AGRICULTURAL SCIENCE AND TECHNOLOGY, VOL. 12, No 3, pp 272-276, 2020
Published by Faculty of Agriculture, Trakia University, Bulgaria
ISSN 1313-8820 (print)
ISSN 1314-412X (online)
http://www.agriscitech.eu
DOI: 10.15547/ast.2020.03.043

Study on the biology of groundnut bruchid, *Caryedon serratus* Olivier [Coleoptera: Bruchidae] on stored groundnut in Ganye area, Adamawa State, Nigeria

C.S. Oaya

Department of Crop Science, Adamawa State University, P.M.B. 25, Mubi, Adamawa State, Nigeria

(Manuscript received 4 May 2020; accepted for publication 27 July 2020)

Abstract. *Study on the biology of groundnut bruchid, Caryedon serratus Olivier was carried out in the Laboratory of the Department of Agricultural Technology, Adamawa State College of Agriculture, Ganye, Adamawa State from June to September, 2015. The sex of the bruchid (male and female) was assigned the sub-treatment while the period of development was the main treatment and was replicated three times. The work considered the pre-oviposition stage, incubation stage, larval stage, pupal stage, adult stage and the total life cycle of the bruchid (male and female). The experiment was carried out under Laboratory conditions at 30-35°C temperature and 70-90% relative humidity. After the experiment was established, weekly counting of the total number of eggs laid was carried out at intervals. The results showed that, the mean developmental stages in both female and male bruchids were: 6.50 and 6.00 days; 17.00 and 18.00 days; 13.50 and 13.50 days; 12.00 and 13.50 days; 48.00 and 50.00 days for incubation stage, larval stage, pupal stage, adult stage and total life cycle of the bruchids, respectively. Moreover, the mean pre-oviposition and oviposition stages in female adult bruchid were 1.50 and 5.50 days, respectively.*

Keywords: Caryedon, female, life cycle, male, serratus, stage of development

Introduction

Groundnut (*Arachis hypogeae* Linn) also known as 'peanut', 'earthnut', 'gobbers', 'pinders', 'manilanuts' belongs to the family leguminosae (Fabacea) (Beghnin and Sewadah, 2003; Samaila et al., 2012). Groundnut originated from South America (Brazil) and was introduced in Nigeria by the Portuguese after the 16th century and its production spread to the Northern part of the country (Malgwi et al., 2013). According to them, the crop has become an important cash crop used for export since the colonial era. Its production in Africa has been estimated at 4.6 million metric tons, with Senegal, Nigeria, Gambia, Democratic Republic of Congo (DRC) and Sudan being the major producers in Africa (Ashley, 1993 and International Crop Research Institute for Semi-arid Tropics - ICRISAT, 2015). According to Food and Agriculture Statistics (FAOSTAT, 2014), Nigeria's production of unshelled nut is about 2.6 million metric tons annually from a land area of approximately 2.5 million hectares. Groundnut yield obtained by farmers in Nigeria ranges from 950-1000 kg/ha (FAOSTAT, 2014). Groundnut thrives best on a well-drained sandy-loam soil, this type of soil facilitates easy penetration of pegs and their development, hence their harvesting (Oaya et al., 2013). The crop is an important source of protein, fats, vitamins and dietary oil for most Nigerians. The unusually high nutritional value of the seeds and their pleasant flavour made groundnuts one of the most important food crops in the tropics and sub-tropics (Musa et al., 2009; Oaya and Malgwi, 2014). Shelled groundnuts are fried, roasted and salted which is eaten as snacks and the crop also serves as raw material for some food industries and as feed concentrates for livestock (David and Adamu, 1988; Oaya et al., 2013).

In Nigeria alone, yield loss of groundnut due to *C. serratus* infestation is estimated at 945,000-1,100,000 tons annually, about 45% loss resulting in several billion naira loss to the country (ICRISAT, 2015). Groundnut seeds are destroyed beyond measure by the same *C. serratus* given optimum favourable conditions (Oaya et al., 2012). Insect pest infestation causes loss in dry mass of the kernels, increased levels of free fatty acids in the oil, thereby lowering the quality, and if the seeds are heavily damaged germination potential is reduced (Malgwi and Oaya, 2014).

