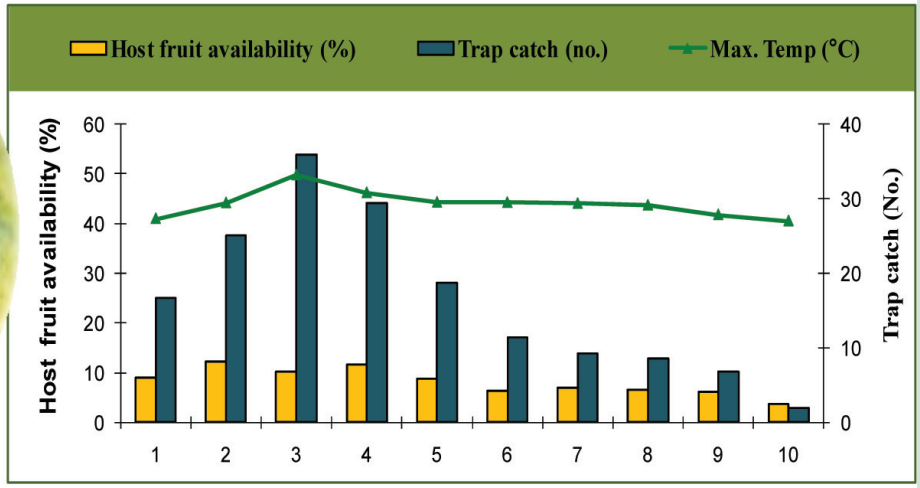
Technical Brochure

Weather and host fruit availability: Major factors influencing the field populations of mango fruit fly, *Bactrocera dorsalis* (Hendel) (Tephritidae: Diptera)



NICRA

INDIAN INSTITUTE OF HORTICULTURAL RESEARCH
Hesaraghatta Lake Post, Bengaluru - 560 089
Phone: 080-28466420-423, 080-28446140-143; Fax: 080-28466291
Email: director@iihr.ernet.in Website: www.iihr.ernet.in

Mango fruit fly, *Bactrocera dorsalis* (Hendel) (Diptera: Tephritidae) is a serious pest on a wide range of fruit crops in the Indian subcontinent. On mango (*Mangifera indica* L.), it causes loss up to 80%. During the off-season (mango is usually not available in India from mid- August to mid February) being highly polyphagous, *B. dorsalis* survives on several alternate hosts encompassing both wild and cultivated fruit crops, thereby completing several generations within a year. Given the economic importance of this pest with strong adaptability to various climates using a mosaic of host crops available, the efficacy of resilient management practices mainly depends on the round the year fruit fly population levels. Therefore, there is a need to study the seasonal abundance and host shift pattern of *B. dorsalis,* a major pest in mango in relation to weather factors and other hosts not only to have a reliable estimate of fruit fly population in field well in advance of mango season, but to strategize off-season management.

