

BIBLIOGRAPHY

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ABSTRACT

The study was conducted at Mites Predatory Rearing House and Balili Experimental Area, Benguet State University from September 2011 to March 2012 to identify the fruit fly species attacking the Cape gooseberry, to determine the duration and morphological characteristics of the different growth stages of *Bactroceraspecies* attacking Cape gooseberry and observe its behavior in terms of areas in larval feeding, mating, oviposition and fecundity.

The fruit fly species attacking Cape gooseberry was identified as *BactroceradorsalisHendel*.

The duration of the different growth stages of *B. dorsalis* on Cape gooseberry are as follows; egg: 3.2 ± 1.03 days, 1st instar larva: 3 ± 0 days, 2nd instar larva: 3 ± 0 days, 3rd instar larva: 3.4 ± 0.52 days, pupa: 19.3 ± 0.48 days. Longevity of the adult female was 42.5 ± 3.54 days and 35.5 ± 2.12 days for the male. Life span of female was 74 ± 1.41 days and 64 ± 9.89 days for the male.

The eggs are white and elongated. The length of the egg was 0.8-1.1 and a width of 0.1mm. The 1st instar larvae was transparent turned to yellowish color when the larva reaches the third instar of larval stage. The body length measures from 0.8- 2.8 mm and a width of 0.1 to 0.7 mm. The 2nd instar body length measures from 2.3- 9.1 mm in length and a width of 0.7-1.5 mm. The 3rd instar body length measures from 7.1- 9.9 mm and a width of 1.5 mm. The pupa was



yellowish in color when newly pupated but turned to brownish after a minute then turned to dark brown when the adult was nearly to emerge from the puparium. It measures from 4.0-5.5 mm in length and a width of 1.5- 2.3 mm. The thorax of newly emerged adult was light brown in color and with yellow stripes that becomes darker after a few hours. The female adult has long, slender and pointed ovipositor. The body length of the female measures from 6.3- 7.9 mm and a width of 1.9- 2.3 mm while the male had a body length of 5.5-6.3 mm and a width of 1.5-1.9 mm.

The newly hatched larvae bore the fruit and start to feed just upon hatching up to the last instar larvae. The female adult that was provided with food lived for about 40- 45 days while the male lived for 34- 37 days. The male and female that was not provided with food just lived for 3- 5 days.

Copulation took place 3-11 days after emergence. Mating was from 10:30 in the morning and 1:00 in the afternoon as when the temperature is about 27-28 °C. Mating duration is about 15-50 seconds.

The female laid eggs daily, one to two days after mating. The eggs laid everyday by the female *B.dorsalis* ranged from 2 to 10 in number with a total of 162 with a mean of 81 ± 2 eggs.



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INTRODUCTION

Cape gooseberry (*Physalis peruviana* Linnaeus) grows as a branching annual or perennial plant which sometimes called golden berry. It is related to the tomato and can be grown in similar soils and climate to the tomato but requires a longer frost-free season to mature its fruit. The plant may be raised from seeds or from cuttings. The golden-orange fruit is contained in a husk. Fruit size is variable which measure about 1- 2 in diameter. Apart from being edible, the fruit are used in pies, ice cream, salads and cocktail (Jackson and Looney, 1999).

Yield of Cape gooseberry in La Trinidad, Benguet is good. The conditions present in locality are favorable to the plant. These circumstances enable the plant to provide optimum yield to maximum yield. With its growing potential in the market, it is seen to provide more profit to the farmers (Ligat, 2011) as cited by (Eladjoe, 2011).

In La Trinidad, Benguet, many injurious arthropods are associated with the Cape gooseberry plant. Due to the fact that Cape gooseberry belongs to the Solanaceae family, it harbored pests of its distant relatives like the tomatoes and potatoes. Eladjoe in 2011 also reported the presence of fruit fly on Cape gooseberry plants including white flies, thrips, fruit worm larvae and chrysomelid beetles.

Fruit flies belong to the insect family Tephritidae in the Order Diptera. They are serious pest of fruit and vegetables throughout the world. The female fruit flies have mainly the habit of laying eggs by inserting its ovipositor into the fruit tissue beneath the skin where the larvae consequently develop. When the eggs hatch and develop to the larval stage, the larval feeding cause considerable damage to the fruit tissue. The larval damage becomes even more serious with secondary infestation by other organism such as



Drosophila spp., fungi and bacteria. If the infested fruits are still immature, they will drop before ripening, and if the infested fruits are ripe, they will drop before harvesting (Cowley, 1990).

