed is dipped in a dilute solution of copper sulphate. *Tilletia levis* was found on specimens.

Loose-smut, called morrão, is not abundant.

Rusts are usually not very harmful, but were quite serious this year. On specimens of Barbela and Mocho a heavy infection of *Puccinia glumarum* was observed inside the glumes and on kernels.

Foot-rot. Although not reported by informant, a foot-rot, probably produced by ***Ophiobolus graminis,*** was Observed on some of the specimens received.

Concelho of Aljustrel

Wheat grown is the same as in the concelho of Cuba.

Bunt is not prevalent now that all farmers treat their seed with copper sulphate.

Loose-smut is not prevalent either.

Rusts, called alforra or vermelhão, are serious in humid seasons such as the last. Early in April and May a heavy epidemic of ***Puccinia glumarum*** swept over this locality, during June ***P. graminis*** invaded the crops. Of the bread-wheats only Carlota Strampeli was found very resistant to both these rusts.

A foot-rot produced the premature turning and drying of many plants. This condition is called branqueio in the locality. No specimens were sent.

Concelho of Almodôvar

Wheat grown by informants : Mocho branco *(T.* ***vulg.*** var. ***lutescens),*** Mocho ruivo = Galego rapado *(T.* ***vulg.*** var. ***milturum),*** Ruivo fino *(T.* ***durum*** var. ***murciense),*** Gigante = ?.

Bunt is sometimes quite serious. Many growers do not treat the seed.

Lopse-smut is rare.

Rusts are called alforra and constitute, after floods, the most serious risk to growers. Traces of an earlier attack of ***Puccinia glumarum*** were visible on most specimens, also a recent very heavy infection of ***P. graminis.*** Trigo gigante showed no signs of ***P. glumarum*** and was very resistant to ***P. graminis.***

Concelho of Mértola

Wheat grown by informants : Barbela ***(T. vulg.*** var. ***erythrospermum),*** Mocho de espiga branca *(T.* ***vulg.*** var. ***lutescens).***

Bunt, called morrão, is not very serious now that seed is treated with copper sulphate.

Loose-smut is ignored by informants.

Rusts, called alforra, are often important and during the last season caused very heavy losses. On specimens teleutosori of ***Pucci-***

nia glumarum were observed in glumes and on sheaths. A recent attack of *P. graminis* was seen on heads, culms and leaf-sheaths.

District of Faro

Cereals are all secondary crops. Area of district: 501.890,00 hectares.

Area of land grown to wheat: in 1926-27: 23.850,27 hectares.

Concelho of Lagos

Wheat grown by informants : Trigo da Grécia *(T. vulg.* var. *erythroleucon,* Kck), Mourisco *(T. durum* var. *Alexandrinum).*

Bunt, called fungão, is of very small importance. Seed is treated with a copper sulphate solution.

Loose-smut, also called fungão, does little damage.

Rusts, known by the name of alforra, are also of small importance. No specimens.

Concelho of Silves

Wheat grown by informants : Cascalvo = Durázio *(T. durum* var. *melanopus),* Mourisco preto = Javardo *(T. durum* var. *lybicum),* Mourisco Ruivo = Vermelho fino *(T. durum* var. *murciense).*

Bunt, the same as in the preceding locality.

Loose-smut, same as in the preceding locality.

Rusts, same as in the preceding locality. A slight infection of *Puccinia graminis* was found on specimens.

Foot-rot. From Messines one informant complained of a bad epidemic of alforra. Specimens show that the fungus responsible for the pathological condition of the plants was not a rust, as he supposed, but *Ophiobolus graminis,* followed by *Cladosporium herbarum* on the empty ears.

Concelho of Albufeira

Wheat grown by informants : Rubião *(T. turgidum* var. *speciosum,* al), Mourisco ruivo = Vermelho fino *(T. durum* var. *murciense).*

Bunt, called fungão, is very rare. Seed is not treated.

Loose-smut, called morrão, is sometimes quite harmful.

Rusts, called alforra, do very little damage. This fact is possibly due to climatic conditions and also to the varieties of wheat grown.

A foot-rot has been observed in this region. No specimens received.

