

Cutting Edge

RESEARCH NEWS FROM CITRUS RESEARCH INTERNATIONAL

September 2002

No. 12

CRI Group Annual Report 2001

Part Two

The CRI annual report for 2001 was completed in July and includes some contributions from other institutions within the CRI Group. This is the second Cutting Edge issue to include summaries of programmes and projects from the annual report. Numbers within the summaries refer to sections within the report.

PROGRAMME: INTEGRATED PEST MANAGEMENT

Tim G Grout (Research & Technical Manager)

Integrated Pest Management (IPM) and biological control are becoming more important for export agents and consumers. In addition, the threat of more stringent pesticide residue tolerances in the future means that research on alternative, IPM-compatible treatments must be conducted for certain pests where few suitable products are registered. Pests considered to have market access or phytosanitary significance must be controlled within an IPM programme and a large proportion of the IPM budget is therefore spent on false codling moth (FCM) and fruit fly research. Much of this research requires labour-intensive post-harvest investigations to verify the efficacy of various treatments in order to gain access to new markets or counter possible additional restrictions imposed by existing markets. This recent change in work focus has once again meant that during 2001, some researchers and technicians spent more time on post-harvest research in the laboratories than on fieldwork in the orchards. Breakthroughs in both pre- and post-harvest control of FCM and fruit fly have meant that our exports to discerning markets are assured for the immediate future. However, EUREPGAP requirements and possible shifts in focus from citrus blackspot to FCM or fruit fly require that our control methods be as effective and as IPM-compatible as possible, so this will continue to receive research attention.

Due to the over-supply of world citrus markets, consumers increasingly demand fruit with "eye appeal". The control of cosmetic pests such as citrus thrips therefore remains essential and the control methods must cause as little disruption as possible to natural enemies, making research on non-target effects also essential. Due partly to the fall in the value of the Rand and due to inflation, citrus growers are faced with escalating costs and need to minimise production costs. In order to optimise sustainable citrus production, control of

red scale and citrus psylla (the vector of Huanlongbing or greening disease) must be both effective and IPM-compatible. Research in 2001 also addressed these issues.

Project: Biocontrol Disruption

Tim G Grout (Project Coordinator, CRI)

With increasing pressure from EUREPGAP requirements and further requests from agents and chain stores, the need to maximise biocontrol in IPM becomes more important every season. Reducing unnecessary disruption of natural enemies in citrus orchards is therefore essential. Two different approaches to ants were investigated. A study near Grahamstown was conducted to compare the rates of predation by ants on pupae of false codling moth, fruit fly and bollworm (3.2.2). *Pheidole megacephala* was the dominant ant at the site and removal of all pest pupae was highest where ants were not poisoned. Significantly more FCM pupae were removed than either bollworm or fruit fly pupae. The alternative research approach to ants was an investigation of three different control methods (3.2.3). Some promising results were achieved against *Pheidole* with baits, chemical trunk bands and poisoning of nests but the chemical used in the baits will not be available in the future. Further research on the other control techniques will depend on interest from the manufacturers of the toxicants. The first two products for which non-target effect (NTE) categorizations against five key natural enemies on citrus were included in their labels, were recently registered for use on citrus. These were Tracer (spinosad) and Calypso (thiacloprid). Further bioassays to test NTEs of various chemicals against key natural enemies were conducted and the database updated (3.2.4). Three of the natural enemies used in the bioassays are now being purchased from insectaries to save labour costs. Difficulties were experienced with fumes from carpets and IGR spray drift affecting mortality so some bioassays need to be repeated. Further bioassays to fill gaps in the database will continue but products that are likely to be important in the future will be prioritised.

Project: Cosmetic Pests

Tim Grout (Project Coordinator, CRI)

During 2001, research on cosmetic pests included citrus thrips, snails, citrus rust mite and citrus bud mite. Citrus thrips populations in many citrus production regions were relatively low during 2001 so planned trials to evaluate chemical treatments for citrus thrips could not be conducted (Experiment 626). The survey of predatory mites found in soil or

