CRI Cutting Edge
Securing the future of citrus through science
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Management of *Elsinoë fawcetti*, causal organism of citrus scab

Jan van Niekerk, Jacquie van der Waals,
MC Pretorius and Elma Carstens
Citrus Research International (CRI)

In May 2019 (Cutting Edge 270), growers were alerted to the fact that *Elsinoë fawcetti,* causal organism of citrus scab, had been listed as a regulated pest by the European Union (EU). To date, no phytosanitary measures specific to *E. fawcetti* have been specified, but interceptions of infected fruit in the EU could result in further action.

Following recent interceptions of scab-infected fruit in the EU, growers are again urged to increase attention in scouting and monitoring for scab in their orchards. It is also of the utmost importance to avoid packing scab-infected fruit for export to the EU.

This Cutting Edge outlines the symptoms, disease cycle of the pathogen, cultural management practices that can be followed, and chemical control strategies.

Symptoms

Leaves are most susceptible to infection just as they emerge from the bud; however, they become resistant to infection once fully expanded. Leaf symptoms appear at first as a protuberance (bump or wart) on the infected side of the leaf with a corresponding indentation or hollow on the opposite side. When leaves are fully expanded, the scab pustules are smaller and little, or no leaf distortion occurs. Lesions on the leaves may sometimes merge and cover large areas to form corky spots (Figs. 1 and 2).

Infection of young fruit results in the formation of warty outgrowths on the rind. Infection of more mature fruit of all cultivars produces pustules on the rind, which are raised only slightly above the normal contour of the fruit surface. If fruit are heavily infected, these pustules can merge to form extensive scabby areas, which may crack into platelets as the fruit expands. The scaly type of scab symptom may be confused with wind scarring, thrips symptoms, or Botrytis symptoms. However, in scab infections, some discrete round pustules are present on the outside of the merged scaly area. On the outside of the affected area, minute islands of scar tissue may also occur.

Fruit remain susceptible to infection for about 3 months after petal fall (12 weeks after fruit set) (Figs. 3 and 4).

Scab lesions on twigs start as small translucent spots that become raised, occurring singly or in groups. With age, the lesions become dark olive green due to the growth of saprophytic fungi on the scab surfaces. Twigs may eventually die back.

Disease cycle

Spores of the pathogen are produced throughout the year on the surface of scab lesions on young fruit and leaves. The optimum temperatures for spore production, germination and infection are between 24 and 28°C. However, infection is still possible at temperatures below 24°C if wet conditions persist for long enough. The spores are spread in the orchard by rain. Infection of susceptible leaf and fruit tissue occurs when wetness duration is 3 – 4 hours at optimal conditions.

As indicated, young leaf flush is especially susceptible to infection but becomes resistant when the flush hardens off. Young fruit remain susceptible up to 12 weeks after fruit set. In the orchard, the pathogen survives on infected or symptomatic leaves, twigs and fruit within the tree canopy.

Cultural management

Based on the disease cycle, it is clear that prolonged periods of wetness in the tree canopy promote the development of scab.

Regular pruning of trees is important because it improves airflow in the canopy, which reduces the duration of wetness. Pruning also improves spray penetration, leading to better chemical control. Additionally, pruning and removing dead wood and leaves from the tree canopy reduces the inoculum pressure in the orchard, limiting future infections.

Chemical control

A preventative approach should be adopted in areas where the disease occurs annually. Treatments should commence at emergence of the first spring flush and continue up to 12 weeks after fruit set.

In areas where the disease occurs infrequently, or has not yet occurred, young vegetative flush and fruit should be inspected after rainy periods for the presence of scab lesions.

All sprays must be applied as medium-cover sprays, ensuring that all fruit surfaces and leaves are thoroughly wetted.

Currently, in South Africa, only copper oxychloride (200 g/100 L water) and cuprous oxide (90 g/100 L water) are registered for the control of citrus scab. Both active ingredients are recommended to be applied from between 75% to 100% petal fall.