Study on the life cycle of fruit fly on Cape gooseberry has not been fully established in Benguet. Cape gooseberry is one of the host plant of fruit fly and other insects wherein they attack the plant particularly during the fruiting stage. Because of the insect's infestation, yield of Cape gooseberry may be reduced. The information gathered on its development or life processes give information on proper management of fruit fly in order to obtain maximum yield of Cape gooseberry.

The study was conducted to identify the fruit fly species attacking the Cape gooseberry, to determine the duration and morphological characteristics of the different growth stages of *Bactrocera* species attacking Cape gooseberry and to observe its behavior in terms of areas in larval feeding, mating, oviposition and fecundity.

The study was conducted at Mites Predatory Rearing House and Balili Experimental Area, Benguet State University from September 2011 to March 2012.



REVIEW OF LITERATURE

Characteristics of Cape Gooseberry

In 1991, Verheij and Coronel stated that in Australia, Cape gooseberry is cultivated such as Golden nugget and New Sugar Giant. Both varieties belong to large-fruited types with bland taste. But, here in the Philippines, Cape gooseberry is being grown and it is locally known as “lobo- lobohan”. It is widely distributed in the Cordillera Administration Region (CAR) particularly in the Benguet province (Philippine Medicinal Plants, 2010).

Cape gooseberry is a soft-wooded perennial plant usually reaching 2 to 3 ft in height. Under good conditions, it can reach 6 ft but it will need support. The spreading branches are purplish and covered with fine hairs. The heart-shaped nearly opposite leaves are 2 ½ to 6 inches long. They are slightly velvety when compared with the narrower and smoother leaves of tomatillo. Bell shaped and nodding flowers form in the leaf axils. They are yellow in color with dark purple- brown spots in the throat, and cupped by a purplish- green and hairy calyx. The fruit is a berry with smooth, waxy, orange- yellow skin and juicy pulp containing numerous very small yellowish seeds (Morton, 1987).

Berendes in 2011 stated that Cape gooseberry is a deciduous shrub. It is relatively known plant under the family Solanaceae. Among its relatives which are being grown are the eggplants and tomatoes.



Uses of Cape Gooseberry

Cape gooseberry has many uses. The fruit is eaten fresh or mixed whole or sliced in fruit salads and fruit cocktails. The fruit is generally stewed and used in making puddings, chutneys and ice creams. It may also be canned or processed into jams and jellies. Cape gooseberry was also used as ornamentals and as an ingredient in making perfumes. In addition, the fruits are stewed with honey and eaten as dessert. The British use the husk as a handle for dipping the fruit icing (Mc Cain, 1993).

In Colombia, the leaves of Cape gooseberry are boiled into a decoction which is believed to be diuretic and anti asthmatic while in South Africa, the leaves are heated and applied as poultices on inflammations. The fruit as a part of daily diet helps in maintaining vision, immune system, lowers the risk of cancers, malaria, asthma and dermatitis (Heiser, 1969).

Insect pest of Cape gooseberry

In 1987, Morton stated that in South Africa, insect pest that attack the Cape gooseberry are cutworms, red spider, potato tuber moth, flea beetle and whiteflies, stem borer, leaf borer and fruit worm. Solanaceous treehopper, thrips, and various beetles also affect the Cape gooseberry plant.

In La Trinidad, many injurious insects including arthropods are associated with the Cape gooseberry plant. These are the chewing insects such as elm leaf beetle, chrysomelid beetle, earwigs, fruit worm larvae, fruit fly larvae, and leaf miner. The piercing-sucking insects were aphids, white fly, thrips, leaf hopper, leaf footed bug and broad mite. The identified chewing and piercing- sucking insects and arthropods were categorized as minor pest of Cape gooseberry (Eladjoe, 2011).



Biology of Fruit Fly

There are four stages in the life cycle of fruit fly: egg, larva, pupa and adult.

Egg. Eggs laid by the female are white, elongated, and slightly curved deposited in small batches (Mariau, 1999). Eggs measure from 0.9 to 1.0mm in length with a mean of 1.06 and a width that measure about two to four days to hatch (Dagdag, 2008).