leaf litter beneath citrus trees was completed (3.3.2) after mites collected in the Eastern Cape, near Groblersdal and in the Nkwaleni Valley were identified. The most promising and widespread predators of citrus thrips belonged to the mesostigmatid mite families; Phytoseiidae, Laelapidae and Ascidae. Some representatives of these families are known from the literature to be predators of thrips while others were earlier identified by Grout and Stephen as predators of citrus thrips using autoradiographic techniques. The more obscure families Rhodacaridae and Parasitidae were also represented at many sites and may be preying on citrus thrips. The laelapid *Androlaelaps* sp. was mass reared and released twice under trees at each of two sites in Mpumalanga (3.3.4). The numbers of thrips were too low at one site to obtain any result but at the other site, a significant reduction in the number of adult thrips caught on yellow traps was achieved. At both sites, numbers of trapped thrips remained below intervention thresholds in release blocks. The use of white clover as a ground cover or sugar-cane leaves as a mulch did not increase natural populations of soil predators sufficiently to have any significant effect on numbers of citrus thrips (3.3.4). Attempts to develop a technique to identify DNA from citrus thrips in predators that had recently fed on citrus thrips failed because the DNA was denatured too rapidly to be recognized. Further attempts will be made using an enzymatic approach in order to identify which general predators feed on citrus thrips in the field. Amongst several unusual thrips species that were collected from citrus during 2000 were two undescribed *Scirtothrips* spp. It is not known whether these species were causing any damage but they could be confused with *S. aurantii* (3.3.3). An investigation of possible attractants for citrus thrips was conducted with a view to using mass trapping or an attract-and-kill technique in IPM orchards (3.3.5). No attractants were found for citrus thrips but ethyl nicotinate attracted 10 times as many non-citrus thrips as yellow traps alone. The chemical p-anisaldehyde was found to significantly repel citrus thrips whilst attracting other thrips and large numbers of cucujoid beetles.

Research was conducted on a new snail repellent socusil (Kaput). This product was found to control both the brown snail *Helix aspersa* and the dune snail *Theba pisana* at the Extender dosage rate, giving similar efficacy to Sluggem pellets (3.3.6). Trials were also conducted with both citrus rust mite and citrus bud mite to find alternatives to amitraz and bromopropylate (Acarol) (3.3.7). The new Bayer product spiroadiclofen (Envidor) that is not yet registered and abamectin at 15 ml plus Orchex 0.3%, controlled citrus rust mite as well as Acarol, as did the less IPM-compatible product chlorfenapyr (Hunter). Hunter was the only product evaluated to give similar control to Acarol against citrus bud mite. However, abamectin may provide adequate suppression if applied twice in a season as a treatment for citrus thrips to cultivars that are not very susceptible to this pest. Resistance of

citrus rust mite to mancozeb was confirmed at two sites in Mpumalanga (3.3.7).

Project: False Codling Moth

Hendrik Hofmeyr (Project Coordinator, CRI)

False codling moth (FCM) remains an important pest in so far as it presents a threat for the ease and safety with which southern African oranges can be exported without incurring phytosanitary penalties. As such, much time and money is spent on research, which includes both pre- and post harvest studies.

Internationally, resistance to the use of chemical insecticides has a major detrimental effect on the availability of products that can be evaluated against FCM. This means that increasingly control methods must be researched that were in the past not commonly accepted as commercially viable .

Progress was made with the development of a granulovirus that was able to suppress FCM in orchard experiments for up to 39 days. It also was superior to the registered insecticide, Alsystin (Sec. 3.4.2). Despite bureaucratic delays, progress was made with the importation of a genetically modified baculovirus to be evaluated against FCM (Sec. 3.4.6). Orchard experiments with the egg parasitoid, *Trichogrammatoidea cryptophlebiae*, show that crop losses in the East Cape can be reduced by more than 60% (Sec. 3.4.3). There are indications that earlier releases rather than later, improve results. The effectiveness of *T. cryptophlebiae* was erratic in the Citrusdal region, although it was demonstrated that parasitoid numbers in orchards can be increased by regular releases (Sec. 3.4.7).

Experiments have commenced to improve the mass rearing technique for FCM in preparation for research aimed at the Sterile Insect Technique (Sec. 3.4.4). Progress was made with an adapted culture medium that greatly reduces the danger of fungal contamination. Existing insectary apparatus were also modified to reduce labour input for the production of FCM eggs. Research also was initiated to rear the egg parasitoid in artificial eggs, which will make rearing of the normal host, FCM, redundant (Sec. 3.4.14). The rearing of *T. cryptophlebiae* in such eggs has not yet been successful.