Concelho of São Bras de Alportel

Wheat grown by informants: Ribeirinho = Ribeiro *(T. vulg.* var. *erythrospermum),* Cascalvo = Durázio *(T. durum* var. *melanopus),* Cascalvo preto — Javardo *(T. durum* var. *lybicum).*

Bunt, called fungão, is of little importance. Seed is treated by many farmers with a solution of copper sulphate.

Rusts, called alforra, are not economically important. *Puccinia glumarum* was found on leaves, sheaths and glumes of Ribeirinho.

Concelho of Olhão

Wheat grown by informants : Barbela = Português *(T. vulg.* var. *erythrospermum),* Tremês preto == Javardo *(T. durum* var. *lybicum).*

Bunt, same as in the preceding concelho.

Loose-smut, same as in the preceding locality.

Rusts, not prevalent.

Concelho of Castro Marim

Wheat grown by informants: Barbela, *(T. vulg.* var., *erythrospermum),* Carisso *(T. turgidum* var. *nigrobarbatum,* Desv.), Branquilho = Canoco *(T. turgidum* var. *megalopolitanum,* Kcke.), Preto — Javardo *(T. durum* var. *lybicum).*

Bunt is called morrão, seed is treated with a solution of copper sulphate.

Loose-smut, called fungão, is not prevalent.

Rusts are called alforra or ferrugem. On specimens received, empty uredosori and teleutosori of *Puccinia glumarum* were visible in the glumes. Sheaths and heads were covered with uredosori of *P. graminis.*

Trigo espantado is the name given by farmers to wheat with deaf ears. According to them, this condition is caused by salt sea winds during flowering time. Foot-rots may possibly sometimes also be responsible.

SUMMARY AND CONCLUSIONS

On specimens of wheat, received during June 1928 from over 100 localities in the different districts of Portugal, the following parasitic fungi were observed :

Tilletia tritici (Bjerk.) Wint., *T. levis* Kuhn, *Ustilago tritici* (Pers.) Rost., *Puccinia graminis* Pers., *P. titricina* Erik., *P. glumarum* Erik., *Septoria tritici* Desm., *S. nodorum* Berk., *Ophiobolus graminis* Sacc, *Fusarium culmorum* £W. G. Sm.) Sacc. brown-neck, a non-parasitic disease was also prevalent. The three last named fungi and brown-neck have not, it is believed, been reported from this country before.

Bunt is known in different localities by the names of fungão, morrão, caria, cheia, cego, fole, machio, ferrugem, fuligem, fumilho. The warty spores of *Tilletia tritici* were found in bunted ears received from the districts of Braga, Porto, Aveiro and Viseu, and the smooth spores of *T. levis* in those from Guarda, Castelo Branco, Portalegre, Leiria, Lisbon, Évora and Beja. No specimens were received from other districts.

Seed treatment is pratised by many farmers all over the country. The method most usually employed consists in steeping and revolving the loose grain in a weak solution of blue-stone. (1 to 1,5 °/o) or in strong vinegar. Both these liquids are reported as effective by most informants. It would be interesting to find out, by accurate tests, if the treatment really prevents infection, and if so, how far this is due to the supposed fungicidal properties of very dilute solutions of copper sulphate or even vinegar, and to what extent the mechanical action of washing is responsible for the benefit. In the larger estates of the wheat-belt, where the amount of seed to be treated is often considerable, sprinkling and spading generally substitutes dipping; in these localities the solutions of copper-sulphate used are, often, much stronger than elsewhere, (5 to 7 °/o). In many parts of the Alentejo seed is sown in the dust. Wherever this is done complaints are often heard concerning the poor germination of pickled seed. . In this section dry treatments should be adopted.

Loose-smut is widespread throughout the country and obviously confused with' bunt in many localities. Morrão is the name most

usually given to this disease; fungão, ferrugem, tição, tabacão and machio are also used. Many informants report that durum wheats are not subject to loose-smut. It is supposed by most farmers, that the usual copper sulfate seed-treatment controls this disease as "well as bunt.

Rusts. The three species which parasitise wheat are all present in this country. Farmers in general do not distinguish them from each other and moreover attribute to them pathological symptoms due to other diseases. The common names for rusts are: ferrugem, ferrujão, vermelhão, pimentão, colorau, malina, doença amarela, pinta amarela, loira, ruiveca, barro, lambra, mangra, mela, mera and alforra, this last name is particulary used in the south.