Larva. In 2008, Dagdag observed that the newly hatch larva is transparent white in color and it will become yellowish when older. It is elongated and cylindrical with white anterior mouth hooks. Upon hatching, the new larva bores a tunnel inside its host, the tunneling process was done by waving its mouthparts towards the tissue of their host plants. The 2nd and 3rd instars larvae were seen to be the most active feeders.

Pupa. Pupation is normally occurs 1-2 inches and about nine days are required for attainment of sexual maturity after the adult fly emerge (Dekker and Messing, n.d). The puparium is yellowish- brown. The pupa had its delicate integument covered within the puparium. The newly pupated larvae measures about 4.4 to 5.2 mm in length and with a mean ranges from 1.9 to 2.2mm in width. The adult will emerge from the pupa within 15 to 17 days (Dagdag, 2008).

Adult. The newly emerge adult had its abdomen flattened with a light color and a balance mixture of dark brown to black and yellow that becomes darker after a few hours. Adult *B.dorsalis* are transparent that had a wing span about 12.8 to 15.2 mm for female and 12.0 to 15.1mm for the male. The female ovipositor is pointed and very slender. The male measures about 6.0 to 7.1 mm in length and a width that ranges from 1.8 to 2.4 mm. The female measures about 7.4 to 8.9 mm in length and 2.2 to 2.8 mm in width. The male



has shorter life span with 37 to 54 days but the female takes about 39 to 61 days to live (Dagdag, 2008).

Damage of Fruit Fly

Steiner (1957) stated that larval feeding in fruits is the most damaging. Damage usually consists of breakdown tissue and internal rotting associated with maggot infestation, but this varies with the type of fruit attacked. Infested young fruit become distorted, callused and usually drop. Mature attacked fruits develop a water soaked appearance. The larval tunnels provide entry points for bacteria and fungi that cause the fruit to rot.

Fruit fly maggots develop in the pulp of the fruit devouring it and favoring the development of bacterial and fungus. The egg punctures made by the adults may affect shipping qualities of the fruit (Metcalf and Flint, 1962).

In 2011, Eladjoe observed that a fruit fly larva is one of the pests infesting Cape gooseberry particularly on fruit. The fruit fly larvae with chewing mouthparts eat the fruit from inside out which causes it to rot.

Cultural Control of Fruit flies

Metcalf and Flint in 1962 stated that traps baited with sweetened bran, fruit juices or terpinyl acetate is extensively used to catch adults in Mediterranean fruit fly. Also, fallen fruit should be collected and buried to a depth of several feet or burned or cooked to destroy larvae. Fruit bagging, protein bait spraying, destruction of fallen and over ripe fruits and early mature green fruits will control the species of *B.philippinensis* (Alwood *et al.*, 1999). While cleaning up of fallen, rotting papayas effectively reduced populations of



Oriental fruit fly. Field sanitation also has been recommended as an integral component of a pest program (Reihcigl, 2000).

In 2007, Prasad stated that tillage is useful in controlling the dormant stages of pest either by burying them deep in the soil so that they are unable to emerge out or brought to the soil surface for exposing them to inclement. Fruit fly of guava, pear, and peach, are controlled by ploughing the soil. In addition, the pre- pupal and pupal populations of *B.dorsalis* occurred in the soil and shallow ploughing with cultivar immediately after harvest is effective in exposing and killing the pupating larva or pupa which mostly present at 4-6 cm depth.

Basingan in 2011 made a study in fermenting different fruits and vegetable as fruit fly attractant. The treatments were ripe citrus, guava, mango, papaya, banana, chayote, bell pepper, and cucumber. It was fermented and was proven that all the treatments were effective in attracting fruit fly.



MATERIALS AND METHODS

Materials

The materials that were used for the biology study of fruit fly were Cape gooseberry fruit, microwave plastic containers, insect cages, binocular microscope, camel hair brush and honey. The materials used for the establishment of Cape gooseberry plants were seedlings of Cape gooseberry, small pricking pots, plastic watering can, holing device, chicken manure, and fertilizers.

Methods

Preparation of Planting Materials. The seedlings of Cape gooseberry were planted first into small pots with a diameter of 15-20 cm for 6-8 weeks. The seedlings were allowed to established and was maintained in a cool dry place for at least one month to provide suitable conditions for the development of the seedlings. Meanwhile, an area of 500 sq. meters of untilled plots where the matured seedlings were transplanted was dig at the center of the plot using a holing device and was assured to have a one meter distance from one hole to another by using tape measure. Nylon ropes also was used as a guide to align the holes into straight lines and the dug soil was placed just beside the hole for this method employs the organic way of planting wherein minimum tillage is applied.