This application will protect the young leaf flush and small fruitlets. Further protection of fruit can be achieved with additional applications of the copper actives mentioned above, 5 weeks after the first application. For protection of fruit, the applications must be repeated until fruit are 12 weeks old.

In South Africa, the chemical management of Citrus Black Spot (CBS) is based on the application of a contact fungicide (copper or mancozeb), done at 80% petal fall, followed by two applications of a strobilurin fungicide (in a tank mixture with copper or mancozeb and mineral oil). The programme usually ends with a contact fungicide (copper or mancozeb) application.

The chemical control programme of Alternaria Brown Spot (ABS) is similar, but with the application of an additional contact fungicide (copper or mancozeb) 4 to 5 weeks prior to the first contact fungicide application for CBS control.

Therefore, a standard CBS or ABS chemical control programme, with copper oxychloride or cuprous oxide as the contact fungicide, should provide sufficient control of citrus scab.

Care should be taken with copper applications on sensitive varieties where stippling can occur if more than three copper applications are done per season. On these varieties, using copper fungicides in the first three applications of the ABS and CBS control programmes should also provide scab control as this will protect fruit for the whole period of susceptibility.

In the USA azoxystrobin and pyraclostrobin are registered and are effective against scab control. However, at this stage, these actives are not registered in South Africa for scab control.

For any further queries, contact Jan van Niekerk (janvn@cri.co.za, 021 808 3721), MC Pretorius (mc@cri.co.za, 013 759 8032) or Elma Carstens (ec@cri.co.za, 082 419 4424).

Fig 1. Scab lesions on upper leaf surfaces.

Fig 2. Scab lesions on lower leaf surface.

Fig 3. Severe scab symptoms on the fruit surface.

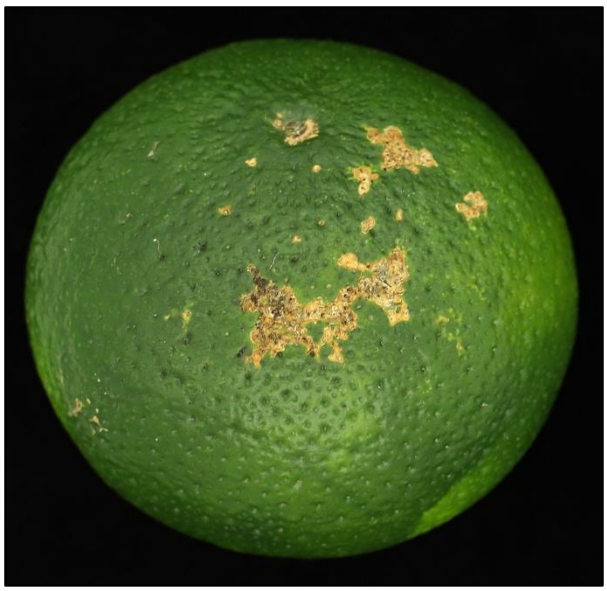

Fig 4. Localised scab symptoms on fruit surface.

CRI Snykant
Verseker die toekoms van sitrus deur wetenskap
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Bestuur van *Elsinoë fawcetti wat* sitrusskurf veroorsaak

Jan van Niekerk, Jacquie van der Waals,
MC Pretorius en Elma Carstens
Citrus Research International (CRI)

In Snykant 270 (Mei 2019), is produsente in kennis gestel dat *Elsinoë fawcetti,* die organisme wat sitrusskurf veroorsaak, as 'n kwarantyn-pes deur die Europese Unie (EU) gelys is. Tot op hede is daar geen fitosanitêre maatreëls spesifiek tot *E. fawcetti* aangedui nie, maar onderskeppings van geïnfekteerde vrugte in die EU kan tot verdere stappe lei.

Na aanleiding van onlangse EU-onderskeppings van skurf-geïnfekteerde vrugte, word produsente aangemoedig om aandag aan verkenning en monitering vir skurf in hul boorde te verskerp. Dit is ook uiters belangrik dat geen skurf-geïnfekteerde vrugte vir uitvoer na die EU gepak moet word nie.