Uredia and telia of *Puccinia graminis* were found on specimens received in June from the districts of Braga, Aveiro, Viseu, Guarda, Castelo Branco, Leiria, Santarém, Lisboa, Portalegre, Évora, Beja and Faro., This disease is therefore clearly ubiquous on wheat in this country. From the concensus of opinions however, it appears that this and other rusts are of relatively small importance in the districts of: Vila Real, Viseu, Bragança, Guarda and even Castelo Branco, where wheat is quite an important crop. The disease is dreaded in all southern districts excepting Faro. The common barberry however, alternate host of *Puccinia graminis,* is only found north of Coimbra. It is therefore a point of considerable interest to find out whether the epidemics, which are observed during the spring in the southern districts, start in the north, in the proximity of barberry bushes and then spread southward, by means of wind-blown uredia, or whether the rust, in the uredo stage, oversummers and overwinters on wheat and wild grasses in southern Portugal.

Puccinia triticina, the least harmful of the three rusts, is probably also found in all parts of Portugal. The aecial phase of this fungus has been observed on *Thalictum sp.* in the United States and in Northern Europe. *Thalictumflavum* L., is widespread in this country; it is not known however whether this plant plays any part in the dissemination of *P. triticina* in Portugal.

Puccinia glumarum causes, without doubt, very serious epidemics in Portugal. In the fields visited by the writer (Belém, Sacavém, Elvas) the disease was at its height, in the past season, during-the months of April and May when most wheat-crops were blossoming or first beginning to fill. *P. glumarum* was found on material from

Braga, Porto, Aveiro, Viseu, Guarda, Castelo Branco, Leiria, Santarém, Lisboa, Portalegre, Évora, Beja and Faro. The alternate host of this fungus is not known in Portugal or elsewhere,

Foot-rots. Plants attacked by *Ophiobolus graminis* were received from several localities in the districts of: Bragança, Porto, Aveiro, Viseu, Guarda, Coimbra, Castelo Branco, Leiria, Santarém, Lisboa, Portalegre, Évora, Beja and Faro. Perithecia, with mature asei, were found on material from Póvoa do Varzim (distr. Porto), Albergaria-a-Velha (distr. Aveiro), Vila Nova da Foscoa (distr. Guarda), Penacova (distr. Coimbra), Salvaterra de Magos (distr. Santarém), Belém (distr. Lisbon), Niza (distr. Portalegre).