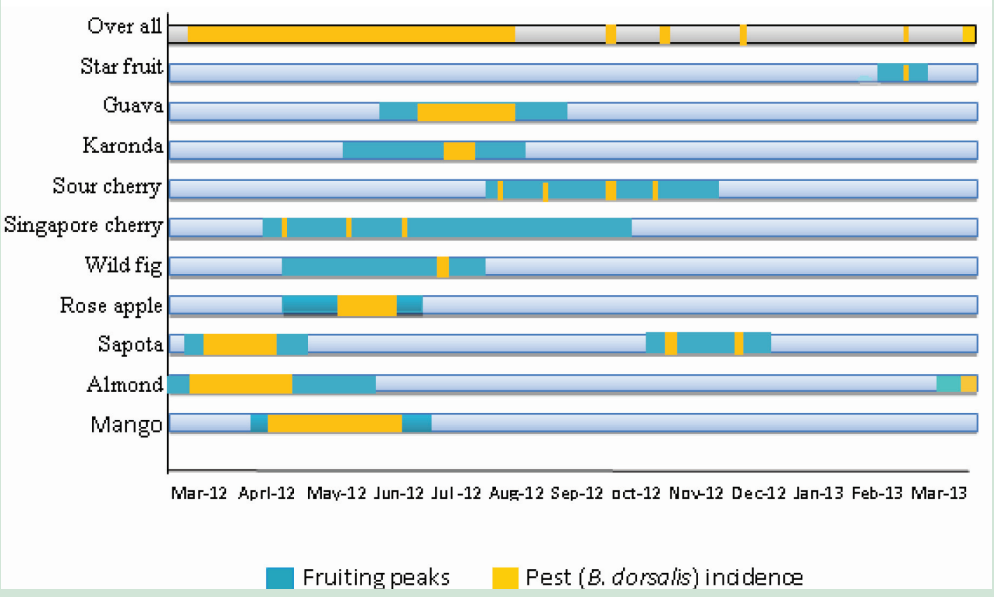


Fig. 1 Survival of *B. dorsalis* round the year with respect to host fruiting peaks

Host-fruit availability is recognized as one of the crucial factors for the existence of *B. dorsalis*. Therefore, continuous monitoring was carried out to locate the potential hosts supporting the *B.dorsalis* survival to understand its regional host-shift patterns during non-fruiting phase of the main preferred host, mango (*M. indica*). Accordingly, weekly fallen fruit sampling was carried out in different local fruiting hosts *viz.* sapota (*Achras sapota*), star fruit (*Averrhoa carambola*), passion fruit (*Passiflora edulis*), singapore cherry (*Muntingia calabura*), wild fig (*Ficus syconium*), tropical almond (*Terminalia catappa*), mulberry (*Morus rubra*), chakota (*Citrus maxima*), papaya (*Carica papaya*), pomegranate (*Punica granatum*), banyan (*Ficus bengalensis*), kokum (*Garcinia indica*), sour cherry (*Prunus cerasus*), cherry guava (*Psidium cattleianum*), cashew (*Anacardium occidentale*), rose apple (*Syzygium malaccense*), common guava (*Psidium guajava*), karonda (*Carissa carandas*) and amla (*Emblica officinalis*) to monitor the fruit fly survival continuously.

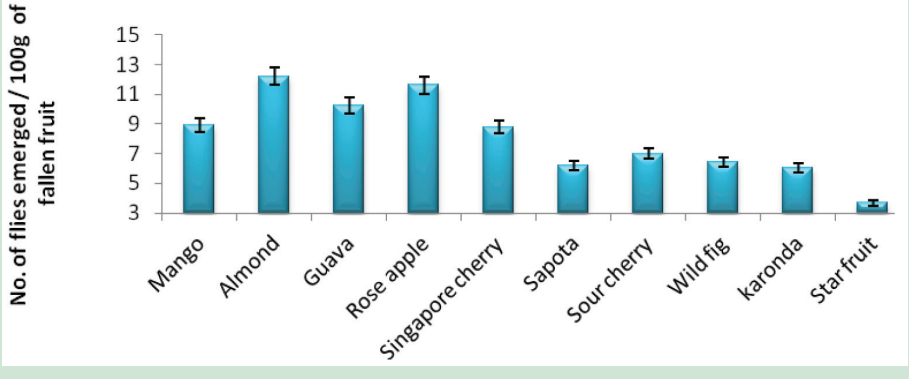


Fig. 2: Fruit fly emergence in fallen fruits of different hosts supporting *B. dorsalis* survival