Planting of the Seedlings. The matured seedlings were transplanted in plots measuring 1m by 10 m. The distance of one seedling from one another was 1 meter in between holes and 2 meter between hills or just every other plot. The plant was provided with 200 g of compost (firmed) and it was watered after transplanting. It was fertilized with fermented chicken manure two months from transplanting.



Collection and Identification of Fruit fly. Matured or ripe fruit was collected from the fields of some Cape gooseberry growers. This was brought at Mites Predatory Rearing House for examination under the binocular microscope to check the presence of fruit fly eggs and larvae. The fruits infested with fruit fly were separated and the eggs or larva was reared and serves as test insect for the biology study as well as for species identification.

Maintenance of the Stock. The infested fruit of Cape gooseberry that was gathered in the field was placed on insect cages. The larvae were allowed to mature as adults. A paired of adult male and female were reared on a separate insect cage where Cape gooseberry fruit or honey was provided as supplemental source of food. The paired male and female were allowed to mate and reproduce which serve as a source of test insect for the study of its biology.

Source and Introduction of the Host. Matured Cape gooseberry fruits were collected from the field (Figure 1) and were brought to the laboratory and were check to insure that it was not infested with fruit fly. The fruit was introduced in insect cages which serve as oviposition sites for the female adult and as the source of food for the larvae.

Biology Study. The Cape gooseberry fruit that was oviposited by the female was taken from the rearing cages (Figure 2). The eggs laid on the fruit were counted and was recorded. Using camel brush, the newly hatched larvae were transferred in microwave plastic containers with Cape gooseberry fruit (Figure 3) that was serve as their source of food. The developmental stages of the larvae were determined by the increase of body size and exuvia of mouthparts. The duration of the pupa was noted when the larva pupated



until the adult emerges from its puparium. The number of male and female fruit fly emerged per batch of eggs laid in one fruit was recorded. Alive and preserved specimens of the different stages of *B.dorsalis* were used in determining their morphological descriptions using foot rule.

Observations on the longevity of adults were recorded by the time of its emergence from the puparium until the death of the insect. This was done by separating specimens and providing food and without food.

The behavior of *B.dorsalis* in terms of larval feeding was observed during its larval development while the mating and oviposition behavior was observed during adult stage.



Figure 1. The Cape gooseberry fruit collected from the field



Figure 2. The insect cage used for biology study





Figure 3. The Cape gooseberry fruit placed individually on microwave plastic containers

Fecundity Study. The reproductive capacity of females was determined by placing one pair of adult female and male in a cage. The number of eggs laid by the female was counted and recorded until the insect ceased on laying eggs. Eggs were collected and counted daily and it was set aside for rearing.

Data Gathered were:

1. Duration and morphological characteristics of the different developmental stage of *B.dorsalis*.

- a. Egg. Incubation period, color, size (length and width) were recorded.
- b. Larva. Duration of the development, color, size (length and width) were recorded.
- c. Pupa. Duration of development, color, size (length and width) were recorded.
- d. Adult. Longevity, morphological characteristics, wingspan, size (length and width) were recorded.



2. Behavioral Studies

- a. Feeding Behavior. This was the manner of feeding by the larvae.
- b. Mating Behavior. This was the frequency and time of mating of the insect.
- c. Oviposition Behavior. This was the manner and site of oviposition.
- d. Fecundity. This was the total number of eggs laid by the female.



RESULTS AND DISCUSSION

Fruit fly Species Attacking Cape gooseberry

The fruit fly species attacking the Cape gooseberry fruit was the *Bactrocera dorsalis* Hendel.

Duration and Morphological Characteristics of the Developmental Stages of *B.dorsalis*

The duration of each developmental stage of *B. dorsalis* are shown in Table 1.

Egg. The incubation period of the egg ranges from 2-4 days with a mean of 3.2 ± 1.03 days. Eggs laid by the female (Figure 4) are white in color and elongated which collaborates to the statement of Mariau in 1999 that eggs laid by the female are white, elongated, and slightly curved deposited in small batches. The eggs were laid in clusters in horizontal manner. Its measurement ranges from 0.8 to 1.1 mm in length and a width of 0.1 mm.