Research was conducted with three products aimed at the disruption of FCM sexual behaviour. The attract and kill product, Last Call, was evaluated in three orchard experiments. Although it reduced the incidence of FCM damaged fruit compared to untreated controls, results were not satisfactory from a commercial perspective (Sec. 3.4.8). The mating disruptors, Isomate and Quant, were also evaluated. FCM infestations in the test sites were very light and it could not be determined whether the products had made any difference to FCM crop damage (Sec. 3.4.9 and 3.4.10).

Numerous chemical compounds were evaluated in laboratory and field trials for their effectiveness as attractants or disruptants for FCM males and females (Sec. 3.4.11). Compounds were found that reacted synergistically with synthetic FCM sex pheromone. Preliminary research was conducted on products responsible for the attraction of female moths to oranges for egg laying (Sec. 3.4.13). No such products have as of yet been identified.

Research was conducted to increase the temperature of the existing cold disinfestation treatment for FCM in packed fruit from $-0,5^{\circ}\text{C}$ to $+0,5^{\circ}\text{C}$ (Sec. 3.4.5). Problems were encountered with both the apparatus and data loggers used in the experiment and the efficacy of the increased temperature to kill FCM larvae, could not be determined. Research on Controlled Atmosphere was continued to find treatments which would be toxic to FCM larvae in packed fruit, while maintaining fruit quality (Sec. 3.4.12). In earlier investigations treatments with low oxygen and carbon dioxide levels were evaluated, which were toxic to larvae, but affected fruit quality adversely. Increased oxygen and carbon dioxide levels were subsequently investigated, but these treatments were less toxic to larvae, while fruit quality was still seriously affected due to excessive rind breakdown and decay.

Project: Fruit Fly

Tony Ware (Project Coordinator, CRI)

This project can be divided into two main groups; namely market access with its research on mitigating treatments and the orchard aspect where monitoring and control are the issues that are addressed. With respect to mitigating treatments, the rearing of the three species of fruit fly of agricultural importance in southern Africa (3.5.2) continued to supply research needs. These insects were used in the cold sterilization of Natal fruit fly-infested apples (contract work with the Deciduous Fruit Producers Trust; 3.5.3) where a 13 day treatment of $0.5\pm 0.5^{\circ}\text{C}$ was effective, cold treatment of Natal fruit fly-infested oranges (3.5.4) where $-0.5\pm 0.5^{\circ}\text{C}$ treatment for 12 days was effective and the methyl bromide disinfestation of fruit-fly-infested avocado (contract research for the Southern African Avocado Growers Association) where the UDSA-APHIS treatment of $32\text{g}/\text{m}^3$ for 4 hours prove to be ineffective against the third instar *Ceratitis cosyra*. Two experiments were done where the monitoring of fruit fly was investigated. In the first experiment colour of the Questlure-baited Sensus fruit fly trap was examined and found to have no effect on trap catches (3.5.5). In the second experiment the position of the Questlure capsule within the Sensus trap was found to play no role in its attractiveness. Based on these two experiments it is suggested that the Sensus trap top should be modified to accommodate the inverted Questlure capsule (to ensure that the lure does not leak and foul the bottom of the bucket) but its colour should be retained.

Project : Production Pests

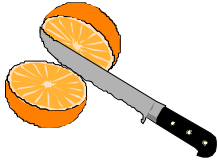
Tony Ware (Project Coordinator, CRI)

Red scale remains a major pest of citrus and the research reported this year focussed on determining a parasitism-related infestation threshold (3.6.2) and the use of Actara (3.6.3), Confidor (3.6.4) and Citricare (3.6.5) for control. The treatment thresholds reported for the Eastern Cape Province last year appear to have been confirmed. It was demonstrated that Actara and Confidor were both effective scalicides but that Citricare was not considered an effective treatment. Three experiments, all on citrus psylla (*Trioza erytreae* [Del Guercio]), were conducted. The first of these was an investigation into the mass trapping of psylla as a control measure (3.6.6). None of the attractants used trapped significantly more psylla than yellow traps by themselves. In the second trial amitraz and abamectin were found to be effective treatments that could replace the organophosphates. Hydrated lime was also effective but produced some burn on some of the semi-expanded leaves (3.6.7). The third study involved the investigation of disease. The project had to be terminated upon the resignation of the individual responsible for the DNA studies.