About 100 insect pests species have been reported to infest stored groundnut and out of these *C. serratus* Olivier [Coleoptera: Bruchidae], *Ephestia cautella* Walker, *Tribolium castaneum* Herbst are important insect pests that causes considerable losses. However, *C. serratus* is an economically important insect pest that causes considerable losses and posed potential threat to stored groundnut especially in the rural communities (Wightman et al., 1987). The bruchid is native to Tropical and Semi-tropical parts of the world from where it spread to other parts of the globe (Prevett, 1967). In 1957, the bruchid was reported on stored groundnut in the Gambia which result in poor seed germination leading to poor yield (Sharma et al., 2017). The larvae of the bruchid, *C. serratus* bored into the seeds through the small holes and feed on the embryo and the endosperm (Prevett,

e-mail: oaya1010@yahoo.com

1967). Insect pests infestation caused considerable qualitative and quantitative losses to groundnuts either stored in shell to be used as seeds or unshelled for milling purposes. The feeding by this notorious insect pest deteriorates the quality of the oil. The biology of the groundnut bruchid, *C. serratus* has been studied by several workers (Pagni and Mann, 1979; Conway, 1983; Pierre and Huignard, 1990; Halle et al., 2002). Therefore, this study aimed at evaluating the biology of the destructive bruchid, *Caryedon serratus* Olivier [Coleoptera: Bruchidae] on stored groundnut in Ganye area taking into account the temperature and humidity of the area.

Material and methods

Study area

The study on the biology of the groundnut bruchid, *Caryedon serratus* Olivier was carried out in the Laboratory of the Department of Agricultural Technology, Adamawa State College of Agriculture, Ganye. The College is located at Gangwokki Village, Ganye Local Government Area within longitude 8°16" North and latitude 12° East of the Equator in the Northern Guinea Savannah agro-ecological zone of Nigeria (Adebayo, 1999).

Culture and maintenance of test insects for laboratory test

The adults *C. serratus* were collected from infested seeds of shelled groundnut and tamarind whole pods (fruits and seeds) (Figures 1 and 2). The infested seeds and pods were kept in the Laboratory in a clean uninfested Kilner jar at an ambient temperature of 35°C and relative humidity of 70%. The Kilner jar was covered with muslin cloth held tightly in place for adequate aeration of the culture and precluded entry or exit of insects. New generations of bruchids were obtained from this stock culture which also provided the source of test insects that was used for the Laboratory test as the cycle is repeated from one generation to the other. The pictorial form of the male, female, life cycle and larvae of the groundnut bruchid, *C. serratus* are presented in Figures 1, 2, 3 and 4, respectively.

Figure 1. Adult male groundnut bruchid, *C. serratus* (Olivier) [Coleoptera: Bruchidae]
Source: USDA (2012)

Figure 2. Adult female groundnut bruchid, *C. serratus(Olivier)* [Coleoptera: Bruchidae]
Source: USDA (2012)

