

# SCREENING OF JUJUBE VARIETIES AGAINST *EUPROCTIS FRATERNA* MOORE

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**ABSTRACT:** Jujube, *Ziziphus mauritiana* is one of the most important fruit crops of Pakistan and consumed for its nutritional and medicinal purpose. However, the occurrence of foliage insect pests is the major threat to reduce the quality and quantity of fruits, ultimately causing tremendous economic loss to the growers. The present study is the first comprehensive attempt on the Screening of jujube varieties against *Euproctis fraterna* of Jujube. The mean population density  $100^{-1}$  leaves. Two peaks of *E. fraterna* were noted, first on 15<sup>th</sup> July, then declined and second peak on 15<sup>th</sup> September and the gradually declined on Golden Gola variety. Whereas, the population on White Kherol variety crossed the ETL (2.5 *E. fraterna*  $100^{-1}$  leaves) in the beginning of June and then declined after 15<sup>th</sup> July. The infestation percentage of *E. fraterna* recorded from different jujube orchards viz: Hyderabad, Tando Allahyar, Matiari, T. Muhammad Khan and Mirpur Khas showed the significant variability in the percentage. Significantly higher infestation percentage recorded in Mirpur khas and lower infestation in Matiari. Black Gola, Lootari Gola, Soofi Umran and Golden Gola were found MR, however, White Gola showed the variability in the resistance potential against *E. fraterna* based on the mean infestation.

**KEYWORDS:** Jujube varieties, Screening, Localities, *Euproctis fraterna*

## INTRODUCTION

Jujube is one of the most important fruit crop of Sindh(Pakistan). It is known as the King of arid region fruits, because it can adapt and tolerate the biotic and a biotic stresses prevailing in the rain fed areas [1]. Jujubes are the species of the genus *Ziziphus* belongs to the family Rhamnaceae [2, 3]. *Z. mauritiana* possess great genetic diversity and thought to occur in nearly every continent of the world. It has ability to grow even an excessive drought and is believe to be the dominant component of the natural vegetation of the India and Pakistan deserts; therefore, it is quote as an example of extremely drought-hardy species of the world [4]. Well-drained sandy loam soils are considered as best suited for Jujube cultivation but it can be successfully grown in many type of soils even high alkaline soils [5, 6, 7]. In addition, jujube can also adopt harsh conditions of temperatures as high as 49-50 °C. However, fruit set adversely affected at temperatures above 35 °C [8, 9]. It have been reported that fruit quality can be obtained best under hot, sunny and drought conditions, but a rainy season may support vegetative growth and flowering, ideally providing enough residual moisture of soil to develop the fruit to maturity [10] Sindh province is peculiar in many varieties of Jujube including Golden Gola, White Gola, Black Gola, Lootari Gola, Soofi Umran and White Kherol are cultivated commercially throughout province [11]. However, district Hyderabad, Tando Allahyar, Mirpurkhas, Tando Muhammad Khan and Matiari are the largest commercially jujube producing regions of Sindh province. Jujube is known to attack by 23 different species of insect pest [12] Among all the insect pests Jujube Hairy caterpillar, *Euproctis fraterna* Moore is considered as serious pest of Jujube [12, 13] (Shah *et al.*,1990; Khan, 1994 and [14] Mann and Kansal, 1999). Polyphagous hairy cater pillars are also destructive to Jujube during summer. The caterpillars feed gregariously on the epidermal tissues of the leaves from lower surface and also

feeds on fruits observed that the larvae of Hairy cater pillar damage the jujube plant by scraping the chlorophyll content of leaves, resulting in skeletonization of leaves [15,16]. There is a great need of advanced research to produce reliable planting materials of selected superior germplasm especially with excellent fruit characteristics, adaptation of germplasm to stress conditions, and protecting from insect pests. In addition, there is a need of applied research to adapt available techniques to planting systems for particular agro ecological and climatic zones.

## MATERIALS AND METHODS

Seven different varieties of Jujube viz; Golden Gola, White Gola, Black Gola, Lootari Gola, Soofi Umran, White Kherol and Jangri were selected to screen out the resistant potential against foliage insect pest. All the varieties have been select on the bases of their genetic potential and popularity in the local market.

### Screening methods

Screening for the resistance against most important foliage insect pest of Jujube was evaluated using direct count of infested leaves by various insect pests. Five trees of each variety was tagged and kept under observation. The total number of damaged and healthy leaves out of 100 randomly selected leaves/branches in each tree of all varieties were examined. Calculation of percentage of damage leaves were described by as follows:

Percent Infestation = Number of damaged leaves / Total number of observed leaves\*100

The resistance potential of all varieties against foliage insect pest also confirmed in five different localities including Hyderabad, Tando Allahyar, Tando Muhammad Khan, Mirpur Khas and Matiari. Based on the percent incidence, jujube varieties have classified though infestation scales for Jujube Hairy caterpillar as mentioned in (Table 1).