Hierdie Snykant verduidelik die simptome en siektesiklus van die patogeen, asook verbouingsmaatreëls- en chemiese beheerstrategieë wat toegepas kan word.

Simptome

Blare is die mees vatbaar vir infeksie wanneer hulle uit die knop kom, maar word bestand wanneer hulle vol-grootte bereik. Blaarsimptome verskyn eers as 'n uitsteeksel (bult of vrat) aan die geïnfekteerde kant van die blaar, met 'n ooreenstemmende inkeping of holte aan die teenoorgestelde kant. Wanneer blare ten volle ontwikkel is, is die skurfpustules kleiner en kom daar min of geen blaarvervorming voor nie. Soms kan letsels op die blare saamsmelt en groot areas bedek om kurkagtige kolle te vorm (Fig. 1 en 2).

Infeksie van jong vrugte lei tot die vorming van vrat-agtige uitgroeisels op die skil. Infeksie van meer volwasse vrugte van alle kultivars, gee aanleidng tot die vorming van pustules wat net effens bo die normale kontoer van die vrugoppervlak uitstaan. As vrugte erg geïnfekteer is, kan hierdie pustules saamsmelt om uitgebreide skurf-agtige areas te vorm wat in plaatjies kan kraak soos die vrugte vergroot. Die skurf-agtige tipe simptoom kan met windskade, blaaspootjie – of Botrytis-simptome verwar word. In skurf-infeksies is sommige diskrete ronde pustules egter aan die buitekant van die saamgesmelte skubberige area teenwoordig. Aan die buitekant van die geaffekteerde area kan 'n paar klein eilande van beskadigde weefsel ook voorkom.

Vrugte bly vir ongeveer drie maande ná blomblaarval (12 weke na vrugset) vatbaar vir infeksie (Fig. 3 en 4).

Skurfletsels op takkies begin as klein deurskynende kolle wat verhewe raak, wat alleen of in groepe voorkom. Met veroudering word die letsels donker groen olyf-kleurig as gevolg van die groei van saprofitiese swamme op die skurf-oppervlaktes. Takkies kan uiteindelik terug sterf.

Siektesiklus

Spore van die patogeen word deur die jaar op die oppervlak van skurfletsels op jong vrugte en blare gevorm. Die optimale temperatuur vir spoorproduksie, ontkieming en infeksie is tussen 24 en 28°C. Infeksie is egter steeds by temperature laer as 24°C moontlik, as nat toestande lank genoeg voortduur. In die boord word die spore deur reën versprei. Infeksie van vatbare blaar-en vrugweefsel vind plaas as die natheidsperiode 3-4 ure is tesame met optimale kondisies.

Soos aangedui, is jong blare veral vatbaar, maar word weerstandbiedend sodra hulle afgehard is. Vruggies bly vatbaat tot 12 weke ná vrugset. In die boord oorleef die patogeen op geïnfekteerde of simptomaties blare, takkies en vrugte binne die boomblaredak.

Verbouingsbestuur

Op grond van die siektesiklus is dit duidelik dat langdurige periodes van natheid in die boomblaredak die ontwikkeling van skurf bevoordeel.

Gereëlde snoei van bome is belangrik omdat dit lugvloei in die bome verbeter en die natheidsperiode verkort. Spuitpenetrasie word ook verbeter deur snoei wat aanleiding gee tot beter chemiese beheer. Snoei en die verwydering van dooie hout en blare uit die boomblaredak verminder die inokulumdruk in die boord wat verdere infeksies verminder.

Chemiese beheer

In areas waar die siekte jaarliks voorkom, moet 'n voorkomende benadering gevolg word. Behandelings moet met die eerste lentegroei (spring flush) begin en voortgesit word tot 12 weke ná vrugset.

In areas waar die siekte sporadies voorkom, of nie voorkom nie, moet jong vegetatiewe groei en vrugte ná periodes van reënval vir die teenwoordigheid van skurfletsels ondersoek word.

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Alle bespuitings moet as medium-dek bespuitings toegedien word, ten einde te verseker dat alle blaar- en vrugoppervlaktes deeglik benat word.

