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IDENTIFICATION OF RESISTANCE TO MELON FUSARIUM WILT IN SEVEN HYBRID COMBINATIONS OF PUMPKINS

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Melon wilt disease, also known as wilt disease, occurs from the seedling stage to the adult stage of plants. According to previous research, grafting is an effective means to improve the resistance of melons and Solanaceae vegetables to soil borne diseases and pests. With the popularization of vegetable grafting, the demand for rootstocks has rapidly increased. Therefore, this experiment takes seven pumpkin hybrid combinations as the research object, studies the resistance of different hybrid combinations to wilt disease, selects pumpkin hybrid combination rootstocks with strong resistance, and provides reference for grafting cultivation in production. The research results indicate that 10 days after inoculation with pathogens, the overall plant infection in the early stage was not significantly affected by the pathogens, and there was no significant difference between the various hybrid combinations. On the 20th day of inoculation with pathogens, Yanbian-3×360-3 showed significant differences in plant height and chlorophyll indicators compared to other pumpkin rootstock hybrid combinations. On the 30th day of pathogen inoculation, Yanbian-3×360-3 showed significantly higher plant stem diameter indicators than other pumpkin rootstock hybrid combinations, showing significant differences from other pumpkin hybrid combinations. Therefore, it can be concluded that Yanbian-3×360-3 had the optimal relative growth rate. Moreover, on the 30th day of pathogen inoculation, the leaf disease index was 52.67%, and the stem disease index was 37.92%, indicating that Yanbian-3×360-3 was less affected by pathogen infection and has stronger resistance to wilt disease. On the 30th day after inoculation with pathogenic bacteria, the investigation showed that the disease index of leaves in Yanbian-2×041-1 was 54.67%, and the disease index of stem dissection was 45.83%. Hetoua2×041-1, with a leaf disease index of 95.33% and a stem cutting disease index of 87.92%. Among the seven pumpkin hybrid combinations, Yanbian-3×360-3 and Yanbian-2×041-1 have the best disease resistance and are neutral disease resistant combinations; Hetoua2×041-1 has the most severe incidence and is a highly susceptible combination. The two pumpkin rootstocks, Yanbian-3×360-3 and Yanbian-2×041-1, have good resistance to melon wilt disease and can be used as grafting rootstocks for melon wilt disease resistance. Considering the affinity between grafting rootstocks and scions and the impact on yield after grafting, further verification is needed in the later stage.

Key words: *pumpkin rootstock, grafting, melon wilt disease, disease resistance.*

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Introduction. Melon wilt disease, also known as wilt disease or vine cutting disease, is one of the important diseases in melons, the harm of wilt disease is an important issue that urgently needs to be addressed in melon production (Wang Gongchen & Ye Qiming, 1990). Cucumber and watermelon are the most severely affected, followed by winter melon and melon. After the plant blooms and bears fruit, symptoms gradually appear, gradually turning yellow from bottom to top, wilting like a lack of water, and returning to normal at night. After a period of time, the entire plant leaves turn yellow and wither, and the root vascular bundle discolors until death.

With the rapid development of melon vegetable industry, specialized and intensive planting in various regions has caused serious problems of continuous cropping obstacles of melon vegetables. With continuous cropping, its incidence rate has increased year by year, causing serious production losses (Zhang Shumei et al., 2010). Melon wilt disease is caused by *Fusarium wilt fungi* Schl. in the family *Nectriaceae (Sordariomycetes, Ascomycota)*. First reported in Minnesota, United States (Ficcadant et al., 2002). Fusarium wilt pathogens overwinter in soil, diseased remains, or fertilizers that have not undergone high-temperature decomposition using hyphae, sclerotium, and chlamydospores, as well as on seeds (Han Jinxing et al., 2009). Fusarium wilt can survive in soil for several years, and new species can emerge through continuous variation, making it difficult to prevent and eliminate (Yang Kankan et al., 2019). According to the survey, the incidence rate of wilt disease in general disease areas is 12.30%-56.75%, while in severely affected areas, the incidence rate reaches over 85%, and even all of them die, bringing huge economic losses to melon production (Ju Xiqian et al., 2022).

