OBSERVATIONS ON FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN NEW SOUTH WALES

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Summary

From November 1995 to June 1999 458 methyl eugenol, 298 cuelure and 156 med fly traps were used to monitor fruit flies across New South Wales exclusive of the Fruit Fly Exclusion Zone. *Bactrocera bancroftii* (Tryon), *B. batemani* Drew, *B. chorista* (May), *B. mayi* (Hardy) and *D. signatifrons* (May) were recorded in NSW for the first time and their locations described. Range extensions of some species, already known to occur in NSW, were also defined. *B. neohumeralis* (Hardy) and *B. endiandrae* (Perkins and May) were trapped to the south of Sydney, extending their published range by more than 500 km whilst *B. bryoniae* (Tryon) although reputed to range south to Sydney was only caught south to Coffs Harbour.

Many fruit fly species appear to have two flying periods, one in spring and another in autumn, with several species having a marked preference for one, or other of these seasons. There is a marked decline in abundance of several species during high summer. Several of the more abundant pest species like *B. cacuminata* (Hering) and *B. tryoni* (Froggatt) showed a marked increase in population during spring and a gradual reduction in numbers over the summer and autumn months but without a decrease in mid summer.

Keywords: geographical distribution, temporal distribution, fruit flies, Tephritidae

INTRODUCTION

Following the outbreak of the exotic Papaya fruit fly (*Bactrocera papayae* (Drew)) in Cairns in 1995 fruit fly monitoring strategies were developed by many Australian States. The aim was to provide assurance to the export markets that this pest was absent from those States. Commonly traps were baited with male attractants like methyl eugenol (ME) (Drew *et al*. 1982). About 300 ME traps were placed in fruit production and other high-risk areas of New South Wales and regularly monitored for *B. papayae*. During 1996 the strategy was expanded to include ports of entry to monitor for incursions of any exotic fruit flies using additional types of male attractant traps. Consequently, an extra 160 ME, cuelure (Drew *et al*. 1982) and med fly (Drew *et al*. 1982) traps were monitored around Sydney, Newcastle, Wollongong and Coffs Harbour. This paper reports on the analysis of these trap catches with respect to species composition, geographical and temporal distribution of lure caught fruit flies in NSW exclusive of the Fruit Fly Exclusion Zone (FFEZ) (http://www.agric.nsw.gov.au/reader/13602).

MATERIALS AND METHODS

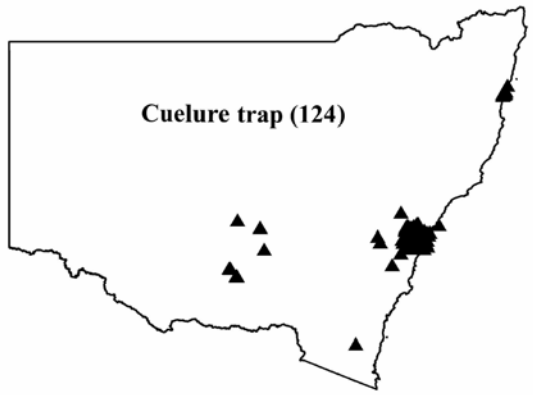
458 ME, 298 cuelure and 156 med fly traps were deployed outside of the FFEZ in NSW (Figure 1). Lynfield traps were used exclusively. Placement of traps reflected risk profile and the spatial results reported here are a consequence of that risk. Increased risk profile resulted from a traps' proximity to ports, fruit production areas or larger urban developments (sentinel traps). Between November 1995 and June 1999 traps were monitored weekly from November to May and fortnightly from June to October.