**Table .1 Scale for the screening for resistance against *Euproctis fraterna* in jujube.**

Scale	Per cent leaf damage	Reaction	Acronym
0	0 %	Highly resistant/Immune	HR
1	1-4%	Resistant	R
3	4.1-7%	Moderately resistant	MR
5	7.1-11%	Susceptible	S
7	>11%	Highly Susceptible	HS

## RESULTS

### Population density of Hairy caterpillar

Diversity of insects observed with Jujube agro-ecosystem analysis (JAESA) at district Hyderabad through different insect scouting methods during 2007 and 2008. During observation it was noticed that *E. fraterna* was attack on all of these varieties. There was also variability in the infestation percentage of different insect pests for White Kherol and Golden Gola varieties (Table.1, Figure.1). However, mean population percentage of insect pests during 2007 and 2008 indicates the highest percentage for Hairy caterpillar in White Kherol, whereas, Golden Gola was severely infested and showed maximum percentage of Hairy caterpillar (Figure.1). The population density of pest observed in the month of March, peaked in June and then gradually declined from July to August. The second peak of all observed insect pests was noticed in the mid of September and then declined from October to December of 2007 and 2008 (Figure .2). It is also important to mention here that jujube growers of Sindh province every year after harvesting the fruits are following the practice of pruning in the month of March to emphasize the new foliage that ultimately increase the production for next season. In this practice, all the foliage of jujube tree is cut and new foliage are grown gradually. It was observed that pruning practice also completely reduced the pest population. The results indicate that in the month of January and February, the population density of pests was negligible that maybe due to the high tannin content in the leaves that makes them harder. With reference to jujube phenology, the population of foliage insect pest started to increase with the growth of primary shoots, which started to grow in the last week of March and lasted in the end of April. The growth of secondary shoots, started from May and lasted in the end of July favored the development of population density. The peak population of various insect pests was observed in the secondary shoots. It was declined gradually with the growth of tertiary leaves and when the leaves became mature, hard in structure compared to the tender leaves. However, the population was fluctuating in the tertiary and mature leaves until the pruning. The population density  $100^{-1}$  leaves of Hairy caterpillar (*Euproctis fraterna*) on White Kherol and Golden Gola was fluctuating during the period of observation. Signification difference was observed for two

varieties, however, no significant difference was observed for both years of observations, 2007 and 2008. The increase in the population of *E. fraterna* was seen from the month of April and which crossed the ETL ( $2.5 E. fraterna 100^{-1}$  leaves) in the beginning of June and then declined in the month of October on Golden Gola variety. Results further indicates that the population showed decline below the ETL only after 15<sup>th</sup> August to 15<sup>th</sup> September, however, in the rest of the months (April to October) it was remained above the ETL. The results regarding the Kherol variety, the ETL was crossed in the beginning of June and then declined after 15<sup>th</sup> July. The highest peak of *E. fraterna* was seen after 15<sup>th</sup> July and then declined. The second peak of *E. fraterna* was noticed after 15<sup>th</sup> September and the gradually declined. The peak population of *E. fraterna* was recorded in the first 15 days of July 2007. During 2008, the boosting time of *E. fraterna* was also same, however, the population density was little lower compared to 2007.

The Infestation percentage of Hairy caterpillar observed during the study period of 2007 and 2008 showed the significant differences for all varieties. The mean infestation percentage of Hairy caterpillar was also significantly varied for all observed varieties, however, no significant difference was observed for two year of observations. The infestation percentage of *E. fraterna* on Black Gola variety was significantly higher in the beginning of July (18.60%) of 2007 and on the 15<sup>th</sup> June (15.60%) of 2008. It reduced in the month of August (4.80 and 2.60%); however, the infestation was increased on 15<sup>th</sup> September (9.40 and 9.00%) of both years, 2007 and 2008, respectively. In the later months it was gradually reduced. Furthermore, from January to March, no infestation of this pest was found on Black Gola variety. The infestation percentage of *E. fraterna* on Golden Gola variety was significantly higher infestation on 15<sup>th</sup> July (26.20 and 26.80%) for both years, 2007 and 2008, however, there was no significant difference was observed for both years. The infestation percentage was reduced in the beginning of August (13.20 and 8.00%) of 2007 and 2008, however, it was increased on 15<sup>th</sup> September (18.40 and 18.80%) of both year, 2007 and 2008, respectively. In the later month, the infestations percentage gradually decreased. Furthermore, from January to March, no infestation of *E. fraterna* was found on Golden Gola variety (Figure 3