According to reports, after vegetable grafting and rooting, the root system of the grafted plant grows vigorously, the absorption capacity is enhanced, and it has a different physiological and ecological response compared to self rooted seedlings (Zhou Baoli et al., 1997; Arai K, 1980). Grafting can significantly enhance plant cold resistance, promote root nutrient absorption, and promote growth and development (Li Jing et al., 2013). Therefore, using disease-resistant pumpkin as a rootstock can reduce the occurrence of soil borne diseases in melons, especially melons wilt disease, root knot nematode disease, etc. (Zhang Honghao, 2015). The use of grafting and root replacement cultivation can effectively prevent and control the occurrence of cucumber wilt disease, while also improving yield, which has been promoted in disease resistant cultivation of watermelon and cucumber (Lei Ming, 2001; Jiang Youtiao et al., 1998). Using disease-resistant pumpkin interspecific hybrids as rootstocks can significantly enhance the growth potential and stress resistance of watermelon compared to interspecific hybrids, effectively prevent the occurrence of soil borne diseases in watermelon, reduce the adverse effects of continuous cropping obstacles in facilities, and ultimately achieve the goal of disease resistance, high-quality, and high yield (Jin Guiying et al., 1997; Lin Depei, 2000). Previous studies have shown that grafting can alleviate the stress of continuous cropping obstacles on watermelon grafted seedlings (Hassell et al., 2008; Chen et al., 2013), reduce the damage of stress on the watermelon plant itself (Lee et al., 2010; Mohamed et al., 2014), improve plant growth potential and yield of small fruit watermelon, reduce the application of fertilizers and pesticides (Ying Quansheng et al., 2014), and improve the nitrogen utilization efficiency of watermelon (Nawaz et al., 2018).Whether grafting can survive and achieve high yield depends on the selection of rootstocks (Liu Guang et al., 2016). Pumpkin has advantages such as strong resistance to disease and stress, developed root systems, strong growth potential, and strong compatibility with most melon vegetables. It has been widely used as a rootstock in the production of cucumber, melon, bitter gourd, and zucchini vegetables. It not only reduces the harm of soil borne diseases such as melon wilt and root knot nematodes, but also improves the resistance and yield of melon crops (Yu Wenjin et al., 2001; Liu Xinhua et al., 2011; Li Han et al., 2013). The pumpkin used for rootstock mainly includes Chinese pumpkin, black seed pumpkin, and hybrid varieties of Indian pumpkin and Chinese pumpkin (King S R et al., 2010).

Grafting is an effective method to improve the resistance of melons and eggplant vegetables to soil borne diseases and pests. The research on grafting techniques for melons began in Japan as early as the 1920s. After the 1980s, vegetable grafting has also received widespread attention in China, America, and Europe, and has been applied to the production of most melons and eggplant vegetables. According to statistics, 95% of greenhouse watermelons, 92% of open field watermelons, and 95% of greenhouse cucumbers in Japan are all produced using grafting technology; over 90% of watermelons in South Korea and over 80% of cantaloupes are cultivated through grafting (Bie Zhilong, 2009). With the popularization of vegetable grafting, the demand for rootstocks has rapidly increased, and rootstock breeding has received attention from internationally renowned seed companies. Monsanto, Syngenta, Rexwan, and Neunem have all carried out rootstock breeding work, indicating that commercial rootstock breeding has received widespread attention (Bie Zhilong, 2012).

The purpose of the study. This experiment takes 7 pumpkin hybrid combinations as the research object to study the resistance of different hybrid combinations to Fusarium wilt, in order to screen out pumpkin hybrid combination rootstock with strong resistance and provide reference for grafting cultivation in production.

Materials and methods. *Materials.* The tested pumpkin rootstocks include Hetoua2×041-1, Yanbian-3×Lingchuanc1, Yanbian-3×360-3, Hetoua2×360-3, Yanbian-4×Lingchuanc1, Yanbian-2×041-1, 360-3×041-1, all provided by the School of Horticulture and Landscape Architecture of Henan University of Science and Technology. The experiment was conducted from August to October 2023 in the cultivation laboratory of the School of Horticulture and Landscape Architecture of Henan University of Science and Technology and the eastern solar greenhouse.

Methods. Seedling preparation. Select evenly plump seeds and set aside when the two cotyledons are flattened and the true leaves are at the top. Preparation of pathogen solution. Prepare to a concentration of 1 using sterile distilled water × 10^7/mL spore suspension is used as the inoculum. Method of inoculation for wilt disease. Artificial inoculation is carried out by soaking roots during the seedling stage. Within one week after inoculation, water 1-2 times a day to keep the soil moist. The temperature in the greenhouse should be maintained at 23–30°C and the humidity should be maintained at 60–80% (Zhang Yong & Liu Zhengxing, 2018).

