Fruit flies (Diptera: Tephritidae) are important pests of the fruit industries of southern Africa. Not only do they cause damage through the feeding activity of the larvae, but fruit that is stung through the action of females attempting to oviposit their eggs, is prone to fungal contamination that results in decay and waste. They are also considered to be of phytosanitary significance and many countries have rules and regulations in place to prevent accidental importation. These facts determined that growers understand the factors influencing fruit fly population dynamics and how they can efficiently control the pest in the orchard. Traditionally, fruit flies in citrus are controlled through the application of baits, usually an organophosphate such as Malathion plus protein hydrolysate, although GF 120 NF (spinosad) and the M3 bait station are registered alternatives.

Fruit fly populations were monitored in the 2002/3 season in the Patensie citrus-growing area along the Gamtoos River in the Eastern Cape Province of South Africa. The particular orchard chosen for this exercise was the Clementine mandarin in which the grower was unable to control the fruit fly population the previous season despite regular multiple bait applications. This had resulted in this fruit being excluded from the export programme and resulted in a financial loss.

The fruit fly populations were monitored using Capilure or Questlure in Sensus traps that were placed in the orchard as illustrated in Figure 1. The Capilure acts as a parahormone and is designed to attract males while Questlure is a food attractant designed to monitor the presence of females. The traps were emptied weekly and all fruit flies caught were identified and sexed.

All the fruit flies caught were Ceratitis capitata (Wiedemann) or Mediterranean fruit fly. However, the distribution of fruit fly catches was strange in that the majority of flies were caught in the traps placed in the border trees of the orchard, even though the whole orchard had been treated with M3 bait stations (Figures 2 and 3). Although the results indicated that the Capilure traps (Figure 2) caught more than 20 times the number of flies than the Questlure traps (Figure 3), the relative numbers caught in each location showed the same trend with both lure types. The natural population ratio between males and females is 1:1 (Ware, unpublished).

![Figure 2. Mediterranean fruit fly catches in Capilure-baited Sensus traps placed outside the orchard, in the border trees of the orchard and in the centre of the orchard.](image)

![Figure 3. Mediterranean fruit fly catches in Questlure-baited Sensus traps placed outside the orchard, in the border trees of the orchard and in the centre of the orchard.](image)

In order to explain this distribution phenomenon, the orchard was inspected a week before harvest. The number of dropped fruit/tree was highest on the side of the orchard nearest the road and decreased across the orchard transect (Figure 4). The fruit was sampled for the presence of fruit fly with the majority of fruit harbouring the pest being found in the trees in the four rows nearest the road (Figure 5). There is a weak correlation between the number of dropped fruit and the number of fruit infested with...
Fig 4. The average number of dropped fruit/tree along the transect A-B (see Fig 1).

Fig 5. The percentage of fruit infested with fruit fly along the transect A-B (see Fig 1).

fruit fly (Pearson’s correlation coefficient R² = 0.71). This statistical test indicated that only a portion of the dropped fruit could be attributed to fruit fly infestation and that some other factor(s) was responsible for the fruit drop.

An examination of the trees showed that up to 50% of the fruit on some of the trees were damaged. Large flocks of mousebirds were noted in and around the orchards moving from tree to tree feeding on the fruit. Mousebirds are small with long tails (Figure 6) and get their name from their habit of climbing around much like mice do. They belong to the Coliidae family, three species of which occur in the Gamtoos Valley. In fact, the red-faced mousebird, *Urocitellus indicus* (Latham) was originally described from a specimen collected in the valley in 1740. The other two sympatric species are the speckled mousebird, *Colius striatus* Gmelin, and the whitebacked mousebird *Colius colius* (L.). Generally, they are gregarious in groups of 5-20 individuals and the flocks exceeding 100 birds noted in the orchards are a result of 2 or more groups coalescing in fruiting trees. Their normal habitat is tangled thickets and along the edges of dense vegetation such as was found between the road and the orchard. They are generally locally nomadic following the fruiting phenology of the area (Maclean, 1985).

The question then arose as to why there was a build up of the fruit fly populations in the face of preventative treatments. It is known that fruit flies require protein for sexual development and this is acquired by the flies feeding on leaf bacteria (Prokopy et al., 1991; Vijaysegaran et al., 1997; Robacker et al., 1998; Robacker and Flath, 1995; Drew et al., 1983; Drew and Lloyd, 1986; Jang and Nishijima, 1990; Robacker and Moreno, 1995) and bird faeces (Prokopy et al., 1992; Prokopy et al., 1996; Sugayama et al., 1997). The large flocks of birds in the orchard ensured that there was a more than adequate supply of natural protein. Prokopy and colleagues (1992) found that a fresh deposit of bird faeces was more attractive than a Malathion/protein bait. Furthermore, the fermenting and decaying damaged fruit would provide a large source of bacteria. These factors would go a long way in explaining the ineffectiveness of the fruit fly control programme in these orchards.