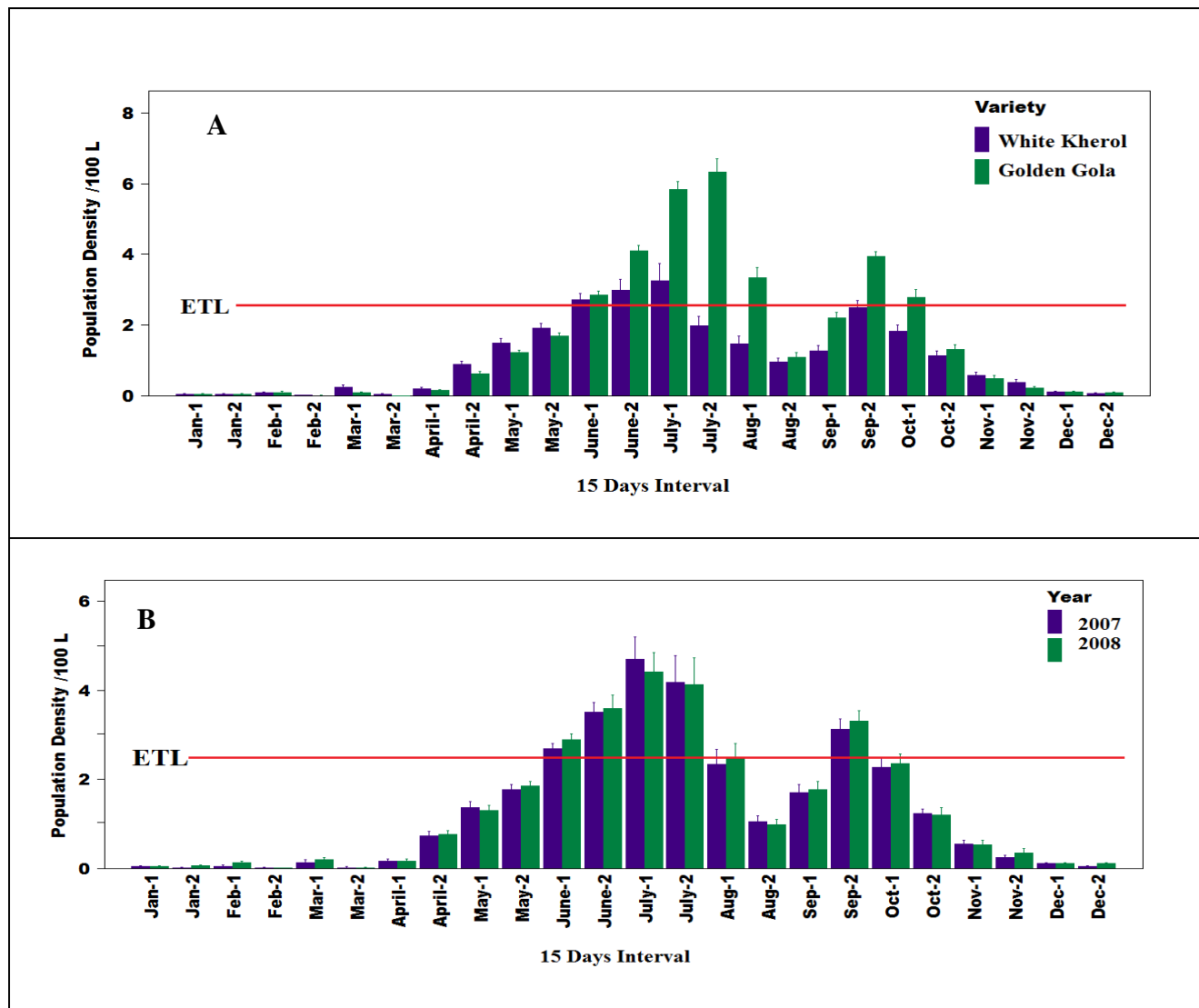


Figure 1: Population density of Hairy caterpillar during 2007 and 2008 in resistant and susceptible varieties of *Ziziphus mauritiana*  
Evaluation of jujube cultivars against Hairy caterpillar (*Euproctis fraterna*)

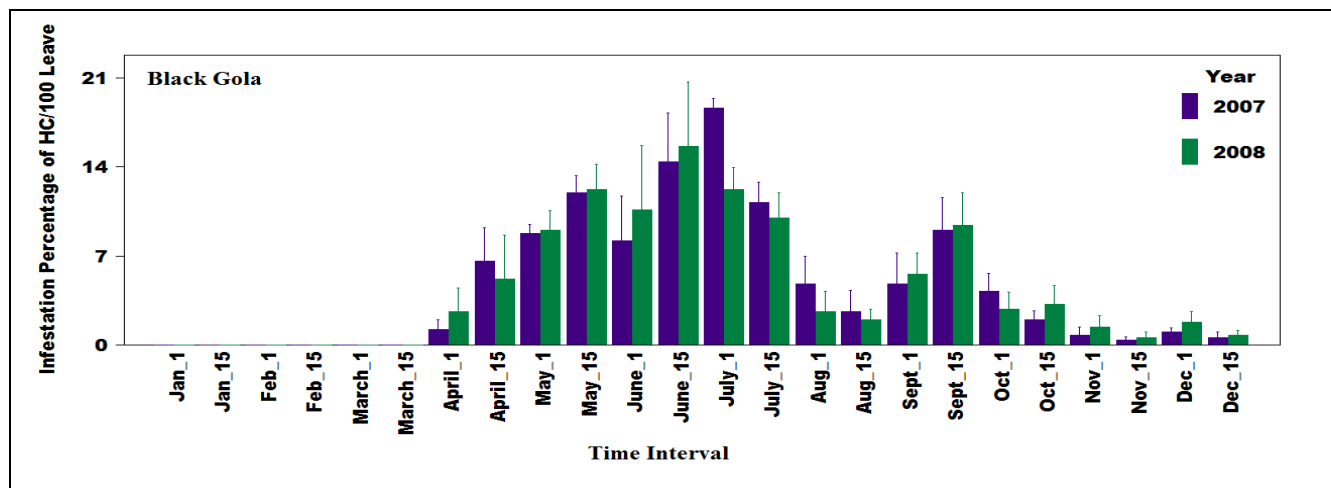


Figure 2: The infestation percentage of Hairy caterpillar (*E. fraterna*) on Black Gola variety evaluated during 2007 and 2008.

The higher infestation (16.00 and 14.00%) of *E. fraterna* on Lotari Gola variety was recorded in the beginning of July, 2007 and 15<sup>th</sup> June, 2008, respectively. The infestation of Hairy caterpillar was reduced to 3.80 and 4.00% on 15<sup>th</sup> August, however, it was increased on 15<sup>th</sup> September (9.00

and 9.40%) for both years, 2007 and 2008, respectively (Figure 4). The infestation percentage of *E. fraterna* on Soofi Umran variety was significantly higher in the whole month of July, 2007 (16.60%) and on 15<sup>th</sup> July, 2008 (15.40%).