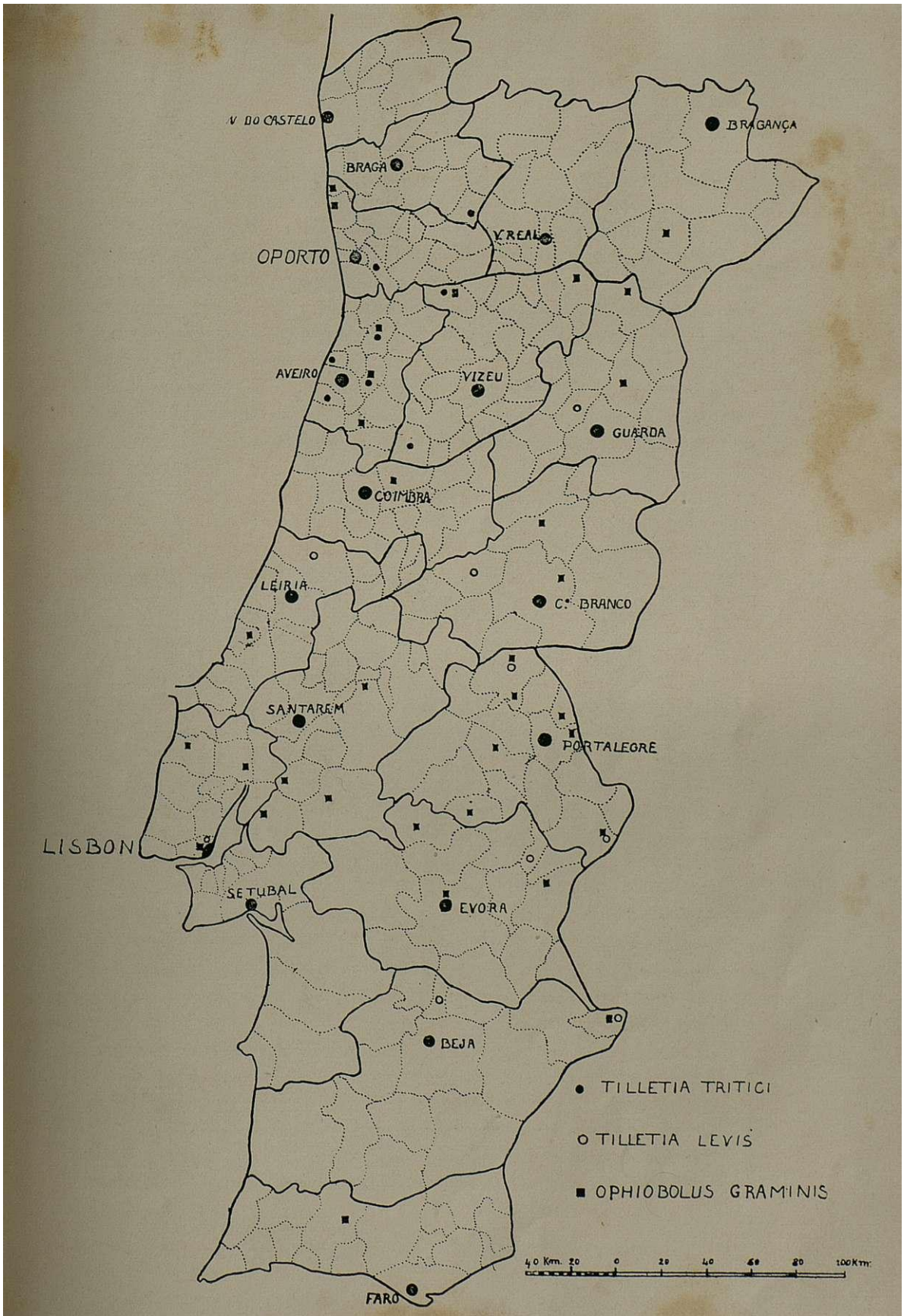
In most localities the harm done by this fungus was very serious during the past season. The names given by farmers to the malady which it causes are : mal branco, espiga branca, branqueio, fogueira, levanto and arejo. Bolor da terra and peco are the names given to the disease by the few farmers who understand that it is produced by something in the soil. In many localities growers attribute to rusts all the damage wrought by foot-rots.

Agriculturists throughout the country, having observed in 1928, a large proportion of dried plants with shrivelled grain in the fields ascribed this condition to the effect of the sudden heat-wave, which, during the latter part of June and July, followed the extremely wet and cold winter and spring. The writer however, noticed, in the fields which she inspected often during the season, that the plants began to show signs of mal-nutrition, such as yellowing and defective graining, much before the heat-wave set in. *Ophiobolus graminis,* which had develppped abundantly during the cold wet weather, was the obvious cause of this condition. A premature drying of the plants would have been observed in these fields, almost to the same degree, although probably not so suddenly even if the cool weather had lasted until harvest.

Ophiobolus graminis was observed at Belém on wheat, barley, and two wild grasses, namely: *Phalaris brachystachis* L. and *Lolium temulentum* L. On these grasses however no perithecia were found.

Astrain of *Fusarium culmorum* was repeatedly isolated at Belém, dining the last two years, from wheat plants with diseased roots, discolored crowns, lower internodes and deaf ears.

Septoria diseases. On material examined in June *Septoria tritici* was found the abundantly only on plants weakened by *Ophiobolut*



MAP OF PORTUGAL, SHOWING THE LOCALITIES FROM WHERE SPECIMENS OF «TILLETIA TRITICI», «TILLETIA LEVIS» AND «OPHIOBOLUS GRAMINIS»

graminis, with the exception of two varieties of *Triticum pyramidale* Perc, which proved extremely sensitive to this parasite.

Septoria nodorum was observed on material from the districts of Santarém, Lisboa and Beja. On crops grown on thin, unfertile soil, this fungus was particularly harmful, causing the death of young tillers, dwarfing of culms and ears, as well as the discoloration of nodes, chaff and awns. The malady is confused with rusts by all growers.

Brown-neck is a non parasitic disease, characterised by brown streaks on glumes, awns, rachis and culms. In one extreme case the writer found a plot of wheat in which the culms were entirely brown. Ribeiro wheats are particularly prone to this condition, which in does not seem to injure the plants at all.