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CRI Groep Jaarverslag 2001

Deel Twee

GEÏNTEGREERDE PLAAGBESTUUR

Deur Tim G. Grout (Navorsing & Tegniese Bestuurder – CRI)

Geïntegreerde Plaagbestuur (GPB) en biologiese beheer word al belangriker vir uitvoeragente en verbruikers. Daarby beteken die bedreiging van strenger insekdoderresiduvlakke in die toekoms, dat navorsing op alternatiewe, GPB-aanvaarbare behandelings op sekere plae, waarvoor min geskikte produkte geregistreer is, toegespits moet word. Plae van marktoegang of fitosanitêre belang moet in 'n GPB-program bestry word en 'n groot deel van die GPB-begroting word daarom op valskodlingmot (VKM) en vrugtevlieg-bestryding uitgegee. Baie van dié navorsing verg arbeidsintensiewe na-oesnavorsing om die doeltreffendheid van verskillende behandelings te toets om toegang tot nuwe markte te kry of om moontlike bykomende beperkings deur bestaande markte teen te werk. Dié onlangse verandering in werksfokus het weer eens beteken dat sekere navorsers en tegnisi gedurende 2001 meer tyd aan na-oesnavorsing in die laboratoriums spandeer het as op boordwerk. Deurbrake in beide voor- en na-oesbestryding van VKM en vrugtevlieg het beteken dat ons uitvoere na kieskeurige markte oor die kort termyn verseker is. EUREPGAP-vereistes en moontlike fokusverskuiwings van sitruswartvlek na VKM of vrugtevlieg, verg dat ons bestrydingstegnieke so doeltreffend en GPB-aanvaarbaar as moontlik moet wees, wat meebring dat dit sal voortgaan om navorsingsaandag te ontvang.

Weens die oorvoorsiening aan wêreldsitrusmarkte, vereis verbruikers toenemend aanskoulike vrugte. Die beheer van kosmetiese plae soos sitrusblaaspootjies bly noodsaaklik en die bestrydingsmetodes moet so min moontlik ontwrigting van natuurlike vyande veroorsaak, wat ook navorsing op nie-teiken organismes noodsaak. Deels te wyte aan die dalende Rand en weens inflasie, kom sitrusprodusente voor stygende koste te staan en word verplig om produksiekoste laag te hou. Om volhoubare sitrusproduksie ten beste te benut, moet die bestryding van rooidopluis en sitrusbladvlooi (die vektor van Huanlongbing- of

vergroeningsiekte), beide so doeltreffend en GPB-aanvaarbaar as moontlik wees. Navorsing in 2001 het ook aan dié onderwerpe aandag gegee.

PROJEK: BIOBEHEER-ONTWRIGTING

Dr. Tim Grout (CRI)

Toenemende druk as gevolg van EUREPGAP-vereistes en verdere versoeke van agente en kettingwinkels, verhoog die behoefte om biobeheer ten volle te gebruik, met elke seisoen. Die vermindering van onnodige versteuring van natuurlike vyande is daarom noodsaaklik. Twee verskillende benaderings tot mierbestryding is ondersoek. 'n Studie is naby Grahamstad uitgevoer om die tempo van mierpredasie op valskodlingmot- vrugtevlieg- en bolwurmpapies te ondersoek (3.2.2). *Pheidole megacephala* was die oorheersende mierspesie in die perseel en die verwydering van plaagpapies was die beste waar die miere nie vergiftig was nie. Betekenisvol meer VKM-papies is verwyder as van beide vrugtevlieë en bolwurm. Die tweede navorsingsbenadering was 'n ondersoek van drie verskillende bestrydingstegnieke (3.2.3). Sommige belowende resultate teen *Pheidole* is met lokase, chemiese stamversperrings en nesvergiftiging verkry, maar die chemalie wat in die lokase gebruik was, is nie verder beskikbaar nie. Voortgesette navorsing op die ander bestrydingstegnieke sal van die belangstelling deur vervaardigers van die gifstowwe afhang. Die eerste twee produkte waarvoor nie-teikeninvloed(NTI)-klassifikasie teen vyf deurslaggewende natuurlike vyande op etikette aangebring is, is onlangs vir gebruik op sitrus geregistreer. Dit is Tracer (Spinosad) en Calypso (thiacloprid). Verdere bio-essaëring om die NTI'e van verskeie chemikalieë te evalueer, is uitgevoer en die databasis is opgegradeer (3.2.4). Drie van die natuurlike vyande wat in die bio-essaëring gebruik word, word nou van insektaria gekoop om arbeidskoste te bespaar. Probleme is met dampe van tapyte en IGR-spuitsdamp ondervind wat oorlewing beïnvloed het, wat meebring dat sekere bio-essaëring herhaal sal moet word. Verdere bio-essaëring om leemtes in die databasis te vul, sal voortgesit word, maar die klem sal op produkte gelê word wat waarskynlik in die toekoms belangrik kan wees.