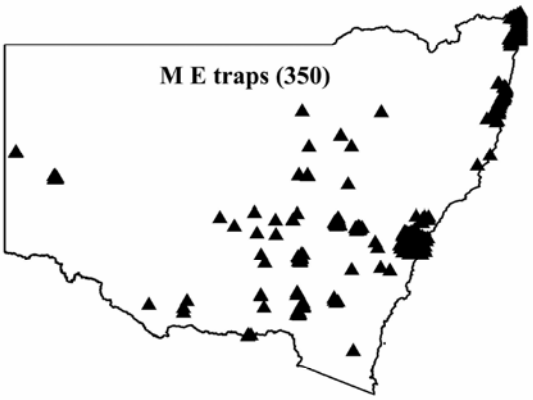
Most trap sites were referenced via Global Positioning System and/or map references. Determinations were made using a variety of keys including printed (Drew 1989, White and Elson-Harris 1992), interactive CD-Rom (White and Hancock 1997) and world wide web based keys (Gillespie 1997). Examination of pinned fruit fly specimens to verify distributional records or to confirm identities was done at the collections of Agricultural Scientific Collections Unit – Orange (ASCU), Australian Museum - Sydney, Australian National Insect Collection - Canberra, Queensland Museum - Brisbane, University of Queensland – Brisbane and Queensland Department of Primary Industry - Brisbane. Voucher specimens of unusual or uncommon occurrences of fruit flies were accessioned in ASCU.

The computer program Arcview was used to generate distributional maps based on the coordinates of monitoring sites.

RESULTS

During the period of analysis more than 2.47 million flies from 72,705 trap catches were examined. To date the monitoring indicates that *B. papayae* is not known to occur in NSW. Similarly no non-endemic fruit flies were trapped.





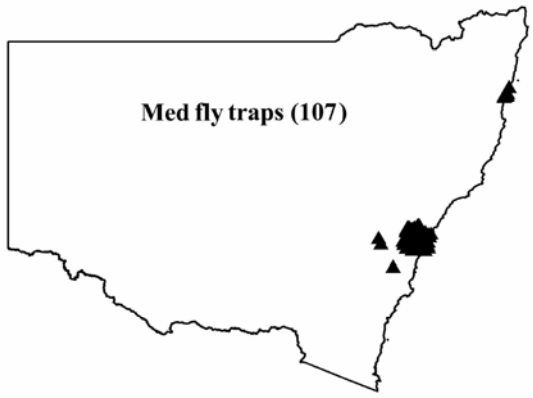


Figure 1. Plots of distributions of Fruit Fly traps in NSW (1995-1997)
Note: Plots include male attractant name followed by the number of plotted traps and the total number of traps of that type in NSW.

Analysis shows that 12 species of fruit fly were caught in various lure traps (Table 1). Single specimens of *Bactrocera strigata* (Perkins) and *Bactrocera cucumis* (French) both not known to be attracted to lures, were trapped in cuelure traps. Table 1 also shows the relative abundances of the flies trapped where this is defined as the per species proportion (percentage) of pooled trap catches. No fruit flies were caught in the med fly traps during the study period.

B. cacuminata was the predominant catch in ME traps, typically accounting for 99% or more of the total catch. Similarly almost all the flies caught in cuelure traps were *B. tryoni*.

Geographical Distributions

In Figure 1 only those trap sites for which GPS coordinates were known were plotted. 353 ME, 121 cuelure and 109 med fly trap sites are shown. The omission of sites without GPS readings does not effect the distribution plots as most sites were interstitial to those for which GPS coordinates were known. Only new distribution records or locations at variance with the public record are shown (Figure 2) and these only include flies caught in ME and cuelure traps. All species found in NSW that are not plotted here agree with the public accounts of their geographical distributions.

Temporal distributions

In Figure 3 the average monthly trap catch is plotted as a proportion of the total seasonal (Nov-May; June–Oct) catches. The plots are grouped by trap type for comparison. In Figure 3 all x-axes represent the month of the year whilst the y-axes represent the number of specimens trapped.

Results for *D. signatifrons* have not been plotted as only single specimens were caught in the months of October, January, March and June of various years and thus have no significance in this context.

DISCUSSION

Geographical distributions

A review of the current literature (Drew 1989, Drew *et al* 1982, White and Hancock 1997, Osborne *et al.* 1997) on the distribution of fruit flies found in NSW shows that five species (*D. signatifrons*, *B. bancroftii*, *B. batemani*, *B. chorista*, *B. mayi*) trapped in this study had not previously been recorded from NSW. Drew (1989) records *D. absonifacies*, *D. signatifrons*, *B. bancroftii*, *B. batemani*, *B. chorista* and *B. mayi* from south-east Queensland only, Figure

Table 1. Species composition and average relative abundance (XRA) of tephritid fruit flies caught in ME[**], cuelure and med fly traps in NSW (1995-1999).