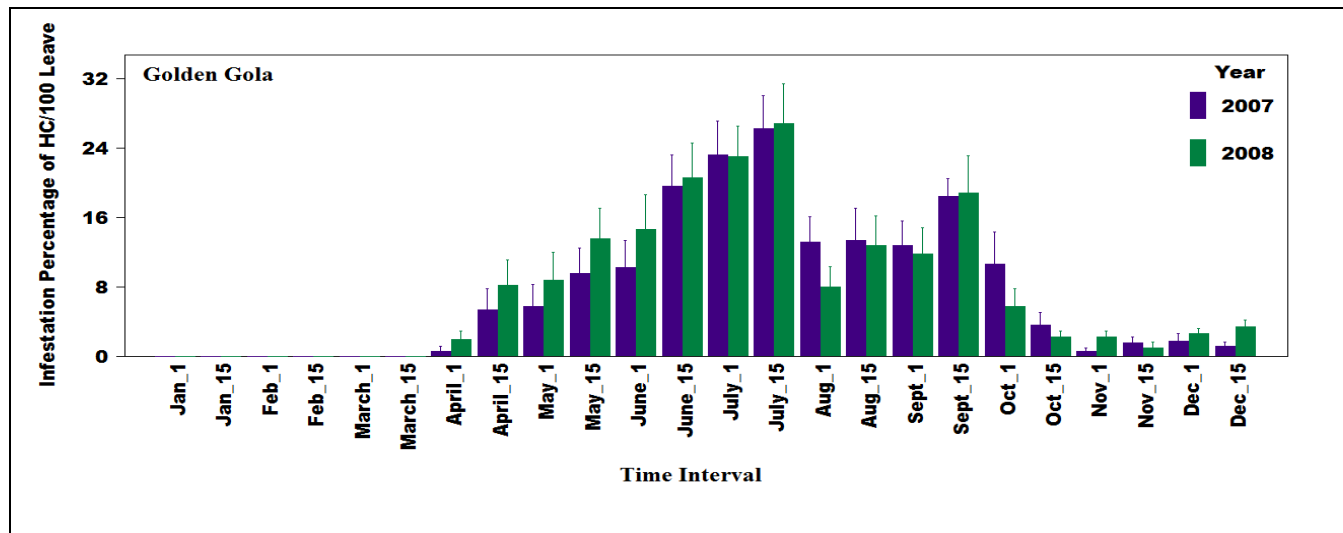


Figure 3. The infestation percentage of Hairy caterpillar (*E. fraterna*) on Golden Gola variety evaluated during 2007 and 2008.

However, no significant difference was observed for both years. The infestation percentage was reduced on August (4.20 and 3.60%) and again increased on 15<sup>th</sup> September (10.00 and 11.60%) of both year, 2007 and 2008, (Appendix-5.1) respectively. In the later months, the infestation percentage gradually decreased. Furthermore, the infestation of Hairy caterpillar in this variety was remained throughout the year except the pruning month, March of both years (Figure 5). The infestation percentage of *E. fraterna* on White Gola variety was higher than the other varieties, however, it was lower than White Kherol and Jangri varieties. Significantly higher infestation was recorded in the beginning of July (31.60 and 38.20%) for both years, 2007 and 2008, respectively; however, there was no significant difference was found for both years. The infestation percentage was reduced on 15<sup>th</sup> August to 5.60 and 6.80% and again increased on 15<sup>th</sup> September (20.20 and 21.20%) of both year, 2007 and 2008, respectively. Gradually it was decreased in the later months, however, from January to March, no infestation of this pest was found on White Gola variety (Figure 6). The results further showed that infestation percentage of *E. fraterna* on White Kherol variety. It was fluctuating round the year, however, comparative to other varieties the infestation percentage was higher (Figure 6). Significantly higher infestation was recorded on 15<sup>th</sup> of July (30.00 and 32.40%) for both years, 2007 and 2008, respectively; however, there was no significant difference was found in both years. The infestation percentage of Hairy caterpillar was reduced to 4.60% on 15<sup>th</sup> August, 2007 and 5.20% in the beginning of August, 2008. In the later month, the infestations percentage was lower. Furthermore, the infestation of Hairy caterpillar in this variety was remained

throughout the year except the pruning month, March of both years. Results regarding the resistance screening against *E. fraterna* for Jangri variety is presented in figure 8. It was fluctuating throughout the year and comparative to other varieties the infestation percentage was higher in the Jangri variety, however, no significant difference was found in Jangri and White Kherol varieties (Figure 6.16). Significantly higher infestation was recorded on 15<sup>th</sup> of July, 2007 (25.20%) and 15<sup>th</sup> June, 2008 (27.60%), respectively; however, no significant difference was found for both years. The infestation percentage of Hairy caterpillar was reduced to 10.2% in the beginning of August, 2007 and 8.20% on 15<sup>th</sup> August, 2008 (Figure 8). In the later months, the infestations percentage was lower. Furthermore, the infestation of Hairy caterpillar on Jangri variety same as White Kherol was remained throughout the year. Overall mean infestation percentage of all varieties observed during 2007 and 2008. Based on overall mean infestation, Black Gola (4.63 and 4.48 %), Lootari Gol (4.55 and 4.61%), Soofi Umran (4.68 and 5.04%) and Golden Gola (7.40 and 7.75%) for 2007 and 2008, respectively, were found MR against *E. fraterna*, however, there was no significant difference in the infestation percentage Black Gola, Lootari Gola and Soofi Umran varieties. The performance of White Gola variety showed the variability in the resistance potential. In 2007, it showed MR, however, in 2008 it performed as susceptible against Hairy caterpillar. The variety White Kherol (8.89 and 9.22%) and Jangri (8.72 and 9.63%) were ranked as susceptible (S) against *E. fraterna* based on the mean infestation of two years, 2007 and 2008, respectively, that was higher than the other varieties, however, no significant difference was noticed between White Kherol and Jangri (Figure 9).