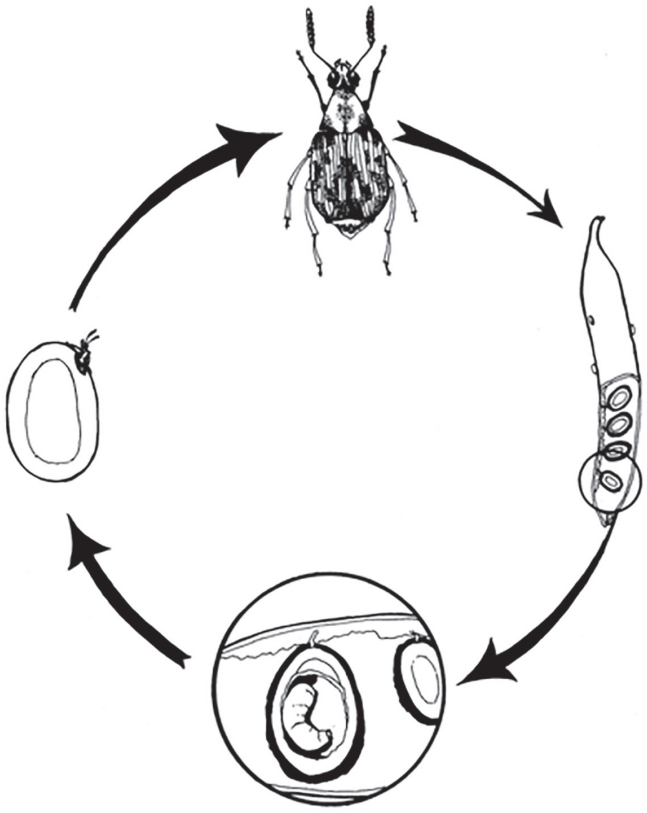

Figure 3. Generalised life cycle of bruchids chart
Source: Rama and Venugopal (2005)

Figure 4. Larva of groundnut bruchid, *C. serratus* Olivier [Coleoptrra: Bruchidae]
Source: USDA (2012)

The stalk culture

The culture of the groundnut bruchid, *C. serratus* used for the study was collected from the infested groundnut seeds and tamarind whole pods obtained from the Laboratory of the Department of Agricultural Technology, Adamawa State College of Agriculture, Ganye in 2015.

The pupae

The infested groundnut seeds containing the pupae were collected and transferred to clean storage jars measuring 16x14x12 cm. The jars were covered with muslin cloth kept in the Laboratory until the adults emerged.

The adults

The adult bruchids that emerged were transferred to clean storage jars and supplied with groundnut seeds. The storage jars were kept in the Laboratory until the females oviposited.

The eggs

The groundnut seeds containing the eggs deposited by the female bruchids were collected and transferred to clean storage jars. The jars were covered with muslin cloth left in the Laboratory until the eggs hatched.

The larvae

The hatched larvae of the bruchids, *C. serratus* were transferred to clean storage jars supplied with groundnut seeds and kept in the Laboratory until pupation and adults emerged. The adults emerged were transferred to clean storage jars and kept until the female oviposited. The culture was therefore maintained and all the stages of the bruchid needed for further experiments were available at any time.

Procedures

The biology of the groundnut bruchid, *C. serratus* was studied on groundnut kernel under Laboratory conditions at 30-35°C temperature and 70-90% relative humidity. Fifteen kernels of groundnuts were kept in plastic containers and two paired 0-24-hour-old adults *C. serratus* were released in each container. The sex of the bruchid (male and female) was assigned the sub-treatment while the period of development was the main treatment and was replicated three times. The Weekly counting of the total number of eggs laid was carried out at intervals until it was sustained. The kernels with 30 eggs were kept in petri dishes in the Laboratory to determine parameters like: pre-oviposition stage, incubation stage, oviposition stage, larval stage, pupal stage, adult stage and the total life cycle of the bruchid.

Results

The result of the study on the biology of groundnut bruchid, *C. serratus* carried out in the Laboratory is presented in Table 1. The result shows that the mean pre-oviposition stage of the female bruchid lasted for one and a half day (1.50). The female bruchid had the highest mean incubation period (6.50 days) while the least was obtained in the male bruchid (6.00 days). The mean oviposition period of the female bruchid was five and a half days (5.50). The male *C. serratus* recorded the highest mean period of larval stage 18.00 days while the female bruchid had the least 17.00 days. Both the female and the male bruchids had equal mean period of development of pupal stage - 13.50 days. The mean adult longevity was longer in the male bruchids (13.50 days) while the females had the least (12.00 days). The male bruchids recorded the highest number of days in the total life cycle (51.00 days) while the female had the least (48.00 days), respectively.