ME lure	XRA (%)	Cuelure	XRA (%)	Med fly lure
B. cacuminata	99.798	*B. tryoni*	96.929	Nil
B. endiandrae	0.169	*B. neohumeralis*	1.333	
B. batemani	0.007	*B. chorista*	0.401	
B. bancroftii	0.015	*B. bryoniae*	0.103	
B. mayi	0.001	*Dacus newmani* (Perkins)	0.007	
B. tryoni *		*D. aequalis*	0.988	
		D. absonifacies (May)	0.339	
		D. signatifrons	0.001	
		B. batemani *		

* indicates species collected in small numbers from the "wrong" lure (XRA was not included).
** ME – Methyl Eugenol.

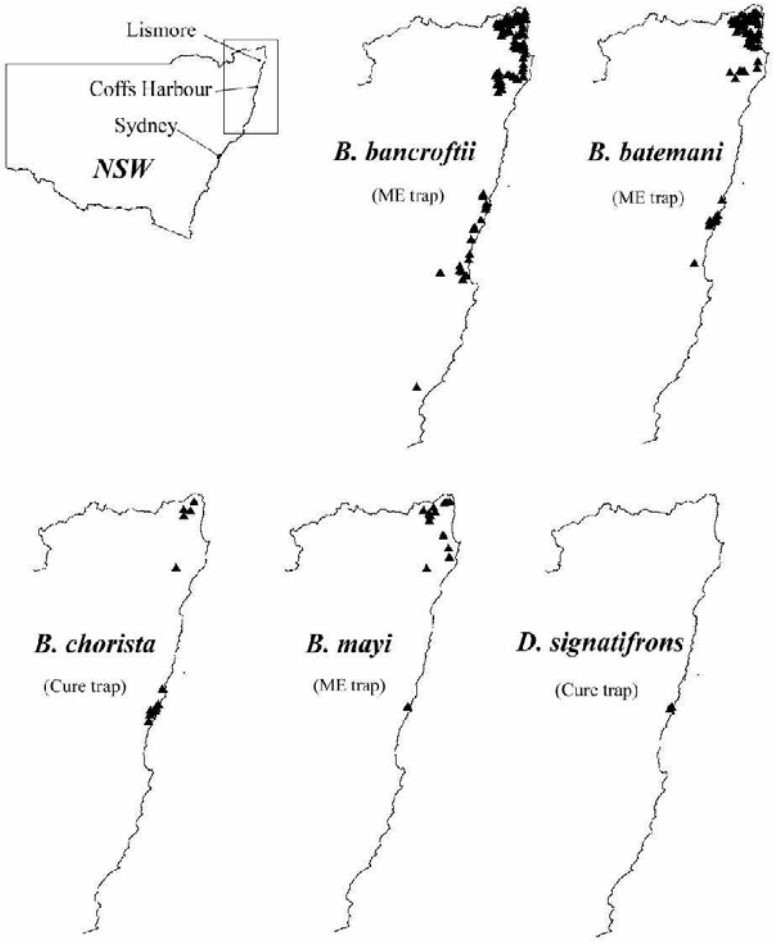


Figure 2 – NSW location records of lure caught fruit flies.