Determination of growth and disease resistance indicators: (1) Growth indicators. On the 10th, 20th, and 30th day after inoculation, three randomly selected pumpkin root stocks were treated and inoculated to measure plant height, plant weight, stem diameter, and fresh root weight. The growth indicators mentioned above were also measured for three control uninoculated pumpkin root stocks, and the relative growth amount of pumpkin root stocks was calculated.

$$Relative\ growth\ rate = Processing\ vaccination\ test\ values\ / \\ / \ Comparison\ of\ unvaccinated\ test\ values \times 100\%$$

(2) Disease resistance indicators. Investigate the incidence of disease on the 10th, 20th, and 30th days after inoculation. First, conduct a graded investigation of the incidence of disease on the leaves of the plants. After 30 days, cut the stems, observe the discoloration of the vascular bundles, and record the occurrence of the disease. For rootstocks, the method of pumpkin leaf disease grading standard (Luo Feng et al., 2011) (Table 1), the method of stem cutting disease grading standard (Zhang Yong & Liu Zhengxing, 2018) (Table 2), the method of resistance evaluation standard (Luo Feng et al., 2011) (Table 3), and the incidence rate and disease index (Guo Tangxun & Mo Jianyou, 2007) were used for calculation.

$$Incidence\ rate = \frac{number\ of\ diseased\ trees\ (plants)}{total\ number\ of\ investigated\ plants} \times 100\%$$

$$Disease\ index\left(DI\right) = \\ = \frac{\sum\left(disease\ level \times number\ of\ plants\ at\ that\ disease\ level\right)}{\left(highest\ disease\ level \times number\ of\ surveyed\ plants\right)} \times \\ \times 100\%$$

Results. Effect of *Fusarium* wilt fungal infection on growth indicators of hybrid combinations of pumpkin rootstocks.

Table1

Fusarium wilt-Leaf Investigation

Disease grading	Disease symptom of plant
0 grade	Asymptomatic;
1 grade	1 or 2 cotyledons slightly yellow, but growing normally;
2 grade	1-2 cotyledons turn yellow or 1 cotyledon shows necrotic spots, while the true leaves turn slightly yellow or wither slightly;
3 grade	The cotyledons wither, the true leaves wither significantly, the plant growth is hindered, and there is less dwarfing;
4 grade	The entire plant is severely withered, with withered and yellow leaves;
5 grade	The entire plant withers and even collapses.

Table 2

Fusarium wilt-Stem Cutting Investigation

Disease grading	Disease symptom of plant
0 grade	No discoloration of vascular bundles;
1 grade	The area of vascular bundle discoloration accounts for less than1/4 of the total area;
2 grade	The area of vascular bundle discoloration accounts for 1/4-1/2 of the total area;
3 grade	The area of vascular bundle discoloration accounts for 1/2-2/3 of the total area;
4 grade	Death.

Table 3

Resistance evaluation criteria of fusarium wilt

Resistance evaluation criteria	Disease index
HR-high resistance	$0<DI\leq15.0$
R-resist	$15.0<DI\leq35.0$
MR-moderately resistant	$35.0<DI\leq55.0$
S-susceptible	$55.0<DI\leq75.0$
HS-high sensitivity	$DI>75.0$

Data processing. Excel 2003 software was used to analyze the experimental data, calculate the average, and SPSS 27 software was used for analysis of variance.

The size of relative growth can reflect the strength of the resistance of pumpkin rootstock hybrid combinations to wilt disease. The larger the relative growth, the less affected the pumpkin rootstock hybrid combination is by wilt disease, and the stronger the resistance. Conversely, the weaker the resistance. From Table 4, it can be seen that the impact of pathogen infection on early plants is not significant, and there is no significant difference between various hybrid combinations. According to Table 5, Yanbian-3×360-3 is significantly higher in plant height and chlorophyll indicators than other pumpkin rootstock hybrid combinations, and shows significant differences from other pumpkin hybrid combinations. According to Table 6, Yanbian-3×360-3 is significantly higher in plant stem diameter than other pumpkin rootstock hybrid combinations, and shows significant differences from other pumpkin hybrid combinations.