Slegs koperoksiechloried (200 g/100 L water) en koperoksied (90 g/100 L water) is tans in Suid-Afrika vir die beheer van sitrusskurf geregistreer. Vir beide aktiewes word aanbeveel dat dit, beginnend tussen 75% en 100% blomblaarval, in aanvang moet neem.

Hierdie bespuiting sal jong blare en vrugte beskerm. Verdere beskerming van vrugte kan met verdere bespuitings van die koperaktiewes wat genoem is, verkry word, 5 weke na die eerste bespuiting. Vir die beskerming van vrugte, moet bespuitings herhaal word totdat die vrugte 12 weke oud is.

In Suid-Afrika berus die chemiese bestuur van Sitrusswartvlek (SSV) op die toediening van ‘n kontakswamdoder (koper of mankoseb) tydens 80% blomblaarval. Dit word deur twee strobilurien (in ‘n tenkmengsel met koper of mankoseb en olie) bespuitings opgevolg. Die program word normaalweg deur ‘n bespuiting met ‘n kontakswamdoder (koper of mankoseb) afgesluit.

Die chemiese beheerprogram van Alternaria-bruinvlek (ABV) is soortgelyk, maar met ‘n addisionele kontakswamdoder- (koper of mankoseb) bespuiting, 4 tot 5 weke voor die eerste kontakswamdoderbespuiting vir SSV-beheer.

‘n Standaard SSV of ABV chemiese beheerprogram, met koperoksiechloried of koperoksied as die kontakswamdoder, behoort dus voldoende beheer van sitrusskurf te verskaf.

Sorg moet egter geneem word met koperbespuitings op sensitiewe variëteite waar fitotoksisiteit (stippling) kan voorkom indien meer as drie koperbespuitings per seisoen toegedien word. Op hierdie variëteite behoort die gebruik van koperswamdoders in die eerste drie bespuitings van die ABV en SSV beheerprogramme voldoende beheer vir skurf te verskaf, omrede dit die vrugte vir die hele periode van vatbaarheid sal beskerm.

In die VSA is asoksistrobien en piraklostrobien vir skurfbeheer geregistreer. Hierdie aktiewes is egter nog nie in Suid-Afrika vir skurfbeheer geregistreer nie.

Vir enige verdere navrae kontak vir Jan van Niekerk (janvn@cri.co.za, 021 808 3721), of MC Pretorius (mc@cri.co.za, 013 759 8032), of Elma Carstens (ec@cri.co.za, 082 419 4424).

Fig 1. Skurfletsels aan die bokant van die blaaroppervlak.

Fig 2. Skurfletsels aan die onderkant van die blaaroppervlak.

Fig 3. Ernstige skurfletsels op die vrugoppervlak.

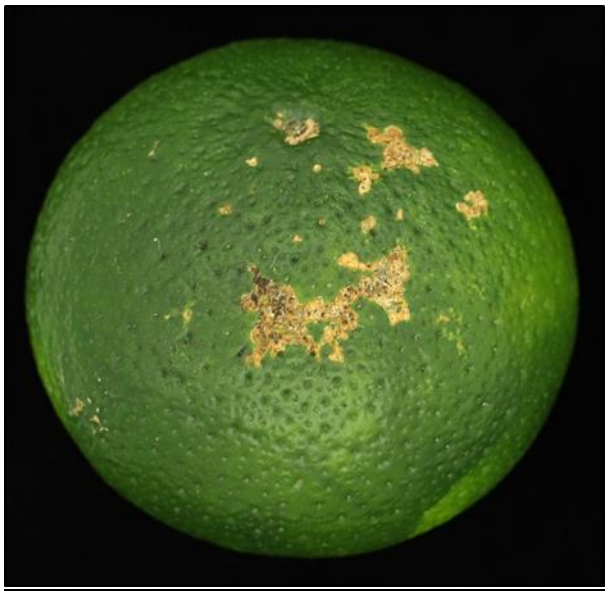

Fig 4. Gelokaliseerde skurfletsels op die vrugoppervlak.