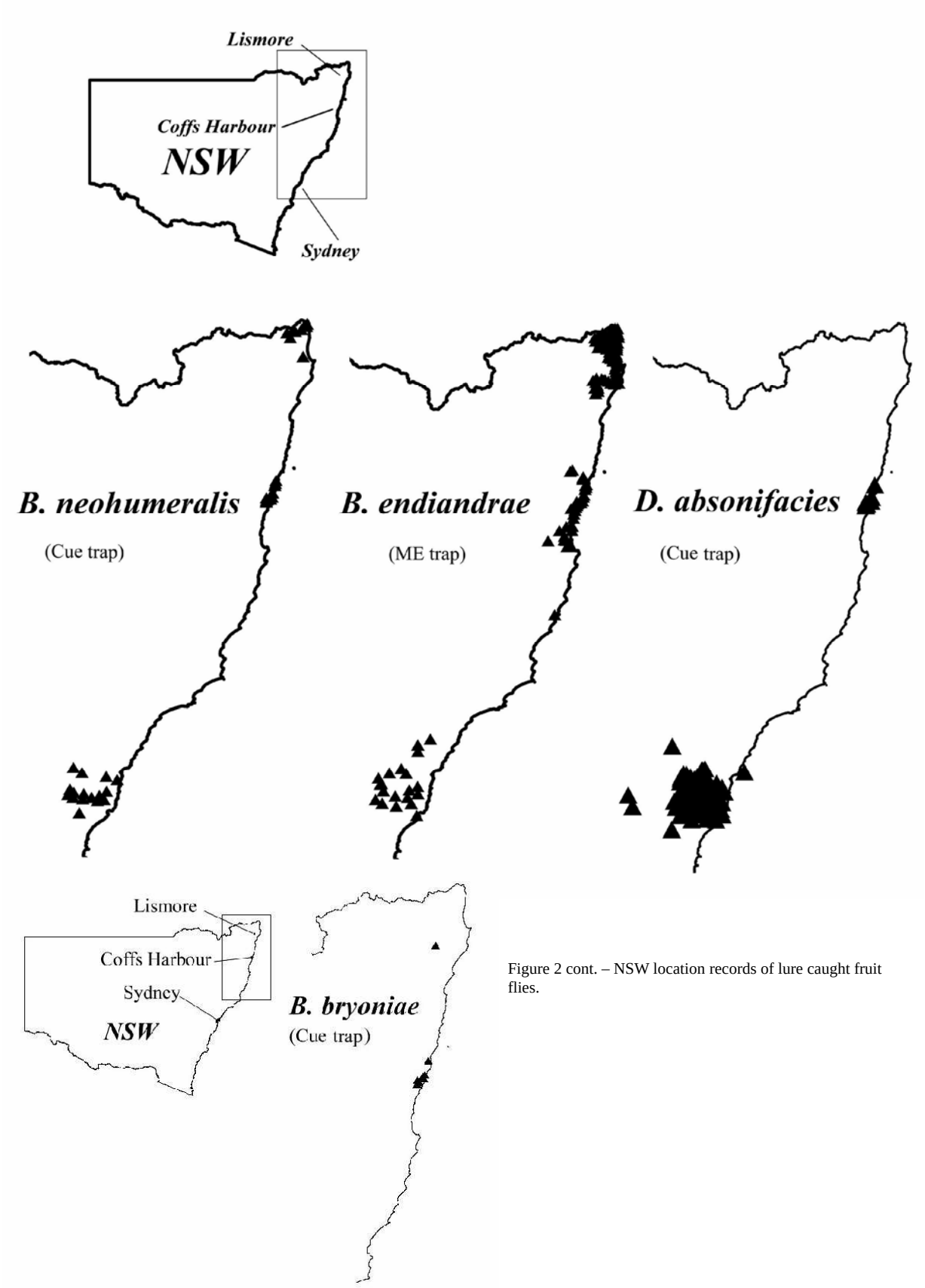


Figure 2 cont. – NSW location records of lure caught fruit flies.