In summary, the relative growth of Yanbian-3×360-3 is optimal, indicating that Yanbian-3×360-3 is less affected by bacterial infection and has stronger resistance to wilt disease. By comparing the coefficient of variation, it can be seen that the coefficient of variation of the number of leaves in the hybrid combination of pumpkin rootstocks is at its maximum on the 10th and 30th days, with values of 15.44% and 9.93%, respectively. The coefficient of variation of stem thickness was the lowest at 4.21% on the 10th day and the highest at 8.73% on the 20th day. The coefficient of variation of chlorophyll was at its minimum on the 20th and 30th days, with values of 5.08% and 1.37%, respectively, indicating that the leaf number of pumpkin rootstock hybrid combinations was significantly affected by bacterial infection, while the effect of chlorophyll was relatively small.

Effect of Fusarium wilt fungi infection on the disease resistance indicators of hybrid combinations of pumpkin rootstocks.

After inoculation of Fusarium wilt fungi, the incidence rate and disease index were counted and calculated. It can be seen from Table 7 that, 30 days after inoculation, among the seven pumpkin hybrid combinations, Yanbian-3×360-3, Yanbian-2×041-1, MR (moderate resistance) is classified according to the level of disease resistance. Yanbian-3×360-3, the leaf disease index reached 83.00, and the stem cutting disease index reached 59.58. Yanbian-2×041-1, the leaf disease index is 54.67, and the stem cutting disease index is 45.83. There is a significant difference between the two and other hybrid combinations. Hetoua2×041-1 on the 30th day after inoculation with pathogens, the leaf disease index

Table 4

Effects of fungal inoculation on growth indicators of pumpkin rootstocks on the 10th day

Hybrid combination name	Relative growth/%			
	Plant height	Stem diameter	chlorophyll	Number of blades
Hetoua2×041-1	94.9±5.27a	100.64±3.66a	103.4±6.48a	116.67±28.87a
Yanbian-3×Lingchuanc1	96±3.31a	104.71±4.78a	104.75±3.66a	100±28.87a
Yanbian-3×360-3	94.44±2.41a	100.24±3.87a	104.99±2.65a	116.67±28.87a
Hetoua2×360-3	85.62±4.6a	98.14±7.32a	90.04±2.68a	93.33±11.55a
Yanbian-4×Lingchuanc1	98.35±6.52a	99.63±2.93a	101.05±0.8a	100±0a
Yanbian-2×041-1	98.48±5.26a	97.26±2.15a	105.04±9.07a	100±0a
360-3×041-1	98.04±7.11a	97.6±4.73a	100.63±5.42a	111.11±19.25a
(CV)/%	5.16	4.21	4.29	15.44

Table 5

Effects of fungal inoculation on growth indicators of pumpkin rootstocks on the 20th day

Hybrid combination name	Relative growth/%			
	Plant height	Stem diameter	chlorophyll	Number of blades
Hetoua2×041-1	97.48±2.18ab	95.73±3.65a	100.37±2.67ab	94.44±9.62a
Yanbian-3×Lingchuanc1	91.11±4.25bc	94.1±5.37a	90.94±2.1b	88.89±19.25a
Yanbian-3×360-3	98.61±2.41a	100.31±7.03a	102.04±5.15a	101.11±18.36a
Hetoua2×360-3	85.62±4.6c	98.14±7.32a	90.04±2.68b	93.33±11.55a
Yanbian-4×Lingchuanc1	96.96±2.64ab	93.36±3.79a	97.54±5.88ab	100±0a
Yanbian-2×041-1	97.58±5.74ab	99.9±5.91a	100.22±10.04ab	100±0a
360-3×041-1	92.62±2.63ab	96.89±3.2a	99.71±2.25ab	93.33±11.55a
(CV)/%	6.65	8.73	5.08	5.66

Table 6

Effects of fungal inoculation on growth indicators of pumpkin rootstocks on the 30th day