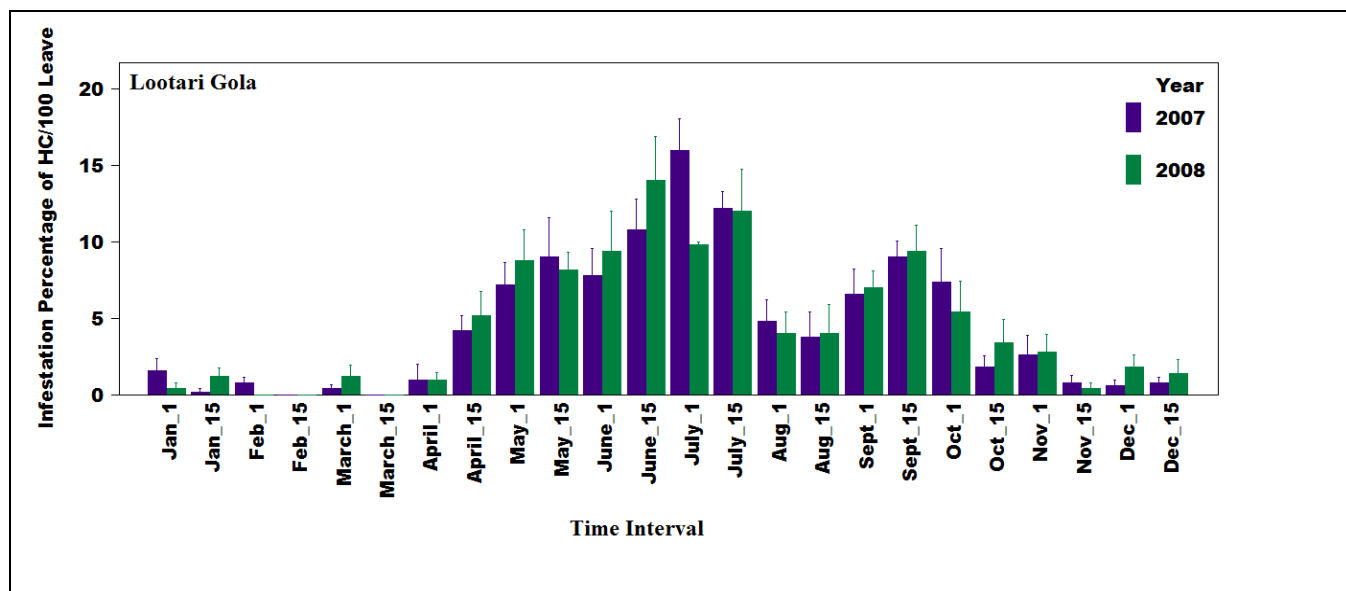


Figure 4. The infestation percentage of Hairy caterpillar (*E. fraterna*) on Lootari Gola variety evaluated during 2007 and 2008.

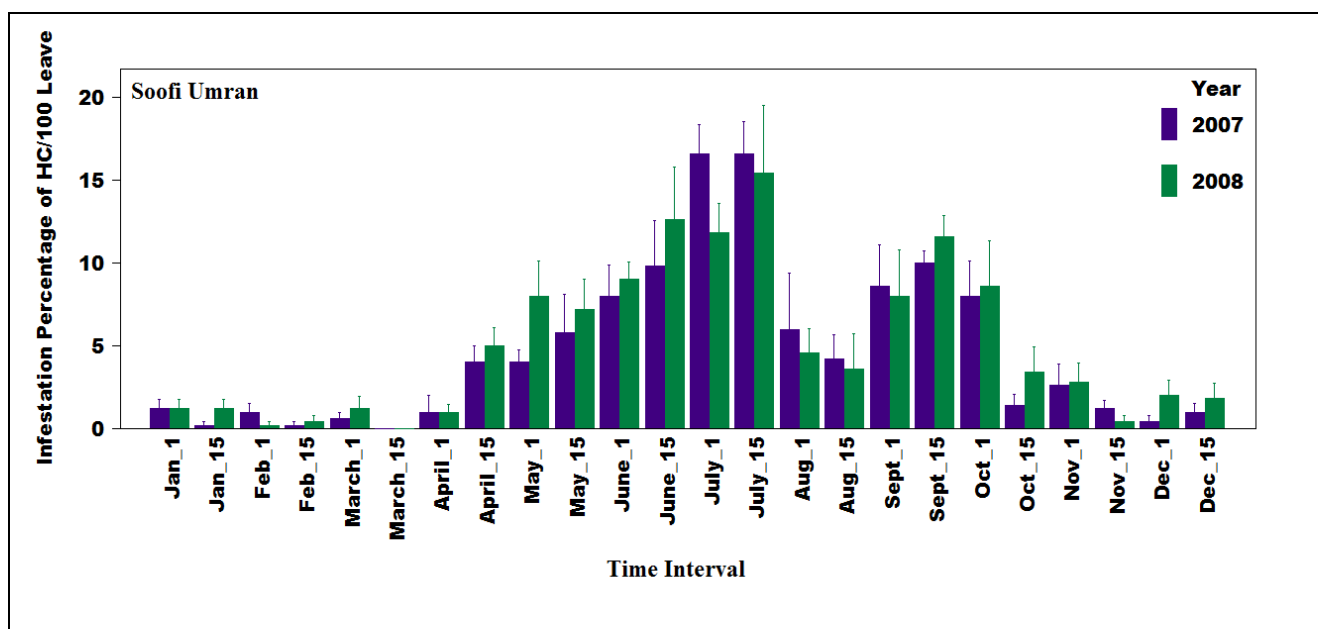


Figure 5. The infestation percentage of Hairy caterpillar (*E. fraterna*) on Soofi Umran variety evaluated during 2007 and 2008.