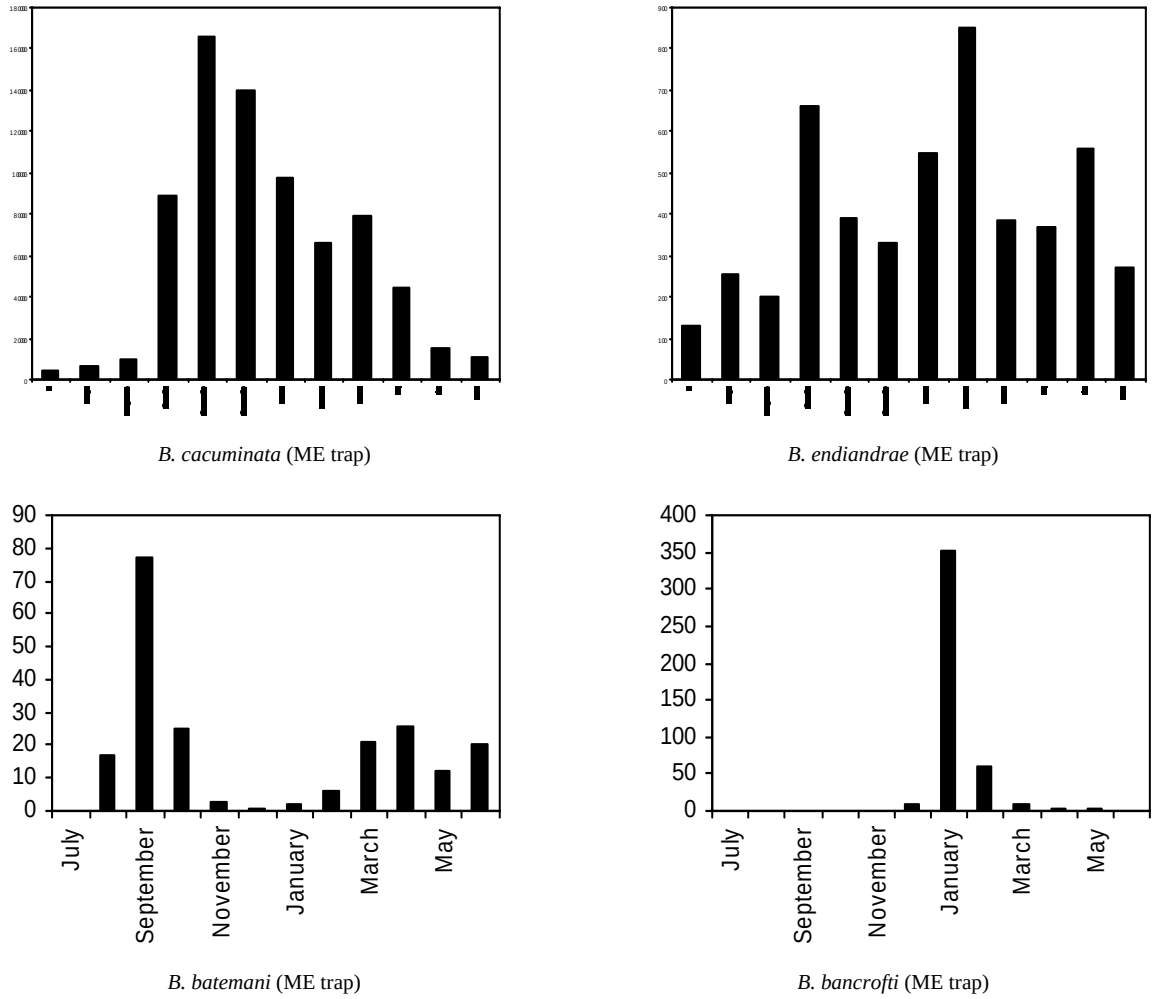
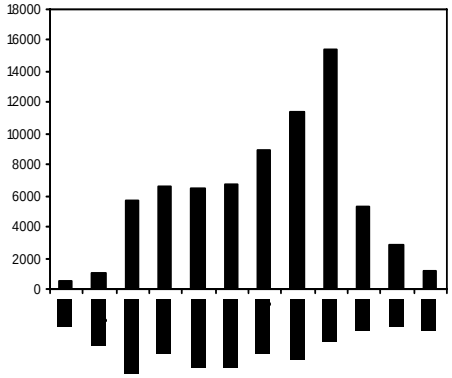


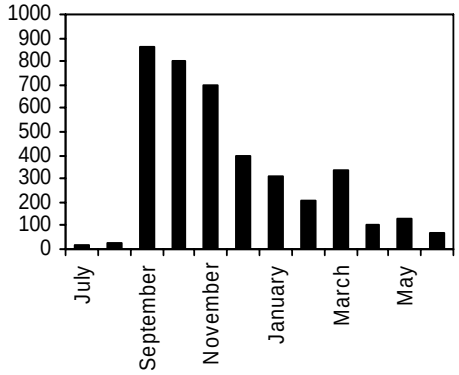
Figure 3 - Mean monthly catches of ME and cuelure caught fruit flies between November 1995 and June 1999.

2 clearly shows that all these species were regularly trapped at least as far south as Coffs Harbour. We collected *D. absonifacies* to the south of Sydney at Shell Harbour thus confirming the findings of Osborne *et al.* (1997) who collected them in Canberra and May (1963) who reports this species from Mallacoota, Noorinbee and Bairnsdale in Victoria. *D. absonifacies* were often collected together with *Dacus aequalis.* These species can be confused, however the smaller body size and bicoloured hind femur of *D. absonifacies* are diagnostic. Only four specimens of *D. signatifrons* were trapped in the three years.