Mapping the temporal distribution of host fruit abundance (Fig.1) showed that the fruit fly population was unimodal, building up from the start of summer to rainy season. A distinct period of low survival was noticed from September to February encompassing winter season. However, despite the large number of host records for *B. dorsalis* (>300 hosts), field infestation was recovered only in ten out of nineteen hosts monitored. Accordingly the H_{index} (Host specificity) of *B.dorsalis* was 0.5 (where $H_{index} \geq 0.5$ represents polyphagy). *Bactrocera dorsalis* population levels are higher between the months of March and July due to the abundance of host fruits *viz*., wild almond (*T. catappa*), guava (*P. guajava*), sapota (*A. sapota*), rose apple (*S. malaccense*) and singapore cherry (*M. calabura*) and its main host, mango (*M. indica*) (Fig. 2). The trap catch exhibited significant positive correlation with host fruit availability (HF) ($r = 0.74$) and fallen fruits (FF) ($r = 0.90$) supporting the breeding of *B. dorsalis* in these fallen fruits.

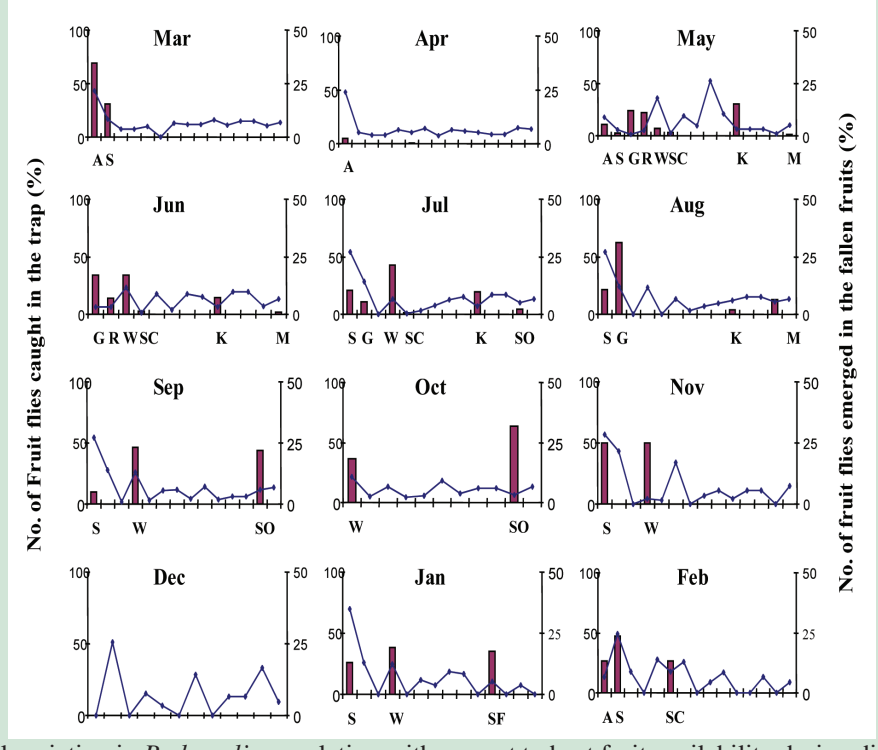


Fig. 3: Temporal variation in *B. dorsalis* population with respect to host fruit availability during different months

- No. of flies emerged; trap catch; A: Almond, S: Sapota, G: Guava, R: Rose apple, W: Wild fig, K: Karonda, M-Mango, SO: Sour cherry, SC: Singapore cherry and SF: Star fruit

Among the weather variables, *B. dorsalis* trap catch exhibited significant positive correlation with maximum temperature ($r = 0.82$) and negative correlation with RH I ($r = -0.87$) and RH II ($r = -0.63$) (Fig. 4). Further, the *B. dorsalis* population levels exhibited a down trend between September to December, may be attributed to lower temperatures that prevailed during these months coupled with fewer fruiting hosts.