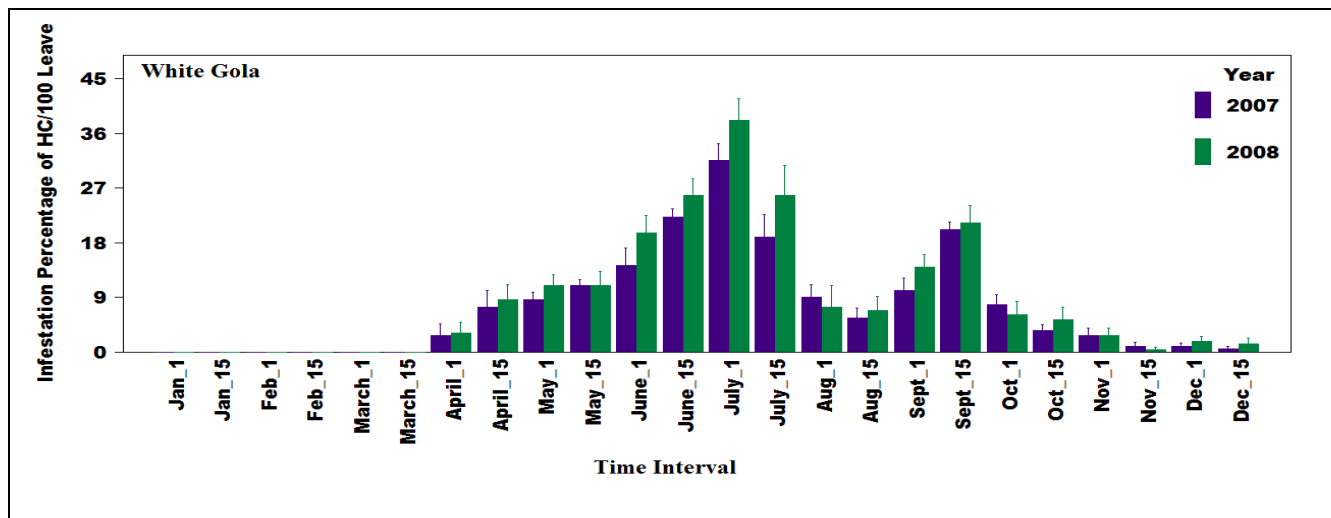


Figure 6. The infestation percentage of Hairy caterpillar (*E. fraterna*) on White Gola variety evaluated during 2007 and 2008.

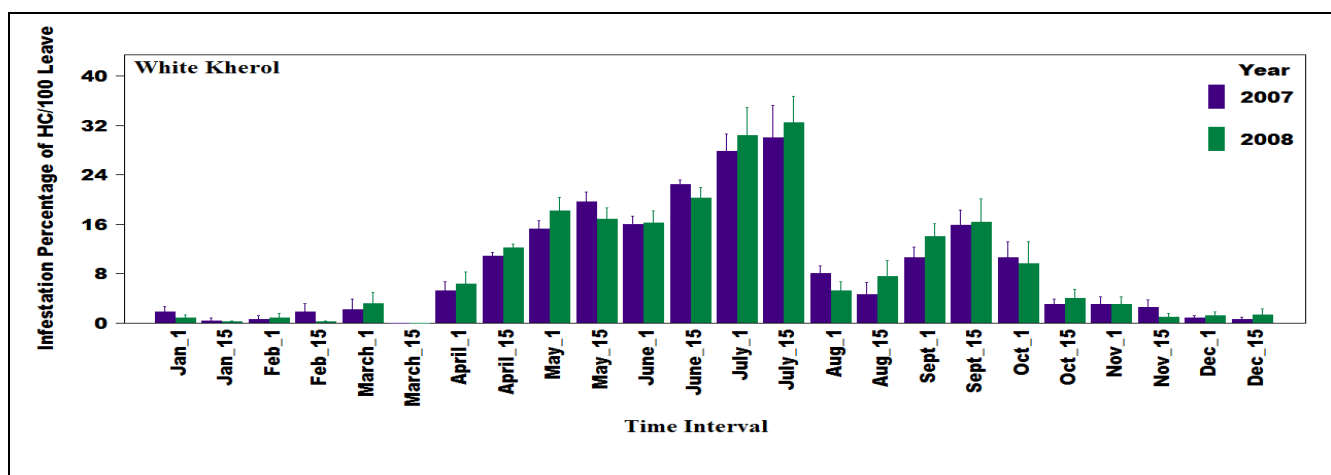


Figure 7. The infestation percentage of Hairy caterpillar (*E. fraterna*) on White Kherol variety evaluated during 2007 and 2008.

