

# A REVIEW OF SUNFLOWER DISEASES RESEARCH OF CHINA

Hua zhipu    Ma guilong

Jilin Agricultural University

Sunflower cultivation in china has gone on for more than two hundred years, 27 diseases have been found. There were 20 fungi diseases, 3 bacteria diseases, 1 virus disease and 3 parasitic plants. (table 1). Six diseases among those (White rot, Downy mildew, Rust, Brown spot, Broomrape and Verticillium wilt.) were the most dangerous diseases. The sunflower lost by it. Since 1899, investigation and record about the sorts of sunflower diseases have begun, but the deepening study has begun since the end of 1970s, as a result of the rise of the acreage under sunflower, the diseases gradually increased, that attracted scholar's attention. Now there are deeper research on the main diseases, the effect of control of some diseases is evident, and get markedly economic benefit yet.

table 1. 27 sunflower diseases of china

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- Alternaria alternata* (Fr.) Keissel.
  - A. helianthi* Tub. et Nish
  - A. leucanthemic* Nelen
  - A. zinniae* Pape
  - Ascochyta campositarum* Davis
  - Botrytis cinerea* Pers.
  - Cercospora pachypus* Ell. et Ev.
  - Corticium centrifugum* (hev.) Bres
  - Fusarium oxysporium* sch.
  - Erysiphe cichoracearum* D. C.
  - Macrophomina phaseoli* (manbl.) Ashby.
  - Plasmopara helianthi* Novot.
  - Phoma oleracea* var *helianthi* Sacc.
  - Puccinia helianthi* Schw.
  - Sclerotinia minor* Jagger
  - S. rolfsii* Sacc.
  - S. sclerotiorum* (Lib.) de Bary
  - Verticillium dahliae* Kleb.

*Septoria helianthi* Ell. et Kell.

*Sphaerotheca fuliginea* poll.

*Erwinia carotovora* subsp. *atroseptica*

*E. carotovora* subsp. *carotovora*

*Pseudomonas caryophylli*

CMV

*Orobancha aegyptiaca* pers.

*O. brassicae*

*O. cumana* Wallr.

### 1. White rot

White rot is the main problem in the sunflower production in china. According to Wang gui (1992), sunflower was seriously damaged in Hei longjiang, Jilin, Liaoning, Shanxi, Neimeng. The incidence of disease was commonly 10~30%, it was probably to be 80% in a erupt year, and caused serious losses. Hua zhipu (1985) found that white rot of flower disc awfully affect seed yield and oil ratio. The seed weight is reduced by 43—46% (4—5 grades), unit weight and seed kernel weight are also reduced, and shell weight is increased by 16~32%, oil ratio is cut down by 27%, but oil quality is about the same. The ratio and the power of germination of infected seeds are all affected seriously, and the rate of emergence is reduced by 19~22%.

The root rot type of white rot is a common disease, and cause seedling withered and dead. Hua zhipu (1991.) stated that the type of root rot may go on from June to September, 75 percent of diseases occur after flowering. The cause of the root rot is sclerotia in soil and infected seeds. The number of sclerotia relate to years of cultivating sunflower in the same massif, and the quantity of diseases is concerned with the number of sclerotia and the distance between root and sclerotia. The test showed that the majority of sclerotia is in 0~10cm soil, when the number of sclerotia reach one per dm., the yield will be cut down remarkably.

The flower rot type of white rot is a main type. The occurrence of flower rot relate to emergence of apothecium directly. Hua zhipu reported that the emergence of apothecium is concerned with water power of soil, the type of soil, temperature and light. The key of forming apothecium is humidity, in August and September, if there are 5 rain days in 10 days, and two times over 10mm rainfall, one of both is more than 20mm, or three times over 10mm rainfall, one of them is more than 15mm, then apothecia may emerge. After apothecia are born, if there is a lot of rain, many apothecia will emerge yet, while little if not. The test also showed that the emergence of apothecium is concerned with growth period of flower disc. Sunflower is susceptible to the fungus from flower to mature period, but resistant in other periods. The disease will develop quickly if the crop is the same.

in the second year, the land is lower, the flower disc is near the surface of soil.

On selection and breeding of variety, Yang shenzhi, et al. identified 526 materials, there were 18 mid-resistant and resistant materials. Liu xuewen, Wang gui, et al. (1990 and 1991) had bred Longkui No. 1 and No. 5 that were much better cross-varieties, and spreaded very large area in production.