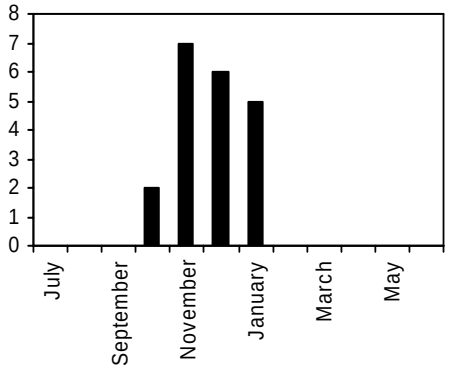
The distributions of certain species may have been misreported. Drew (1989) records *B. endiandrae* from Northern NSW, whilst White and Hancock (1997) record this species from NSW, Victoria and South Australia. In this study specimens were trapped from the Queensland border south along the coastal strip to Sydney (Figure 2). Based on these trapping results *B. endiandrae* is unlikely to occur either in Victoria, South Australia or southern and inland NSW. Similarly *B. neohumeralis* has been recorded from Queensland south to Coffs Harbour (Drew 1982) whereas our monitoring shows that this species ranges at least as far south as Sydney. It is unclear whether the presence in the Sydney area of this species represents repeated incursions of this species or a residual, albeit small population. Only 88 flies were caught in the Sydney region in total from June 1997 until June 1999 and were typically represented by sporadic single fly captures in a range of different traps. December and January 1997 represented a peak of activity for *B. neohumeralis* in the Sydney area, with simultaneous captures in up to 8 traps of up to 16 flies. This corresponded with their peak activity on the north coast. *B. bryoniae* is reputed to range from Sydney north into Queensland, however we did trap this species south of Coffs Harbour.



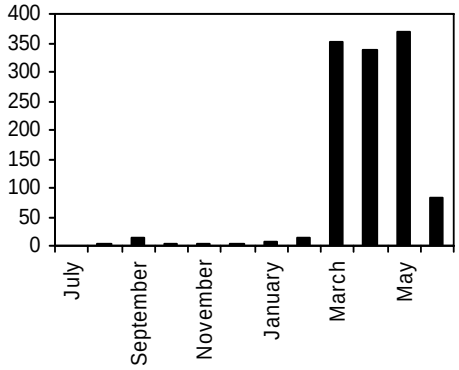
B. tryoni (cuelure trap)



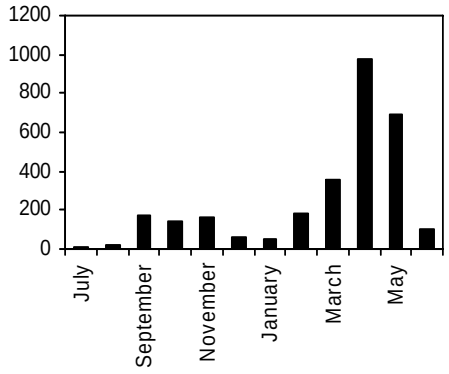
B. neohumeralis (cuelure trap)



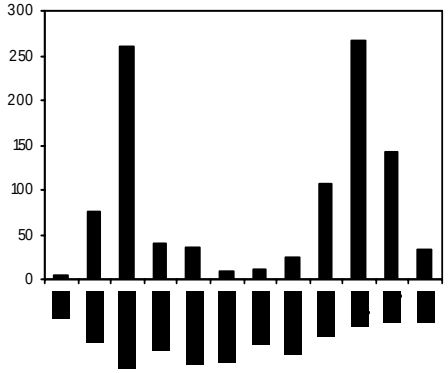
B. newmani (cuelure trap)



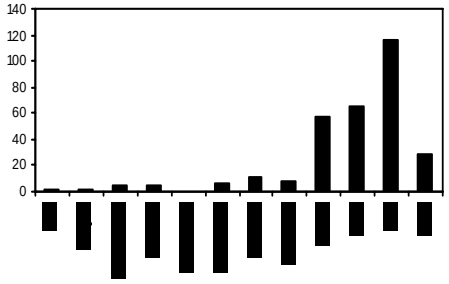
B. chorista (cuelure trap)