PROJEK: KOSMETIESE PLAË

Tim G Grout (CRI)

Gedurende 2001 het navorsing op kosmetiese plaë sitrusblaaspootjie, slakke, sitrusroesmyt en sitrusknopmyt ingesluit. Sitrusblaaspootjiebevolkings in baie sitrusproduserende gebiede was relatief klein gedurende 2001 en beplande proefwerk met chemiese behandelings kon nie uitgevoer word nie (Proef 626). Die opname van predatoriese myte in die grond of blaarreste onder sitrusbome is afgehandel nadat identifikasie van myte wat in die Oos-Kaap, naby Groblersdal en in die Nkwali-vallei gevind is (3.3.2). Die belowendste en wydverspreidste roofmyte van sitrusblaaspootjie het aan die Mesostigmata-orde behoort: Phytoseiidae, Laelapidae en Ascidae. Sommige verteenwoordigers van dié families is bekend in die literatuur as blaaspootjiefpredatore, terwyl ander vroeër deur Grout en Stephen as predatore van sitrusblaaspootjie met behulp van outoradiografiese tegnieke geïdentifiseer is. Die minder bekende Rhodacaridae- en Parasitidae-families wat in baie persele gevind is, kan ook op sitrusblaaspootjie voed. Die Laelapidae-myt, *Androlaelaps* sp., is in massa geteel en twee keer onder bome in elk van twee persele in Mpumalanga losgelaat (3.3.4). Die blaaspootjies in een perseel was te min vir enige resultate, maar in die ander perseel is voldoende blaaspootjiegatelle op geel lokvalle beduidend verminder. Die gebruik van witklawer as 'n grondbedekker, of suikerriet as 'n deklaag, het nie die natuurlike voorkoms van grondpredatore soveel verhoog dat dit 'n beduidende invloed op blaaspootjiegatelle gehad het nie (3.3.4). Pogings om 'n tegniek te ontwikkel waardeur blaaspootjie-DNA in predatore, wat onlangs op blaaspootjies gevoed het, geïdentifiseer kon word, het misluk omdat die DNA te vinnig gedenaturaliseer het. Verdere pogings sal aangewend word om veelsydige predatore wat op blaaspootjies in boorde voed, te identifiseer deur 'n ensiematiese benadering toe te pas. Tussen verskeie ongewone blaaspootjies wat gedurende 2000 op sitrus versamel was, is twee onbeskryfde *Scirtothrips* spp. gevind. Dit is onbekend of dié spesies enige skade aangerig het, maar hulle kon met *S. aurantii* verwar word (3.3.3). Verskillende lokmiddels vir sitrusblaaspootjies is getoets met die oog op massavangste of 'n lok-en-vrektegniek in GPB-boorde (3.3.5). Geen lokmiddels vir sitrusblaaspootjies is gevind nie, alhoewel etielnikotinaat 10 keer meer nie-sitrusblaaspootjies as geel lokvalle aangelok het. Die chemiese verbinding, p-anisaldehyd, het sitrusblaaspootjie betekenisvol afgeweer, maar ander blaaspootjies en groot gatelle Cucujoidea-kewers aangelok.

Navorsing is met 'n nuwe slakafweerder, socusil (Kaput), uitgevoer. Dié produk het beide die tuinslak, *Helix aspersa*, en die duineslak, *Theba pisana*, teen die Extender-dosis bestry, met soortgelyke doeltreffendheid as Sluggem-korrels

(3.3.6). Proewe is ook uitgevoer met sitrusroesmyt en sitrusknopmyt om alternatiewe vir amitraz (Mitac) en bromopropilaat (Acarol) te soek (3.3.7). Die nuwe Bayer-produk spirodiclofen (Envidor), abamectin teen 15 ml/hl plus 0,3% Orchex, asook die minder-GPB-verenigbare produk, chlorfenapyr (Hunter), het roesmyt net so goed soos Acarol bestry. Hunter was die enigste getoetste produk wat soortgelyke resultate as Acarol teen knopmyt gelewer het. Abamectin kan bevredigende onderdrukking van sitrusknopmyt verskaf indien dit twee keer per seisoen teen sitrusblaaspootjie gebruik word op kultivars wat nie baie vatbaar vir dié plaag is nie. Weerstand van sitrusroesmyt teen mankoseb is by twee persele in Mpumalanga bevestig (3.3.7).