Table 1. Periods and stages of development of *C. Serratus*, in days

Stages of development	n	Range, days		Mean, days	
		Female	Male	Female	Male
Pre-oviposition stage	15	1.00-2.00	-	1.50	-
Incubation stage	15	5.00-8.00	5.00-9.00	6.50	6.00
Oviposition Stage	15	3.00-8.00	-	5.50	-
Larval Stage	15	16.00-18.00	17.00-19.00	17.00	18.00
Pupal Stage	15	13.00-14.00	13.0-14.00	13.50	13.50
Adult Stage	15	11.00-13.00	12.00-15.00	12.00	13.50
Total life cycle	15	47.00-49.00	49.00-52.00	48.00	51.00

Source: Laboratory Studies (2015)

Discussion

The results obtained showed that longevity was longer in the female than the male groundnut bruchids, *C. serratus.* This agrees with Rama and Venugopal (2005) who reported that an average adult longevity of the male and female bruchid is 27.4 and 30.2 days, respectively. However, Sharma et al. (2017) found that male and female groundnut bruchid, *C. serratus* lived 11.72 and 14.47 days, respectively. The incubation period also varied in both sexes. This is in consonant with Oaya and Malgwi (2014) who established mean incubation period of 6.0 and 6.5 days in both female and male *C. serratus* on groundnut kernels at ambient temperature and humidity. Similarly, the larval period or stage was longer in the female groundnut bruchids, *C. serratus* compared to the male ones. This finding is in conformity with Sharma et al. (2017) who reported that mean larval stage ranges from 16.75 to 22.75 days with an average of 19.75 days in both sexes. However, Sundria and Kumar (2004) observed that the larval period of *C. serratus* on groundnut kernel is 25.40 days in both sexes. Moreover, pupal stage also varied in both sexes. This finding corroborates with Rama and Venugopal (2005); Sundria and Kumar (2004) who stated that an average pupal stage of *C. serratus* on groundnut kernel in both sexes is 15.50 and 16.90 days, respectively. On the other hand, studies showed that adult male groundnut bruchid, *C. serratus* lived longer than the female bruchid. This could be because female *C. serratus* die immediately after oviposition while the male live a little longer. This substantiates the earlier work by Oaya et al. (2012) who reported that adult female groundnut bruchid, *C. serratus* lay up 70 eggs and thereafter die.

Conclusion

The biology of *C. serratus* shows that the incubation stage, larval stage, pupal stage, adult stage and life cycle in both female and male groundnut bruchid range 5.80-8.00, 13.00-14.00, 13.00-13.50, 11.00-15.00 and 47.00-50.00 days, respectively. Moreover, pre-oviposition, incubation and oviposition stages in the female specimens range 1.00-2.00, 5.00-8.00 and 3.00-8.00 days, respectively. The work principally showed that the larval stage of the cycle of the bruchid survived longer than all other stages in the cycle. It is a proven fact that the larval stage is the most destructive stage in the cycle. It is therefore suggested that control measures within the storage environment should be applied immediately after harvest to curtail the activities of this destructive stage of the bruchid.

References

Adebayo AA, 1999. Climate II. In: Adamawa State in Maps (eds. A.A. Adebayo and A.L. Tukur), pp. 23-25. Paraclete Publishers, Jimeta Yola, Nigeria.

Ashely J, 1993. Drought and Adaptation: In: Dry Land Farming in Africa (ed. R.J. Rowland), Macmillan Education Ltd. London, p. 10.

Beghnin J and Sewadah M, 2003. The Impact of Groundnut Trade Liberalization. Tim Hill Publishing Company Limited India, pp. 241-242.

Conway J, 1983. Notes on the Biology and Ecology of Groundnut Seeds Beetle, *Caryedon serratus* (Olivier) [Coleoptera: Bruchidae] Under Field Conditions in Senegambia. Tropical Stored Products Information, 45, 11-13.

David G and Adamu P, 1988. Crops of the Drier Regions of the Tropics. Longman Group Ltd., London, p. 157.

FAOSTAT (Food and Agriculture Statistics), 2014. http://www.faostat,fao.org

Halle DN, Awaknavar JS and Samashekhar A, 2002. Biology of Tamarind Beetle, *Caryedon Serratu*s Olivier on Groundnut and Other Hosts. Insect Environment, 8, 67-69.

ICRISAT (International Crop Research Institute for Semi-arid Tropics), 2015. Farmer's Guide to Profitable Groundnut Production in Nigeria, Patancherum, 502324, Telengana, India. International Crops Research Institute for Semi-Arid Tropics, p. 36.