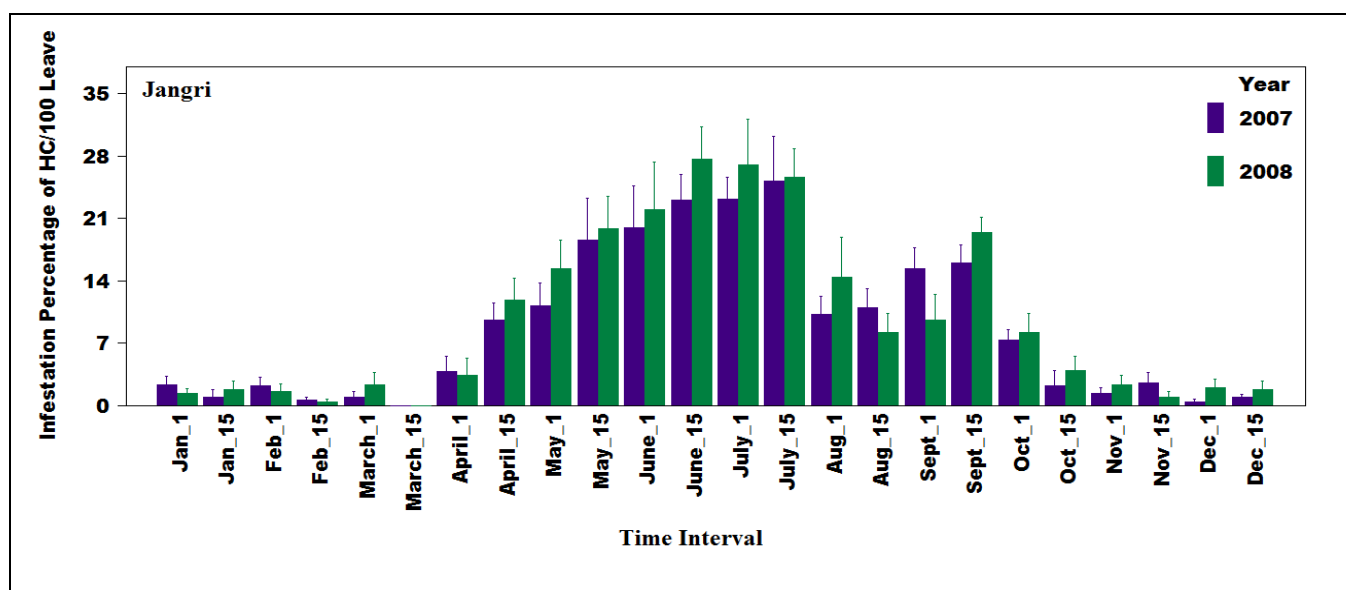


Figure 8. The infestation percentage of Hairy caterpillar (*E. fraterna*) on Jangri variety

evaluated during 2007 and 2008.

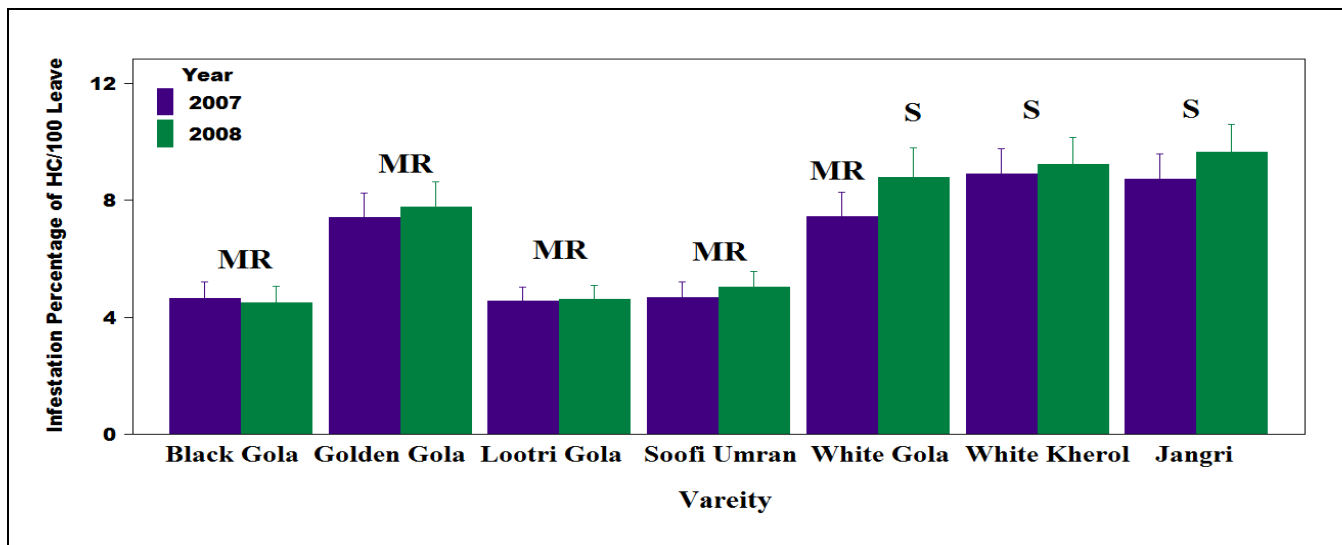


Figure 9. Mean infestation percentage of Hairy caterpillar (*E. fraterna*) for all jujube varieties evaluated during 2007 and 2008.