PROJEK: VALSKODLINGMOT

Hendrik Hofmeyr (CRI)

Valskodlingmot is nog steeds 'n belangrike plaag sover dit 'n groot bedreiging inhou vir die gerief en veiligheid waarmee suider-Afrikaanse lemoene uitgevoer kan word sonder om fitosanitêre probleme op die lyf te loop. As sodanig, neem navorsing op die probleem, wat voor- en na-oesondersoeke insluit, heelwat navorsingstyd en -geld in beslag.

Internasionale weerstand teen die gebruik van chemiese insekdoders het 'n groot nadelige uitwerking op die beskikbaarheid van produkte wat teen valskodlingmot (VKM) getoets kan word. Dit beteken dat daar toenemend gekonsentreer moet word op bestrydingstegnieke wat in die verlede redelik algemeen nie as kommersieel lewensvatbaar beskou is nie.

Vordering word gemaak met die ontwikkeling van 'n granulovirus wat VKM in boordproewe vir tot 39 dae lank onderdruk het en beter as die geregistreerde insekdoder, Alsystin, gevaar het (Afd. 3.4.2). Daar word ook, ten spyte van burokratiese rompslomp, vordering gemaak met die invoer van 'n geneties-veranderde bakulovirus, wat teen VKM getoets moet word (Afd. 3.4.6). Boordproewe met die eierparasitoïed, *Trichogrammatoidea cryptophlebiae*, dui daarop dat dit oesverliese weens VKM-besmetting in die Oos-Kaap met meer as 60% kan verminder (Afd. 3.4.3). Dit lyk ook asof vrylatings eerder vroeër as later moet begin vir beter resultate. *T. cryptophlebiae* het wisselvallig in die Citrusdalse gebied gewerk, alhoewel dit blyk dat parasitoïedgatelle in boorde verhoog kan word deur gereelde loslatings (Afd. 3.4.7).

Daar is begin met die verbetering van die massateeltgniek ter voorbereiding vir navorsing wat met die Steriele Insektegniek beoog word (Afd. 3.4.4). Vordering is gemaak met 'n aangepaste voedingsmedium wat die gevaar van swamkontaminasie grootliks verminder. Wysigings is ook aan bestaande apparaat

aangebring wat arbeid vir die produksie van VKM-eiers sal verminder. Navorsing is ook ingelei op die teel van die eierparasitoïed met behulp van kunsmatige eiers, wat die teel van die normale gasheer, VKM, onnodig maak (Afd. 3.4.14). Sukses is egter nog nie met die teel van eierparasitoïede in sulke eiers behaal nie.

Navorsing op drie produkte wat die geslagsgedrag van VKM kan ontwig, is uitgevoer. Die lok-en-vrekprodukt, Last Call, is in drie boordproewe in Citrusdal getoets. Alhoewel dit oesskade weens VKM in vergelyking met onbehandelde kontroles verlaag het, was die resultate uit 'n kommersiële oogpunt nie bevredigend nie (Afd. 3.4.8). Die paringsontwrigters, Isomate en Quant, is ook getoets. VKM-besmettings in die proefpersele was egter baie laag en daar kon nie afgelei word of die produkte enige verskil aan VKM-oesskade gemaak het nie (Afd. 3.4.9 en 3.4.10). Etlke honderde chemiese verbindings is alreeds in laboratorium- en boordondersoeke getoets wat moontlik 'n lok- of afdrywende werking op VKM-mannetjies en -wyfies kan hê (Afd. 3.4.11). Enkeles is gevind wat 'n sinergistiese werking saam met sintetiese VKM-feromoon het. Voorlopige navorsing is uitgevoer om produkte te vind wat moontlik met die aanlokking van wyfiemotte na lemoene kan inmeng (Afd. 3.4.13). Geen sulke produkte is tot dusver gevind nie.