Larvae. The newly hatched larvae (Figure 5) developed in 3 days with a mean of 3 ± 0 days. The larvae were transparent but it was changed into a yellowish color when the larva reaches the third instar of larval stage. The body length of the 1st instar larva measures from 0.8- 2.8 mm and a width of 0.1 to 0.7 mm.

The second instar larvae developed in 3 days with a mean of 3 ± 0 (Figure 6). The body length measures from 2.3- 9.1 mm in length and a width of 0.7-1.5 mm. On this larval stage, the larvae were become voracious on feeding.

The third instar larvae developed from 3-4 days with a mean of 3.4 ± 0.52 days (Figure 7). The larvae were yellowish in color and keeps on jumping when they come out from the fruit which indicates that they were finding a suitable place to pupate. The body



Table 1. Duration (Days) of the different developmental stages of *B. dorsalis*

DEVELOPMENTAL STAGES	DURATION (Days)	
	Range	Mean
Egg	2-4	3.2± 1.03
Larvae		
1 st instar	3	3± 0
2 nd instar	3	3 ± 0
3 rd instar	3-4	3.4 ± 0.52
Pupa	19-20	19.5 ± 0.5
Adult		
Female	40-45	42.5± 2.5
Pre- reproductive period	5-12	8.5± 3.5
Reproductive period	22-25	23.5 ± 3.54
Post- reproductive period	8-13	10.5± 2.5
Male	34- 37	35.5 ± 2.12
Total life span		
Female	71-77	72.5 ± 2.12
Male	57- 71	64 ± 9.89



Figure 4. The newly laid eggs (4x)

Figure 5. The newly hatched larvae (1st instar) (4x)



Figure 6. The 2nd instar larva (4x)



Figure 7. The 3rd instar larva (4x)

length of the 3rd instar larvae measures from 7.1- 9.9 mm and a width of 1.5 mm. Their body was soft and flexible. Before the larvae accomplish their jumps, the anterior and posterior part of larvae meet together wherein the mouth hooks grabbed the end of the body tensing the muscles then quickly released the mouth hooks from the rears of their body that results to jumping. Development and increased of body size of the larvae depends on the amount of food they intake.

Pupa. The pupa developed from 19- 20 days with a mean 9.5 ± 0.5 days. When newly pupated, the pupa was yellowish in color (Figure 8) but turned to brownish after a minute then turned to dark brown when the adult was nearly to emerge from the puparium (Figure 9). It measures from 4.0-5.5 mm in length and a width of 1.5- 2.3 mm.

Adult. The ratio of female versus male that emerged from batch of pupa is 4:3. Adult has short and aristate antennae. The thorax of newly emerge adult was light brown in color and with yellow stripes that becomes darker after a few hour. The abdomen (ventral) of the adult had a combination of dark and brown marking while the abdomen (dorsal) was brown in color with two horizontal black stripes and vertical stripe.



The marking on the abdomen of the adult formed a T-shaped pattern. Wings of fruitfly was transparent and folded at the back when newly emerge.

Adult (Female).The longevity of the female adult ranged from 40-45 days with a mean of 42.5 ± 2.5 days. The pre-reproductive period of the female ranged from 5-12 days with a mean of 8.5 ± 3.5 days. The reproductive period was 22-25 days with a mean of 23.5 ± 3.54 days and the post reproductive was 8-13 days with a mean of 10.5 ± 2.5 days. The total life span of the female ranged from 71-77 days with a mean of 72.5 ± 2.12 days. The female adult has long, slender and pointed ovipositor (Figure 10-11). The body length of the female measures from 6.3- 7.9 mm and a width of 1.9- 2.3 mm. The wingspan measures 11.9- 12.7 mm.

Adult (Male). The longevity of the male adult ranged from 34- 37 days with a mean of 35.5 ± 2.12 days. The body length measures from 5.5-6.3 mm in length and a width of 1.5-1.9 mm (Table 2). The wingspan measures from 11.1 to 11.9 mm. The male total life span was 57- 71 days with a mean of 64 ± 9.89 days.

The adult female has longer life span with a total of 71-77 days while the adult male has shorter life span with a total of 57-71 days. The morphological characteristics of the different stages of the *B.dorsalis* from egg to adult collaborate to the biology of the *B.dorsalis* on bell pepper that was studied by Dagdag in 2008.