Hybrid combination name	Relative growth/%			
	Plant height	Stem diameter	chlorophyll	Number of blades
Hetoua2×041-1	89.78±2.75a	91.78±1.85bc	95.65±2.4a	91.07±7.78a
Yanbian-3×Lingchuanc1	86.91±1.86a	90.55±1.12c	93.84±3.48a	94.44±9.62a
Yanbian-3×360-3	92.15±3.77a	96.55±1.04a	101.61±12.95a	106.67±11.55a
Hetoua2×360-3	91.27±4.31a	93.78±1.3b	94.13±15.26a	100±0a
Yanbian-4×Lingchuanc1	90.02±9.64a	93.1±2.23b	89.57±2.63a	90.48±16.5a
Yanbian-2×041-1	92.09±3.65a	93.9±0.22b	102.88±17a	101.11±18.36a
360-3×041-1	88.63±6.96a	87.12±0.65d	96.99±16.03a	94.44±9.62a
(CV)/%	7.90	5.60	1.37	9.93

Note: Different lowercase letters in the same column show significant difference (P<0.05).

was 95.33 and the stem cutting disease index was 87.92. According to the classification of disease resistance level, HS (high susceptibility) was found. Based on the above data, it is shown that there is consistency between the calculation of disease index and the classification of disease resistance levels, and the plant growth indicators, indicating the differences in wilt resistance among the seven pumpkin hybrid combinations.

Discussion. Fusarium wilt is a global soil borne disease in facility watermelon production, with a serious degree of harm and a wide range of harm (Kou Qinghe et al., 2012). After being infected by Fusarium wilt fungi, the most intuitive manifestation of plant morphological changes is the loss of water at the top, wilting and drooping of cotyledons and true leaves, browning and decay at the base of stems and vines, and sudden collapse of seedlings (Niu Xiaochen, 2011). Through investigation, it was found that the growth of each hybrid combination control was normal and there was no disease. However, after inoculation with pathogenic bacteria, the symptoms exhibited by the plants were stunted seedlings in the early stage, yellowing of cotyledons, necrotic spots appearing, and gradually shrinking and drying up; In the middle stage, the true leaves of the plant turn green and yellow, with constriction at the base of the stem and longitudinal cracks on the epidermis. When moist, a white or pink mold layer appears on the surface, and brown stripes appear at the stem nodes; In the later stage, the whole plant gradually yellows and suddenly withers and dies in severe cases; This fully demonstrates that the pathogen of wilt disease has strong pathogenicity.

It is generally believed that disease tolerance is the ability or characteristic of plants to resist some diseases and maintain certain growth. The incidence rate and mortality rate of populations can reflect their disease tolerance. High incidence rate and low mortality rate indicate strong disease tolerance. Wang Xinli (2020) found that symptoms began to appear on the 7th day after seedlings were inoculated with Fusarium wilt fungi, with the fastest increase in

Table 7

Comparison of resistance identification results after 30 days of inoculation with Fusarium wilt fungi

Hybrid combination name	The number of the disease incidence about different level						Disease number	Total number	Disease index		Resist disease level	
	0 grade	1 grade	2 grade	3 grade	4 grade	5 grade			Blade	Cut stem	Blade	Cut stem
Hetoua2×041-1	0	0	0	1	12	47	60	60	95.33±8.08a	87.92±8.04a	HS	HS
Yanbian-3×Lingchuanc1	0	0	0	5	41	14	60	60	83.00±4.58b	59.58±4.73c	HS	S
Yanbian-3×360-3	0	0	32	18	10	0	60	60	52.67±1.53c	37.92±1.91d	MR	MR
Hetoua2×360-3	0	0	0	4	42	14	60	60	83.33±6.35b	74.58±16.27ab	S	S
Yanbian-4×Lingchuanc1	0	0	0	0	60	0	60	60	80.00±0.00b	62.92±4.73bc	S	S
Yanbian-2×041-1	0	0	25	27	7	1	60	60	54.67±0.58c	45.83±8.32d	MR	MR
360-3×041-1	0	0	0	10	32	18	60	60	82.67±2.89b	67.92±6.17bc	S	S

Note: In the disease resistance level, HR represents high resistance, MR represents moderate resistance, and S represents susceptibility.

disease incidence from the 9th to the 11th day. According to the analysis of the investigation results on plant growth indicators, it was found that the symptoms of plant disease were obvious 20 days after inoculation, which is consistent with the study by Xu Kai (2021).