Navorsing is uitgevoer om die bestaande temperatuur waarteen die huidige kouedisinfestasiëbehandeling van verpakte vrugte plaasvind ($-0,5^{\circ}\text{C}$), te verhoog tot $+0,5^{\circ}\text{C}$ (Afd. 3.4.5). Probleme is met die apparaat en dataloggers is in die proef ondervind, wat beteken dat geen afleiding oor die doeltreffendheid van die hoër temperatuur om VKM-larwes te dood, gemaak kon word nie. Beheerde Atmosfeernavorsing is voortgesit om behandelings te vind wat VKM in verpakte vrugte kan dood, met behoud van vrugkwaliteit (Afd. 3.4.12). In vroeëre werk is behandelings met lae suurstof- en koolsuurgasvlakke getoets, wat dodelik vir VKM-larwes was, maar vrugkwaliteit benadeel het. Verhoogde suurstof- en koolsuurgasvlakke is vervolgens getoets, maar dit was minder doeltreffend teen die larwes, terwyl vrugkwaliteit nog steeds ernstig weens skilafbraak en vrugbederf benadeel is.

PROJEK: VRUGTEVLIEG

Tony Ware (CRI)

Dié projek kan in twee verdeel word, naamlik marktoeganklikheid met navorsing op risiko-verlagende behandelings en boordwerk waar monitering en bestryding die tersaaklike aspekte is. Met betrekking tot risiko-verlagende behandelings voorsien teling van die drie vrugtevliespesies van landboukundige belang in suider-Afrika nog steeds in navorsingsbehoefte (3.5.2). Dié insekte is in drie proewe gebruik,

naamlik (i) die kouedisinfestering van Natalse vrugtevlies-besmette appels, waar 'n 13-daelange behandeling by $-0,5^{\circ}\text{C}(\pm 0,5^{\circ}\text{C})$ doeltreffend was (kontrakwerk vir die Sagtevrugteprodusente Trust, 3.5.3); (ii) kouebehandeling van Natalse vrugtevlies-besmette lemoene waar 'n 12-daelange behandeling by $-0,5^{\circ}\text{C}/+0,5^{\circ}\text{C}$, doeltreffend was (3.5.4) en (iii) metielbromied-disinfestasië van vrugtevliesbesmette avokado's (kontraknavorsing vir die Suider-Afrikaanse Avokadoprodusente Vereniging) waar die USDA-APHIS behandeling van 32 g/m^3 vir 4 uur lank, ondoeltreffend was teen derde instar Maroelavlieë, *Ceratitis cosyra*. Twee proewe is uitgevoer waarin vrugtevliesmonitering ondersoek is. In die eerste proef is die kleur van die Sensus-lokval (met Questlure toegerus) ondersoek. Kleur het geen invloed op lokvalvangste gehad nie (3.5.5). In die tweede proef is bevind dat die posisie van die Questlure-kapsule in die Sensus-lokval geen invloed op lokkrag gehad het nie. Gebaseer op dié twee proewe word voorgestel dat die Sensus-lokval se deksel só verander word dat die Questlure-kapsule omgedraai gebruik kan word (sodat die lokmiddel nie kan uitlek en die lokval bevuil nie), maar dat die huidige kleur daarvan behou word.

PROJEK: PRODUKSIEPLAE

Tony Ware (CRI)

Roodopluis is nog steeds 'n belangrike sitrusplaag en die navorsing waarvoor dié jaar verslag gelewer word, het gefokus op die bepaling van 'n parasitisme-verwante besmettingsdrempelwaarde (3.2) en die gebruik van Actara (3.3), Confidor (3.4) en Citrocare (3.5) vir roodopluisbestryding. Die drempelwaardes vir behandeling waarvoor verlede jaar verslag gelewer was, is skynbaar bevestig. Daar is gewys dat beide Actara en Confidor doeltreffende dopluisdoders is, maar dat Citrocare nie doeltreffend is nie. Drie proewe is op sitrusbladvlou, *Trioza erytrae* (Del Guercio), uitgevoer. Die eerste was 'n ondersoek na massavangste van bladvlou as 'n bestrydingstegniek (3.6.6). Geeneen van die lokmiddels wat gebruik was, het beduidend meer bladvlou as geel lokvalle opsigself gevang nie. In die tweede proef is bevind dat amitraz en abamectin doeltreffende behandelings is wat die organofosfate kan vervang. Kalkswawel was ook doeltreffend, maar het sommige jong blare gebrand (3.6.7). In die derde studie is die siekte, Huanglongbing, bestudeer. Die proef is gestaak weens die bedanking van die persoon wat vir die DNS-studie verantwoordelik was.

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