Figure 8. The pupa (Newly pupated) (4x)

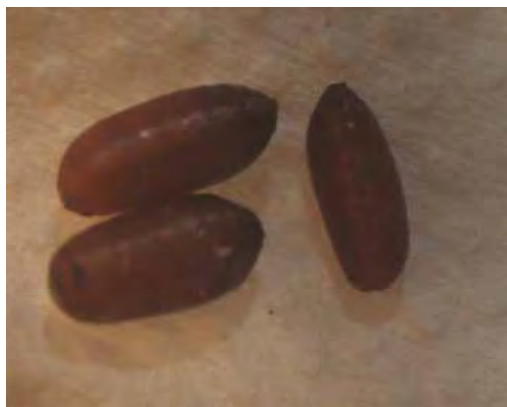


Figure 9. The nearly to emerge pupa (4x)



Figure 10. The adult female Figure 11. The adult female (ventral view)(4x)(dorsal view) (4x)



The adult male Figure 13. Adult male (ventral view) (4x)(dorsal view) (4x)

Figure 12.



Table 2. Range size (mm) of the developmental stages of *B.dorsalis* reared in room temperature

DEVELOPMENTAL STAGES	LENGTH (mm)	WIDTH (mm)
Egg	0.8-1.1	0.1
Larvae		
1 st instar	0.8-2.8	0.1-0.7
2 nd instar	2.3-9.1	0.7-1.5
3 rd instar	7.1-9.9	1.5
Pupa	4.0-5.5	1.5-2.3
Adult		
Male	5.5-6.3	1.5-1.9
Female	6.3-7.9	1.9-2.3

Longevity

The Table 3 shows the longevity of adult female and male *B. dorsalis* with food and without food. The female adult that was provided with food lived for about 40- 45 days while the male lived for 34- 37 days. The male and female that was not provided with food just lived for 3- 5 days. The result implies that cultural management of the Cape gooseberry is necessary to control *B.dorsalis* by way of cleaning up rotten Cape gooseberry fruit wherein *B.dorsalis* develop and live longer.



Table 3. Longevity (Days) of the adult *B. dorsalis* reared in room temperature

ADULTS	WITH FOOD		WITHOUT FOOD	
	RANGE	MEAN	RANGE	MEAN
FEMALE	40- 45	42.5±3.54	3- 5	3.67±1.15
MALE	34- 37	35.5±2.12	3- 5	3.67±1.15

Behavioral Patterns of *B. dorsalis*

Feeding Behavior. The newly hatched larvae bore the fruit and start to feed just upon hatching up to the last instar larva. The larvae bores a tunnel inside its host, the tunneling process was done by waving its mouthparts towards the tissue of the Cape gooseberry fruit. During the second instar larvae, they become voracious in feeding up to the third instars.

Mating Behavior. It was observed that before mating, the male keep on following the female. The male move closer to the female while the wings were spread laterally. Male faces the female and walk back in forth. When the female accept the male, the male approach the female and waves its wings backward and forward then jumps on the female and curls its abdomen and attempt copulation. Copulation took place 3-11 days after emergence from puparium. The mating was observed from 10:30 in the morning and 1:00 in the afternoon as when the temperature is about 27-28 °C. Mating duration is about 15-50 seconds.

Oviposition Behavior. The female laid eggs daily, one to two days after mating. The female was observed on the surface of the fruit while it keeps on searching a site for oviposition. When the female finally found a suitable site on where to lay the eggs, it



brings out its 6 mm long and pointed ovipositor and injected on the fruit and deposits the eggs just after the peelings of fruit. The female were also observed depositing its eggs on the surface or peeling of the fruit. The small pin hole on the surface of the fruit was the sign and site where the female laid its eggs. The site of the oviposition was also recognized through the juice that comes out from the fruit just after the female deposited the eggs.

Fecundity

The Table 4 shows the number of eggs laid by the female *B. dorsalis*. The eggs laid everyday by the female *B. dorsalis* was about 2 to 10 in number with a total of 162 eggs with a mean of 81 ± 2 eggs. The female can deposit 2 to 10 eggs in one Cape gooseberry fruit daily.

Table 4. Number of eggs laid by the female *B. dorsalis*

SAMPLE NO.	TOTAL NO. OF EGGS
183	
279	
Total	162
Mean	81 ± 2



SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at Mites Predatory Rearing House and Balili Experimental Area, Benguet State University from September 2011 to March 2012 to identify the fruit fly species attacking the Cape gooseberry, to determine the duration and morphological characteristics of the different growth stages of *Bactrocera* species attacking Cape gooseberry and to observe its behavior in terms of areas in larval feeding, mating, oviposition and fecundity.