Malgwi AM, Samaila AE, Yemisi JO and Oaya CS, 2013. The Effect of groundnut sucking bug (*Rhyparochromus littoralis* Dist.) on the oil content of groundnut kernels on two groundnut cultivars in Northern Nigeria. Journal of Food Science and Quality Management, 11, 70-75.

Malgwi AM and Oaya CS, 2014. Towards achieving an integrated pest management for the control of the groundnut bruchid (*Caryedon serratus* Olivier) on stored groundnut and tamarind in Yola, Nigeria. Global Journal of Biology, Agriculture and Health Sciences, 3, 96-104.

Musa AK, Dike MC and Onu I, 2009. Evaluation of Nitta (*Hyptis suaveolens* Poit.) Seed and Leaf Extract and Seed Powder for the Control of *Trogoderma granarium* Everts (Coleoptera: Dermestidae) in Stored Groundnut. American-Eurasian Journal of Agronomy, 2, 176-179.

Oaya CS Malgwi AM and Samaila AE, 2012. Damage potential and loss caused by the groundnut bruchid *Caryedon serratus* Olivier [Coleoptera: Bruchidae] on stored groundnut and tamarind in Yola. International Organization of Scientific Research, India. Journal of Agriculture and Veterinary Science, 1(6), 58-62.

Oaya CS Malgwi AM and Samaila AE, 2013. Insecticidal efficacy of African rock fig leaf powder (*Ficus congensis* Engl.) against the groundnut bruchid (*Caryedon serratus* Olivier) on stored groundnut in Yola. Journal of Agriculture and Veterinary Science, 2, 24-27.

Oaya CS and Malgwi AM, 2014. Evaluation of the Impact of *Mesostena picca* (Kraatz), a predator of the bruchid, *Caryedon serratus* (Olivier) on stored groundnut and tamarind. Science Journal of Agricultural Research and Management, Article ID sjarm 117, 4. dol:10.7237/sjarm/1.

Pagni HR and Mann BK, 1979. Some aspects of biology of *Caryedon Serratu*s Olivier [Coleoptera: Bruchidae]. Bulletin of Grain Technology, 17, 43-47.

Pierre D and Huignard J, 1990. The biological cycle of *Caryedon Serratu*s Boh. [Coleoptera: Bruchidae] on one of its

host plants, *Bauhinia rufescens* (Lam.) (Casalpinioidae) in a Sahelian Zone. Acta Oecologia, 11, 93-101.

Prevett PF, 1967. The field occurrence of *Caryedon Serratu*s Olivier, the groundnut seeds beetle [Coleoptera: Bruchidae] in Uganda. Journal of Stored Products Research, 3, 267-268.

Rama DD and Venugopal R, 2005. Some observations on the biology of groundnut seeds beetle, *Caryedon Serratu*s Olivier [Coleoptera: Bruchidae]. Legume Resource, 28, 229-230.

Samaila AE, Malgwi AM and Oaya CS, 2012. Survey of the Abundance of 'Offa' the Groundnut Sucking Bug (*Rhyparochromus littoralis* Dist.) an Emerging Field Insect Pest of Groundnut in Adamawa Central Senatorial District, Adamawa State. Journal of Biology, Agriculture and Healthcare, USA, 3, 110- 114.

Sharma A, Khinchi SK and Kumawat KC, 2017. Studies on biology of *Caryedon Serratu*s olivier on groundnut, *Arachis hypogeae* (L.). Journal of Entomology and Zoology Studies, 5, 579-582.

Sundria MM and Kumar A, 2004. Biology of groundnut bruchid, *Caryedon Serratu*s Olivier on different test hosts. Annals of Plant Protection Sciences, 12, 9-12.

USDA (United State Department of Agriculture), 2012. Annual Report, p. 36.

Wightman JA Admin PW Rao GVP and Dick TM, 1987. Research on groundnut pests at ICRISAT. In: Proceedings of the Second Regional Groundnut Workshop for Southern Africa, pp. 103-104.