Besides biological property of the pathogen, natural host was also studied. Chen shenkuan (1991,) reported that there are 17 wild hosts. Bu yin, et al. (1993) found that there are 82 hosts in Humeng, Neimeng, China. On epidemiology and forecast of the disease, Zhang dechang reported that water-heat coefficient =  $\frac{SR}{ST \geq 10} \times 10$ , if it is over 3, Sunflower will be damaged seriously. Hua zhipu, et al. (1989) gave a forecasting formula for the type of root rot, disease ratio  $\hat{Y} = 0.977 + 0.593x$  ( $x$  is the number of sclerotia per  $\text{dm}^3$ ), for the type of flower rot,  $\hat{Y} = 7.950 + 0.2482x$  ( $x$  is the rainfall from flower to mature period). Lu guangqiu (1992 and 1994), Xu limin (1992 and 1993), Liang quan (1993), Yan yipei (1992), et al. studied the trend of growth and decline of white rot, and forecasted the peak of apothecium stem germination, preliminarily constructed electronic computer forecasting model on the flower disc rot type of white rot.

On the disease control, different methods are rightly used in different area. Heilongjiang province, Liu xuewen and Wang gui (1992) proposed to use resistant varieties Longkui No. 1, eliminate the source of pathogen, rotate crop for 2 or 3 years, sowing at the proper time, high and lower plant companion cropping, treat the seed, and chemical control. Neimeng province, Yang baoheng, Zhou weimin, et al. used an integrated control, use wheat as a companion crop with sunflower, crop in different row distance, adjust sowing period, select the seed with single disc, rotate for 4 years, spray Fungicide at the flower period, etc. The method extended in sunflower production from 1989 to 1994, the area reached 4.236 million ha., disease ratio was cut down from 20—60% to 0.5—1%, but 16.97 million kg yield were increased. Huazhipu (1991) used late sowing, rotating for more than 2 years, getting rid of sclerotia in seeds, mixing seeds and Fungicide, applying potash fertilizer, spraying Fungicide 2 or 3 times at the full blossom period, etc. The integrated control method was spreaded about 72 thousands ha., the average control effect was 81.21%, yield was increased by 35.94%. Yang shenzhi (1992) used fungicide to control, got better effect.

## 2. Sclerotinia minor

The disease was found in Bameng, Neimeng. Yang baosheng, Zhou weimin and Zhou jingwu stated that the more serious the disease is, the more the number of sclerotia is, the majority of sclerotia is in 10—20cm soil, infection of sclerotia on the surface of soil is the most. The lifetime of sclerotia may reach 5 years according to experience. The occurrence of the disease mainly relate to soil humidity. Sclerotinia minor may infect 7

crops, such as kidney bean, etc.

On control, Yang baosheng, Zhou weimin and Zhou zhiwu, et al. used an integrated control method, rotate for more than 5 years, adjust sowing time, eliminate the diseased plant, chemical control, and so on, disease ratio only was 0.4%, and got 99.1% control effect.

### 3. Rust

The disease seriously occurred in western Liaoning, Shanxi, Neimeng. According to Liu wei (1985), disease ratio reached 76%, and the disease dropped yield by a big margin. Zhang jinwen (1987) reported that there was so big epidemic in Neimeng, in 1983 and 1984. The loss reached 30–60%, and all destroyed in some places.

On the primary infection, Liu wei reported that teleutospores in diseased plant may overwinter and effect the primary infection in spring. Spermogonia, aecia and uredopustules develop on the leaves of seedling, then spreaded uredospores cause the secondary infection. Liu wei, et al. (1985) reported that the development of rust is largely concerned with variety, edible variety is more susceptible to *Puccinia helianthi* than oil variety. Fuxindeke and Sandaoxu are seriously damaged, but palidqweike not. Rust largely develop if the temperature and humidity of air is higher from the first days of July to the second days of August, and also occur even if dry weather last many days. On the development and epidemiology of rust, Zhang jinwen (1987) concluded that the rainfall in the second and last days of May and June is a main factor which affect the development of rust, the rainfall in the second and last days of may determine the number of teleutospores germination and basidiospores penetration; the rainfall in the second and last days of June affect the number of the first uredospores. but the rainfall of July and August is not a main factor.

Rust control must use an integrated method. According to Liu wei (1985), et al., use resistant varieties, turn up the soil after autumn, rotate crop, sow early, chemical control, and so on.

### 4. Downy mildew.

Downy mildew was found in Shanxi, North—east three provinces of China. Wang furong (1992) reported that the incidence of the disease is 4–5% at the area intercropping spring wheat in Yiding basin, and is 43–79% at a serious disease area. A serious diseased plant is lower and become dead, without yield. Infected seeds and oospores in the soil are main sources of infection, zoosporangia may spread and cause secondary infection.