The fruit fly (*B. dorsalis*) underwent four developmental stages namely, egg, larvae, pupa and adult. The incubation of the egg ranges from 2-4 days with a mean of 3.2 ± 1.03 days. The larvae underwent three larval instars. The 1st instar and 2nd instar developed in 3 days while the 3rd instar developed from 3- 4 days. The pupa developed from 19- 20 days. The longevity of the female adult ranged from 40-45 days while the male ranged from 34-37 days. The eggs are white and elongated. The length of the egg measures from 0.8 to 1.1 mm in length and a width of 0.1 mm. The body length of the 1st instar larva measures from 0.8- 2.8 mm and a width of 0.1 to 0.7 mm. The body length of the 2nd instar larva measures from 2.3- 9.1 mm in length and a width of 0.7-1.5 mm. The body length of the 3rd instar larva measures from 7.1- 9.9 mm and a width of 1.5 mm. The body length of the female measures from 6.3- 7.9 mm and a width of 1.9- 2.3 mm.

The newly hatched larvae bore the fruit and start to feed just upon hatching up to the last instar larva. Copulation took place 3- 11 days after emergence at around 10:30 in the morning and 1: 00 in the afternoon. Mating duration is about 15-50 seconds. The female laid eggs daily, one to two days after mating. The eggs laid everyday by the



female *B.dorsalis* was about 2-10 in number with a total of 162 eggs with a mean of 81 ± 2 eggs.

Conclusion

The species of fruit fly attacking Cape gooseberry fruit was *Bactrocera dorsalis* Hendel. The total life span of the female ranged from 71-77 days while 57- 71 days for male. A female lay 2 to 10 eggs in one Cape gooseberry fruit daily.

Recommendation

Further study on the biology of *B. dorsalis* on other host plants is recommended. Since Cape gooseberry belongs to Solanaceae family it harbored the insect pest which is fruit fly from its distant relative like tomato. Harvesting of ripe Cape gooseberry fruit is recommended to deprive the fruit fly with their source of food since Cape gooseberry serves as one of their host.



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APPENDICES

Appendix Table 1. No. of eggs laid daily

Days of laying Eggs		No. of eggs laid	
S ₁	S ₂		
	Day 1		
	Day 2		
	Day 3		
	Day 4		
	Day 5		
	Day 6		
	Day 7		
	Day 8		
	Day 9		
	Day 10		
	Day 11		
	Day 12		
	Day 13		
	Day 14		
	Day 15		
	Day 16		
	Day 17		
	Day 18		
	Day 19		
	Day 20		
	Day 21		
	Day 22		
	Day 23		
	Day 24		
	Day 25		
	Day 26		
	Day 27		
	Day 28		
	Day 29		
	Day 30		
	Day 31		
	Day 32		
	Day 33		
	Day 34		
	Day 35		
	Day 36		
	Day 37		

Appendix table 1 continued...



Day 38	}	Post reproductive period
Day 39		
Day 40		
Day 41		
Day 42		
Day 43		
Day 44		
Day 45		
TOTAL	83	79
MEAN	41.5	39.5



Appendix Table 2. The length and width (mm) of the egg of *B. dorsalis*

SAMPLE	LENGTH	WIDTH
--------	--------	-------



1	1.1	0.1
2	1.1	0.1
3	1.1	0.1
4	0.8	0.1
5	1.1	0.1
6	0.8	0.1
7	0.8	0.1
8	1.1	0.1
9	1.1	0.1
10	1.1	0.1
TOTAL	10.1	1
MEAN	1.0	0.1

Appendix Table 3. The length and width (mm) of the 1st instar larvae of *B.dorsalis* from day 1 to day 3



SAMPLE	LENGTH			WIDTH		
	1	2	3	1	2	3
1	1.1	1.5	2.3	0.1	0.1	0.7
2	0.8	1.5	1.9	0.1	0.1	0.1
3	1.5	1.9	0.1	0.1	0.1	0.7
4	1.1	1.5	3.2	0.1	0.1	0.7
5	1.5	1.9	3.2	0.1	0.1	0.7
6	1.5	1.9	2.8	0.1	0.1	0.7
7	1.5	1.9	2.8	0.1	0.1	0.7
8	1.1	1.5	1.9	0.1	0.1	0.1
9	1.1	1.9	2.8	0.1	0.1	0.7
10	1.5	1.5	2.8	0.1	0.1	0.7
TOTAL	12.7	17	26.8	1	1	5.8
MEAN	1.27	1.7	2.68	1	1	0.58