## DISCUSSION

Jujube, *Ziziphus mauritiana* is one of the most important fruit, consumed worldwide for its nutritional and medicinal purpose [17, 18] (Kaseem *et al.*, 2011; Padmanabhan *et al.*, 1993). Beside its economic value, several biotic and abiotic factors are influencing on the production and quality. Currently in the jujube ecosystem, occurrence of insect pest is the major threat to reduce the quality and quantity of fruits, ultimately causing tremendous economic loss to the growers. It also reported that some time these insect pests may reduce upto the 100 percentage of crop yield. However, the literature available on *Z. mauritiana* especially in Pakistan indicates very negligible work has reported over this important fruit tree, especially on plant protection side for these injurious insect pests. There are only two reports available in the literature for the insect pests of jujube in Pakistan. In the first it is mentioned that about 23 different species of insect pests, however, out of these 13 species attack on the foliage right from sprouting to fruit harvest of jujube tree (Khan, 1994). In the second report, the infestation of fruit fly and lower infestation of caterpillars, weevils, beetles, and mite on jujube tree was reported by Sarwar (2006). However, no any further details are reported in this study that can be used as indicators for insect pest management. The current study is the first comprehensive study on the screening of Jujube varieties against Hairy caterpillar, which is the main threats for this most important fruit tree. In addition, documentation of foliage insect pests and natural enemies, and integrated approaches for the foliage insect pests management are also highlighted here. The results so far achieved on different objective of current study are discussed here with reported lines. In Pakistan, jujube is attacked by 23 species of insect pests out of these 13 species attack on the foliage right from sprouting to fruit harvest (Khan, 1994). In another study, [19] Sarwar (2006) reported some species of insect pests (fruit fly, caterpillars, weevils, beetles, and mite) of jujube trees causing considerable damage. The other research results also revealed that number of foliage insect species are found on jujube such as *Euproctis fraternal*, *Synclera univocalis* [20, 21,22] (Singh

and Mann, 1982; Wang, *et al.*, 2002; Mann, 1981), [23,24,25] (Bhatnagar and Lakra, 1992 Verma *et al.*, 1972, Bhatnagar and Lakra, 1992), [23] Shah *et al.* (1990) recorded *Euproctis lunata*, *E. fraterna*, *Tarucus indica*, *Castalius rosimon*, *Oacassida pudibunda*, *O. cruenta*, *Xanthochlelus faiinus*, *Mylocerus undecimpistulatus*, *Crinorrhinos crassirostris*, and *Perissopneumon tamarindus* for the first time as pests of *Z. mauritania* in Gujarat, India. [24] Jothi and Tandon (1993) reported that in jujube orchard, *Apis florea* was the most common insect visitor. Other major pollinators were *Stomorphina discolor*, *Chrysomya megacephala*, *Eristalinus arvom* and *Camponotus compressus*. Among the foliage insect pests of Jujube Hairy caterpillar is considered as serious pest (Bhatnagar and Lakra, 1992; Man and Kansal, 1999). [25] Lei and Zang (2000) reported seven main pests of Indian jujube such as *Synclera univocalis*, *Adoretus spp*, *Panonychus citri*, *Inderbela tetraonis*, *Amrasca devastans*, *Taucus theophrastus*, and *Porthesia Taiwan*, *Euproctis fraterna*. In the current study, we also identified 13 different insect pests. Similar to above mentioned reports, *Ancylis sativa*, *Euproctis fraterna* and *Adoretus pallens* were identified as major foliage insect pest of jujube in Pakistan. Similarly, hairy caterpillar is widely distributed in India and Pakistan [26] (Singh and Grewal, 1981). This is polyphagous in nature and is reported as destructive pest to Jujube especially during summer season (Kavitha and Savithri, 2001). In the current study, Hairy caterpillar (*Euproctis fraterna*) was major and important insect pest infesting on both, White Kherol and Golden Gola. Two peaks of *E. fraterna* were noted, first after 15<sup>th</sup> July, then declined and second peak after 15<sup>th</sup> September and the gradually declined. The population of *E. fraterna* crossed the ETL (2.5 *E. fraterna* 100<sup>-1</sup> leaves) in the beginning of June and then declined in the month of October, however, in Kherol variety, population crossed the ETL in the beginning of June and then declined after 15<sup>th</sup> July. This variability maybe due to the varietal response as well as due to the influence of abiotic factors on the insect pest population. Sarwar (2006) reported different insect pests fauna on some jujube trees causing considerable damage to matured plants. Their findings



showed highest infestation of fruit fly, however, amongst other beetles and Hairy caterpillar were also recorded.

## CONCLUSIONS

Current study is the first comprehensive research on the **Screening of jujube varieties against *Euproctis fraterna* moore**, which is threat for this promising fruit of Pakistan.

Two peaks of *E. fraterna* were noted, on 15<sup>th</sup> July, then declined and second peak on 15<sup>th</sup> September and the gradually declined. The infestation percentage of Hairy caterpillar was significantly higher at Mirpur Khas followed by Tando Muhammad Khan compared to Hyderabad, Tando Allahyar and Matiari districts. The cultivar screening for the resistance against *A. sativa*, *E. fraterna* and *A. pallens* that Jangri variety was found high resistant (HR) against Jujube leaf roller. White Kherol, Black Gola, Soofi Umran and Lootari Gola was ranked as resistant (R), whereas, Black Gola, Lootari Gola, Soofi Umran and Golden Gola were found (MR) against *E. fraterna*, however, White Gola variety showed the variability in the resistance potential. The variety White Kherol and Jangri were ranked as susceptible (S). Golden Gola and Lotari Gola has been ranked as susceptible, whereas, Black Gola and Soofi Umran were ranked as MR, respectively.

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