In the grading of disease resistance grade, Luo Feng (2011) used disease index as the basis and standard, and Martyn et al. (1989) used incidence rate as the basis and standard. The two grading methods have slight differences, but both can comprehensively evaluate the resistance of different materials to Fusarium wilt disease. This study used the method of Luo Feng (2011) to evaluate the disease resistance level of each material based on the disease index. Based on the analysis of the investigation results of the leaves, it can be concluded that Yanbian-3×360-3, Yanbian-2×041-1 is a neutral disease resistant combination. Based on the analysis of the investigation results of stem dissection, it can be concluded that except for Hetoua2×041-1 at the river head, the disease index of stem cutting was 87.92, and other hybrid combinations did not exceed 75.00. Therefore, it can be seen that Hetoua2×041-1 Weak disease tolerance. The disease index of Yanbian-3×Lingchuanc1, Yanbian-4×Lingchuanc1, after stem dissection was 59.58 and 62.92, respectively, with leaf disease index exceeding 75.00. The aboveground parts of the plant showed chlorosis and yellowing of leaves from bottom to top, dwarfing and wilting. However, when observing the base of the plant stem during stem dissection, softening and constriction were rarely observed, indicating that the roots of these two hybrid combinations have a certain defense ability against the invasion of the pathogen of wilt disease.

Conclusions. Through inoculating seven pumpkin hybrid combinations with Fusarium wilt pathogens, it was found that Yanbian-3×360-3, Yanbian-2×041-1 has the best disease resistance and is a neutral disease resistance combination. These two pumpkin rootstocks have good resistance to melon wilt disease and can be used as grafting rootstocks for melon wilt disease resistance. Considering the affinity between grafting rootstocks and scions and the impact on yield after grafting, further verification is needed in the later stage.

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Виявлення стійкості до фузаріозного в'янення у семи гібридних комбінацій гарбуза

Фузаріозне в'янення дині виникає від стадії розсади до дорослої стадії рослин. Згідно з попередніми дослідженнями, щеплення є ефективним засобом підвищення стійкості баштанних та пасльонових овочів до хвороб і шкідників, джерелом інфікування якими є ґрунту. З популяризацією щеплення овочевих культур стрімко зріс попит на підщепи. Тому в нашому експерименті взято сім гібридних комбінацій гарбуза як об'єкт дослідження, вивчено стійкість різних гібридних комбінацій до фузаріозного в'янення, відібрано підщепи гібридних комбінацій гарбуза з високою стійкістю та надано рекомендації щодо вирощування прищеп у виробництві. Результати досліджень показують, що через 10 днів після інокуляції патогенами, загальна інфікованість рослин, на ранній стадії, не зазнала значного впливу патогенів, і не було суттєвої різниці між різними гібридними комбінаціями. На 20-й день інокуляції патогенами гібрид Яньбянь-3×360-3 показав значні відмінності у висоті рослин та показниках хлорофілу порівняно з іншими гібридними комбінаціями гарбуза. На 30-й день інокуляції патогенами Yanbian-3×360-3 показав достовірно вищі показники діаметра стебла рослин, ніж інші гібридні комбінації підщеп гарбуза, демонструючи достовірні відмінності від інших гібридних комбінацій підщеп гарбуза. Таким чином, можна зробити висновок, що Яньбянь-3×360-3 мав оптимальну відносну швидкість росту. Більше того, на 30-й день після інокуляції патогеном індекс ураження листків становив 52,67%, а індекс ураження стебла – 37,92%, що свідчить про те, що гібрид Яньбянь-3×360-3 менш уражувався патогенною інфекцією і мав вищу стійкість до фузаріозного в'янення. На 30-й день після інокуляції патогенними бактеріями дослідження показало, що ступінь ураження листя у Yanbian-2×041-1 становив 54,67%, а ступінь ураження стебла – 45,83%. Hetoua2×041-1, із ступенем ураження листя 95,33% та ступенем ураження стебла 87,92%. Серед семи гібридних комбінацій гарбуза Yanbian-3×360-3 та Yanbian-2×041-1 мають найвищу стійкість до хвороб або є нейтрально стійкими до хвороб комбінаціями; Hetoua2×041-1 має найвищу захворюваність і є високо сприйнятливою комбінацією. Дві підщепи гарбуза, Yanbian-3×360-3 і Yanbian-2×041-1, мають хорошу стійкість до фузаріозного в'янення і можуть бути використані як підщепи для підвищення стійкості до фузаріозного в'янення. Враховуючи спорідненість між підщепами і прищепами та вплив на врожайність після щеплення, необхідна подальша експериментальна робота.

Ключові слова: *гарбузова підщепа, щеплення, фузаріозне в'янення, стійкість до хвороб.*