Appendix Table 4. The length and width (mm) of the 2nd instar larvae of *B.dorsalis* from day 4 to day 6



SAMPLE	LENGTH			WIDTH		
	4	5	6	4	5	6
1	4.0	5.1	7.1	0.7	0.7	1.1
2	4.4	4.7	7.5	0.3	0.7	1.1
3	4.0	4.7	7.1	0.7	0.7	1.1
4	2.3	4.7	8.3	0.7	0.7	0.7
5	4.7	6.3	8.3	0.7	1.1	1.5
6	4.0	6.3	8.7	0.7	1.1	1.1
7	4.0	5.1	8.3	0.7	0.7	1.1
8	4.0	5.5	8.7	0.7	0.7	1.5
9	4.4	5.1	7.1	0.7	0.7	1.1
10	4.4	6.7	9.1	0.7	1.1	1.5
TOTAL	40.5	54.2	80.2	6.6	8.2	12.2
MEAN	4.05	5.42	8.02	0.66	0.82	1.22

Appendix Table 5. The length and width (mm) of the 3rd instar larvae of *B. dorsalis* from day 7 to 8



SAMPLE	LENGTH				WIDTH			
	7	8	9	10	7	8	9	10
1	8.7	9.1	9.5		1.5	1.5	1.5	
2	8.7	9.1	9.5		1.5	1.5	1.5	
3	8.3	8.7	9.5		1.5	1.5	1.5	
4	8.3	9.1	9.1	9.5	1.1	1.5	1.5	1.5
5	8.3	9.5	9.5		1.5	1.5	1.5	
6	8.7	9.5	9.5		1.1	1.1	1.5	
7	8.3	8.7	9.1	9.5	1.1	1.5	1.5	1.5
8	8.7	8.7	9.1	9.5	1.5	1.5	1.5	1.5
9	7.1	8.7	9.5		1.1	1.5	1.5	
10	9.1	7.1	9.5	9.9	1.5	1.1	1.5	1.5
TOTAL	84.2	88.2	93.8	38.4	13.4	14.2	15	6
MEAN	8.42	8.82	3.84	3.84	1.34	1.42	1.5	0.6

Appendix Table 6. The length and width (mm) of the pupa of *B.dorsalis*

SAMPLE	LENGTH	WIDTH
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1		4.7	1.9
2		4.7	1.9
3		4.7	1.9
4		4.7	1.9
5		5.5	2.3
6		4.7	1.9
7		5.5	2.3
8		4.3	1.9
9		4.0	1.5
10		5.1	2.3
TOTAL	47.5	19.8	
MEAN	4.75	1.98	

Appendix Table 7. The length, width and wingspan (mm) of adult male *B.dorsalis*

SAMPLE	LENGTH	WIDTH	WINGSPAN
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1	5.9	1.9	11.9
2	5.9	1.9	11.9
3	5.9	1.9	11.9
4	5.5	1.5	11.1
5	5.9	1.5	11.9
6	5.9	1.5	11.9
7	5.5	1.9	11.1
8	5.5	1.5	11.1
9	5.5	1.9	11.1
10	6.3	1.9	12.7
RANGE	5.5- 6.3	1.5- 1.9	11.1-
TOTAL	57.817.4	116.6	
MEAN	5.781.74	11.66	

Appendix Table 8. The length, width and wingspan (mm) of adult female *B.dorsalis*

SAMPLE	LENGTH	WIDTH	WINGSPAN
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1	7.9	1.9	15.8
2	6.3	1.9	12.7
3	6.7	2.3	13.4
4	7.9	1.9	15.8
5	7.9	2.3	15.8
6	7.1	2.3	14.2
7	7.5	1.9	15.0
8	6.7	1.9	13.4
9	6.7	2.3	13.4
10	7.9	1.9	13.4
RANGE	6.3-7.9	1.9-2.3	12.7-15.8
TOTAL	72.6	20.6	142.9
MEAN	7.6	2.06	14.29