In the 2003/4 season there were further reports from the area that the growers were unable to control fruit fly. An investigation was undertaken and, although no specific data were collected, it was evident that only those Clementine mandarin orchards that had suffered bird damage had a fruit fly problem. This observation was confirmed in one 2 ha orchard that was monitored with two fruit fly traps, only one of which was luring fruit flies. This was a trap positioned near a dense thicket of natural bush. Trees that surrounded this trap had up to 20% of their fruit damaged by birds. The other trap some 200 m away on the other side of the orchard did not catch one fly, this correlated with the fact that there was no bird-damaged fruit in the vicinity.

These observations need to be confirmed but there is ample circumstantial evidence that one pest (mousebirds) can result in repercussions in another pest (fruit fly). This relationship can have a devastating impact on these growers’ earnings (direct damage to the fruit from the birds) and their ability to export (the phytosanitary risk posed by the presence of fruit fly). Solutions to the problem need to be researched but loud noises may be used to frighten the birds away and let a neighbour bear the consequences. Exclusion netting is another option. A last option to exterminate the birds is ecologically drastic and may backfire on the growers if the consumers get wind of the practice.

LITERATURE CITED


Peteca spot of lemons

PAUL CRONJÉ
Citrus Research International, University of Stellenbosch, Department of Horticulture

During 2004 a high incidence of peteca spot of lemons was reported in all citrus production areas of South Africa. The following article is a review of the available literature followed by a summary of the information gathered during a CRInet survey.

INTRODUCTION

Peteca spot of lemons, also called "rumple" (Knorr, 1963), was identified as early as 1917 in the USA lemon industry (Coit, 1917). This disorder can affect over-mature fruit on the tree but mostly develops 3 to 4 days after fruit has been packed (Oberbacher and Knorr, 1965; Khalidy et al., 1969; Offers, 1987). Fruit hanging on the east side of trees, as well as large, mature fruit were found to be more susceptible than small, immature fruit (Salerno, 1963; Knorr and Koo, 1969; Grierson, 1981). Mineral nutrition, particularly relating to Ca and B metabolism, and insufficient irrigation during the critical growth period have been identified by Khalidy et al. (1969) to play a role in the development of the disorder. There are also claims that it is exacerbated by heavy oil sprays (Klotz and Fawcett, 1941; J.H. Warrington, pers. comm.). Peteca spot is thought of as a postharvest disorder but is most probably the result of sub-optimal production and environmental factors that could result in high occurrence.

SYMPTOMS AND DEVELOPMENT OF THE DISORDER

Symptoms

Peteca is characterised by deep depressions with round edges on the peel surface (Fig. 1). The symptoms appear after the collapse of an oil gland (situated in the flavedo), leaking the oil into the lower flavedo and albedo cells. The visible browning of the rind (Fig. 2) is probably the result of changes in the gas exchange from the albedo due to the oxygen depletion more than enzymatic browning. The containment of oil within the gland is thus very important, as the release of oil has been implicated in disorders such as pitting and oleocellosis. The cells in the depression are free of abrasions and signs of mechanical injury. Secondary infection may occur in such pitted areas (Labuschagne et al., 1977; Nobel, 1999; Knight et al., 2001).

Mineral nutrients

Lemons with peteca spot had ≥30% decline in Boron (B) compared with unaffected lemons and the affected tissue had ≥23% increase in Calcium (Ca) levels (Storey and Treesby, 2002). Although the results are the opposite to what is expected, the relationship between higher Calcium levels and the increased incidence of peteca spot can be explained as follows. Cells surrounding the oil glands were found to be broken as well as having an abundance of calcium oxalate crystals in peteca spot-affected tissue (Khalidy et al., 1969).

The Birds & Bees Fruit Flies

Continued from page 25

food (bacteria) and host fruit. Oecologia 87: 394-400.
Rebacker, D.C., Martinez, A.I., Garcia, J.A. and Bartelt, R.J. 1998. Volatiles attractive to the Mexican fruit fly (Diptera: Tephritidae) from eleven bacter-