Jin zheyu reported that germination of zoospores need suitable temperature, humidity, pH and water quality. Wutianping, et al. (1989) identified race 1 isolate of pathogen in Baicheng, Jilin province, Li ziqin, et al. (1992) identified race 3 isolate of pathogen in Yi zhou, Shanxi province. Wang furong, et al. (1988–1991) identified 247 materials, the

test showed that Fenkui No. 1, etc. 28 materials are high resistant to race 3. Jin zheyu, et al. (1990) identified 127 materials, the test showed that 36 materials are resistant to race 1.

Zhou zhaozhi, et al. (1992) used cotton blue—safranin O to dye the shell of seed, blue hypha and red tissues could be seen clearly, used fluorescent lamp to irradiate, hypha and hollstorium produced bright blue fluorescence, but plant tissues didn't. So it is a very convenient method to test seeds. Wang furong, et al. (1989) stated that the sources of primary infection are infected seeds and soil.

On control, Wang furong and Jin zheyu reported that the effect of using 0.2—0.3% Ridomil to mix seeds is 100%

#### 5. Brown spot

Brown spot distributed in Liaoning, Jilin, Heilongjiang, Neimeng and Shanxi provinces, etc. *Alternaria helianthi*, *A. alternata*, *A. lanthanemica*, *A. zinniae* all caused brown spot of sunflower, but *A. helianthi* is the main one. On biology of pathogen, Zheng huaimin, et al. (1983) reported that the sources of primary infection are infected seeds, leaves and stems. Pathogen may live more than 1 year, but pathogen which is in 10cm soil could not overwinter. Brown spot emerge in the last days of June, and quickly develop. Emergence time and development of brown spot largely relate to rainfall in June, July and August.

There is very large difference on resistance of varieties. Zheng weimin, et al. (1981—1984) identified 361 varieties and cross—varieties, 8 among those were resistant to pathogen. Lu baonan, et al. (1982—1986) identified 500 sources of varieties, there were not immune and high resistant varieties but 15 among those were mid—resistant varieties. Pathogen may infect sunflower at the whole period of growth, but early growth period is more resistant to pathogen. On chemical control, according to zheng weimin, the effect of carbendazim is the best. It was a better method to use resistant varieties, to change spring sowing into summer sowing, to spray two times fungicide at the disease period in Liaoning province, in 1983.

#### 6. Verticillium wilt

The disease distribute in Liaoning, Jilin, Hebei, Neimeng provinces, etc. According to Ren gengfa, et al., incidence of the disease usually is 10%, but reach 45.5% at serious disease area. The more serious the disease is, the more the loss is. The most loss reach 84.13%. Sunflower is infected by *Verticillium dahliae*. Ren gengfa (1989) studied pathogenity, isoenzyme and culture properties, and thought that there are 3 physiological form. Pathogen may overwinter on seeds or harvest residuals, and may infect again. There is very large difference on the resistance among varieties. but cultivated varieties are susceptible.

#### 7. Broomrape

Sunflower broomrape distribute in Hebei, Beijing, Xinjiang, Shannxi, Gansu, Shandong, Shanxi, Neimeng, Heilongjiang, Liaoning, Jilin. Wang yongqiang (1958 and 1959) reported that broomrape clearly reduce the yield, if there are 15 broomrapes on a plant, yield reduce by 28%, and if there are 119 broomrape on a plant, yield reduce by 56%. Zhao shuhua, et al. (1983) reported that yield reduce by 70.27% at the most serious disease area, oil yield also reduce by 17.85%. Wang yongqiang (1961), Liu baogang (1982) and Zhao shuhua (1983) studied developmental law of broomrape, broomrape may emerge from the first day of July to the second days of September. On control, according to Wang yongqiang (1961), hoe up broomrape, and spray 2.4-D when flower disc do not reach 10cm. Zhao shuhua, et al. (1983) put forward control methods—rotating crop, early hoeing, spraying lasso and using resistant varieties. Fu lining (1988) stated that the effect of spraying treflan on the surface of soil is much better from sowing to emergence of seedling.

Besides above—mentioned 7 diseases, bacterial stalk rot, etc. were also studied, and much better achievement was obtained. It is believed that studies on our country's sunflower diseases will be developing in depth along with the unceasing development of science.

#### References

Hua zhifu, et al, some factors of occurrence sclerotinia sclerotiorum (root rot type) in sunflower 《oil crops of china》1991. 2

Occurrence and harmfulness of wilt rot of sunflower 《oil crops of china》1986. 2

Studies on the production condition of apothecium of Sclerotinia sclerotiorum of sunflower 1992 《13th international sunflower conference》summary of scientific contributions

Forecasting the occurrence of sclerotinia sclerotiorum (Lib) De Bary (Root rot) in sunflowers and its application 《Helia》1992.

Study on integrated control of sclerotinia sclerotiorum of sunflower in Jilin province 《acta phytophylacica sinica》1994

Seed treatment used for control of sunflower wilt 《Proceedings of the 12th international sunflower conference》1988