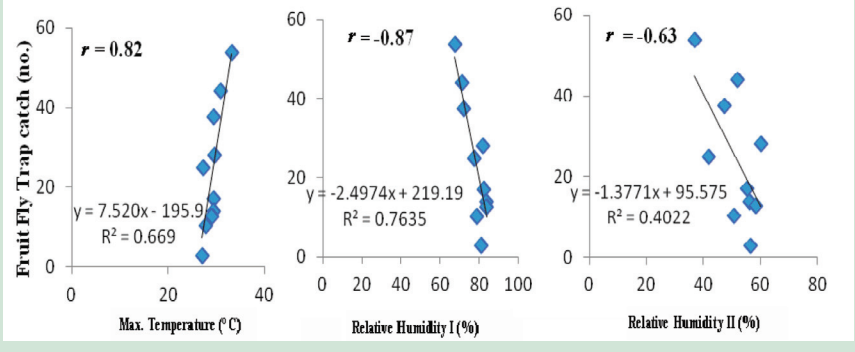


Fig. 4: Relationship between the weather parameters with trap catch of *B. dorsalis*

The multiple regression analysis considering the host phenology and climate factors could predict the fruit fly trap catch to the tune of 98% ($y = -44.63 + 1.00HF_{(x1)} - 0.02\ FF_{(x2)} + 5.04$ Max. temp $_{(x3)} - 1.26$ RH I $_{(x4)} + 0.91$ RH II $_{(x5)}$; $F = 57.49$, $P<0.001$, $R^2 = 0.98$) (Fig. 5).

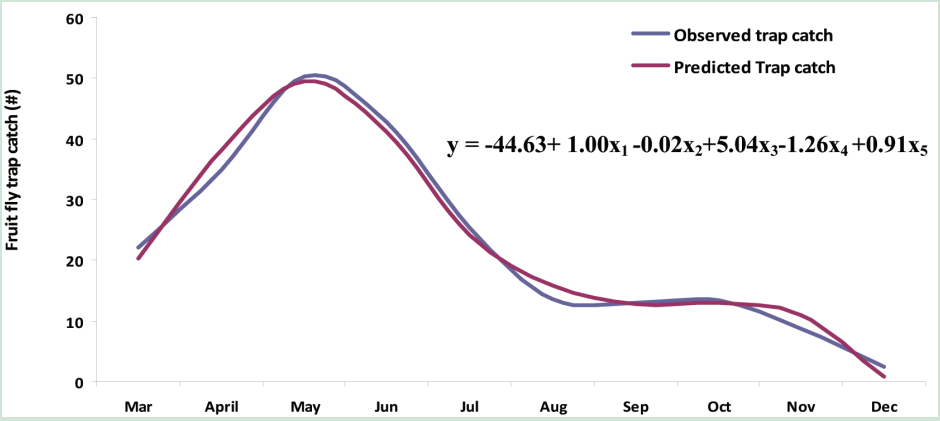


Fig. 5: Prediction of fruit fly catch using host plant phenology and weather parameters

The present study provides the basic information on seasonal abundance and host shift pattern of *B. dorsalis* in relation to regional host plant phenology and climate. The fruit fly population levels depends mainly on host fruit availability and prevailing climatic factors. It can be concluded that the fluctuations of *B. dorsalis* population are highly influenced by prevailing ecological conditions and the peak population was observed in the month of March-June coinciding with mango fruiting season. Thereby the efficient management of fruit fly *B.dorsalis* has to be promoted from the month of February onwards to realize maximum benefit of management strategies. The impact of winter season and less availability of hosts after September is the "weak link" when climate resilient IPM should be explored to further mitigate/ eradicate the population to offset a spurt in fruit fly population at the advent of mango season.

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Contributors

Dr. P.D. Kamala Jayanthi, Dr. Abraham Verghese, Mrs. A. Arthikirubha, Dr. V. Sridhar, Dr. R.M. Bhatt

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For further information, contact
Director
INDIAN INSTITUTE OF HORTICULTURAL RESEARCH
Hesaraghatta Lake Post, Bengaluru - 560 089
Phone: 080-28466420-423, 080-28446140-143; Fax: 080-28466291
Email: director@iihr.ernet.in Website: www.iihr.ernet.in