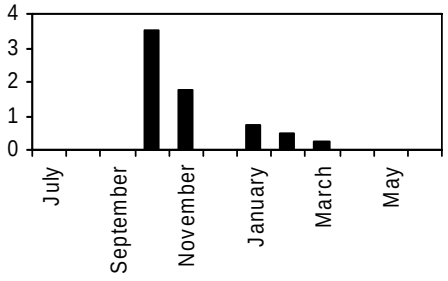
D. aequalis (cuelure trap)



D. absonifacies (cuelure trap)



B. bryoniae (cuelure trap)



B. mayi (cuelure trap)

Figure 3 cont. - Mean monthly catches of ME and cuelure caught fruit flies between November 1995 and June 1999.

The small number of cuelure traps situated on the north coast of NSW at Coffs Harbour provide only a partial picture of the occurrences of some fruit fly species in northern NSW. Apart from six cuelure traps at Coffs Harbour there were no cuelure traps between the Queensland border and Newcastle for the period of this analysis. This may explain the low frequency of weakly cuelure attracted species like *D. signatifrons.* It is likely that *D. signatifrons* would be encountered more frequently between Coffs Harbour and the Queensland border if further cuelure traps were located in this area. The same is true for several other cuelure responsive species in northern NSW.

Specimens in the ASCU collections suggest that *B. cucumis* is present in northern NSW, however it did not occur in our survey because it is not attracted to synthetic lures or traps. The distribution of *B. cucumis* is generally known only from the damage its larvae cause to cucurbit crops. Drew (1989) reports several other non lure responding species like *B. mutabilis* (May) and *B. nigra* (Tryon) are recorded from SE Queensland. It seems likely that these fruit flies will be shown to be more widespread than is presently known and they are likely to occur in northern NSW (Drew pers. comm.).

Further trapping in northern NSW with food based lures may demonstrate the presence of these species outside SE Queensland.

Temporal distributions

Of the observed species the four most commonly encountered species appear to fly in NSW throughout the year. *B. tryoni*, *B. neohumeralis*, *B. cacuminata* and *B. endiandrae* were trapped in all months with reduced abundance during winter. This suggests that these species may breed year round.

D. newmani and *B. bancroftii* appear to be single brooded. Despite only meagre trappings, the flying period of *D. newmani* in mid summer is all the more remarkable for its existence to the west of the dividing range, a harsher habitat, barely tolerated by most other fruit flies. The almost singular emergence of *B. bancroftii* in January and February is most likely linked to larval infestation of the specific fruiting of its, as yet unknown, rainforest host tree. *B. chorista* and *B. bryoniae,* whilst being trapped through most of the warmer months, are most commonly found in autumn (March–May). Similarly, *D. aequalis* was most common in autumn but also had a small spring brood. *B. batemani* and *D. absonifacies* both have well defined spring and autumn broods.

Many of the rainforest inhabiting fruit flies of the northern forests of NSW, like *B. batemani* and *B. bryoniae*, show a marked decline in abundance through mid summer (November-January). This seasonality may reflect an intolerance to some limiting environmental parameter in mid summer, or perhaps, the spring and autumn flowering and fruiting of the native trees that are larval hosts of these fruit flies.

A deeper understanding of the reasons for the flying times of these flies will come with greater knowledge of the larval developmental ecology and native host fruit availability in northern NSW. Drew *et al.* (1982) and White and Elson-Harris (1992) provide some information on known host fruits of some of these species found in NSW.

ACKNOWLEDGMENTS

The perseverance and dedication of NSW Agriculture regulatory officers are acknowledged as playing an important role in the collection of these data. Similarly the highly talented monitoring staff of ASCU who performed the identifications are thanked for their vital role in the collection of data. I thank Dr P. Cranston (formerly ANIC), Mr M. Moulds (AM), Mr J. Donaldson (QDPI), Mr G. Daniels (formerly UQ) and Dr G. Monteith (QM) for access to the collections in their charge. Dr W. King is thanked for preparing the spatial distributions with the Arcview program.

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