Assessment of the response of fifteen cowpea [Vigna unguiculata L. (Walp.)] genotypes to infestation by Callosobruchus maculatus Fab. (Coleoptera: Bruchidae)

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Abstract: Storage of cowpea [Vigna unguiculata L. (Walp)] is constrained by the cowpea seed bruchid pest, Callosobruchus maculatus. However, in Ghana, little is known of the responses of cowpea genotypes to infestation by C. maculatus. Hence, the assessment of responses of fifteen cowpea genotypes to C. maculatus infestation in vitro. Forty seeds of each of the cowpea genotype were weighed and inoculated with five pairs of C. maculatus. The cultures were incubated for 40 days at 29 ± 1 °C. Three replicates of each cowpea genotype were arranged in a randomized complete block design and the mean seed weight loss, and bruchid development among others were subjected to analysis of variance and the means distinguished with the Fisher's Least Significant Difference. The mean development period (egg to adult emergence) ranged from 21–28 days and the severity of seed damage was between 2.86 and 7.01. The susceptibility index ranged from 19–22 and seed weight loss was above 60% for all genotypes. Oviposition rate, percentage of seed weight loss, and severity of seed damage were significantly different (P < 0.05) among the cowpea genotypes. Percentage seed weight loss significantly (p < 0.05) correlated with the mean C. maculatus development period (r = 0.62) and number of F₁ progeny (r = 0.56). The damage to cowpea seeds by C. maculatus infestation and the loss in seed weight can be reliably controlled by exploiting resistant genes to improve cowpea immunity to the pest.

Subjects: Agriculture & Environmental Sciences; Plant & Animal Ecology; Entomology

Keywords: Agriculture & Environmental Sciences; Plant & Animal Ecology; Entomology

1. Introduction  
Cowpea [Vigna unguiculata L. (Walp.)], is a legume that is indigenous to Africa (Adam & Baidoo, 2008; Maina et al., 2012). Cultivated cowpea is one of the most adaptive food legumes in tropical and sub-tropical regions of the world (Abate et al., 2011; Amusa et al., 2014; Maina et al., 2012; Obopile et al., 2011). It is a major grain legume in sub-Saharan Africa (Food Crop Development Project, [FCDP], 2005; Ige et al., 2011) and the most widely consumed legume in Ghana (Ministry of Food and Agriculture, [MoFA], 2010; Ocran et al., 1998).

A major constraint to cowpea storage is infestation by the cowpea bruchid, Callosobruchus maculatus (Coleoptera: Bruchidae). Other common names are cowpea seed bruchid and bean beetle (Adam & Baidoo, 2008; Amusa et al., 2014, 2013). The bruchid is a major field-to-store pest
that severely reduces the quantity and quality of cowpea seeds, thus adversely affecting their viability, sale, or use as food (Lole & Ofuya, 2011; Obopile et al., 2011). The damage is caused by the larvae feeding and developing within the seed, and holes created for adult emergence (Beck & Blumer, 2011).

Cowpea losses through *C. maculatus* infestation are fairly large (Murdock et al., 1997; Obopile et al., 2011). Although, no accurate figures are available, estimates of cowpea damage are usually expressed in percentages in terms of weight loss to demonstrate cowpea susceptibility and consequential economic losses (Umeozor, 2005). There are several reports from around the world on cowpea that suggest that the most important cause of loss of stored cowpea is due to *C. maculatus*. For example, Golob et al. (1996) reported that *C. maculatus* was the most important cause of loss of stored cowpea in Ghana; Deshpande et al. (2011) reported a significant quantitative and qualitative loses of caused by *C. maculatus* in cowpea during seed storage in India and Bamaiyi et al. (2006) attributed significant nutritional loss in stored cowpea grains to effect of *C. maculatus* infestation, etc. From a market survey of cowpea in markets in northern Ghana, it was found that damage by *C. maculatus* varied from 14 to 94% (Golob, 1993).

One of the most common methods for controlling cowpea bruchids by producers has been the use of chemicals. However, there are concerns about the adverse effects of chemical insecticides on human health (Parven et al., 2021; Yuanyuan et al., 2022). For example, Parven et al. (2021) hypothesised that extensive and intensive use of pesticides in developing nations is a serious concern, found residues detected in significant number of country and yard long bean samples, and concluded that most insecticide-contaminated beans samples pose potential health risk in humans. Efforts have been made to find simple, easy-to-use, and non-expensive methods of bruchid control that are safer for consumers (Deshpande et al., 2011; Fawki et al., 2012). There is high genetic diversity in cowpea and potentially different levels of susceptibility to *C. maculatus* (IFAD, 2000). The utilization of the inherent resistance in improved varieties of cowpea is probably the cheapest method of reducing the *C. maculatus* population (Fatokun et al., 2002; Lüth et al., 2013; Mahama, 2012). Currently, there is inadequate information on the resistance or susceptibility of cowpea genotypes in Ghana to *C. maculatus*. Most local cultivars have not been screened to understand their different responses to the cowpea seed bruchid, for selection of their desirable traits for the development of hybrid cowpea towards a possible resistance to bruchid infestation at storage, and secure economic gains of this all-important food shortly. Hence, there is an urgent need for screening of more local cultivars and breeding lines of the crop along with cultivars with some known levels of resistance in that regard. The main objective of this study was, therefore, to screen fifteen cowpea genotypes against cowpea seed bruchid to determine their levels of resistance or susceptibility to infestation and determine how they respond to attack in storage.

2. Materials and methods

2.1. Source of cowpea genotypes

Fifteen cowpea genotypes (Table 1) were used for the study. Four genotypes (Adom, Bengplia, Padi-Tuya, and IT97K4-99-35) were released cultivars, six (UC-01, UCC-White, UC96-11, UC96-241, UC96-445, and UC96-513) were breeding lines and two (GH3684 Red and GH3684 Black) were landraces and other three different cowpea genotypes. The seeds were obtained from the Crop Research Institute, Fumesua, and the Department of Molecular Biology and Biotechnology of the University of Cape Coast and multiplied at the Teaching and Research Farm of the University of Cape Coast.

2.2. Culturing of *C. maculatus*

Bruchid cultures were established according to the method described by Beck and Blumer (2011) and Magagula and Maina (2012). Cowpea grains already infested with *C. maculatus* were obtained from the Entomology Laboratory of the Crop Research Institute, Kumasi, Ghana. Sixty adult bruchids of mixed sexes were introduced into mixed cultivars of cowpea in 1 litre Kilner jars and
Table 1. Parentage and desirable traits of cowpea genotypes used

| Genotypes  | Parentage/Genotype                        | Some desirable traits*                      |
|------------|-------------------------------------------|--------------------------------------------|
| Adorn      | CR-06-07                                  | Smooth coat                                |
| Bengal     | JT835-818                                 | High grain yield, early maturing (50–60 days) |
| Padi-Tuya  | SARC 3–122-2                              | High grain yield, erect vines, good for fodder |
| IT97K-499-35| Songotra (IITA Cross)                      | High grain yield, resistant to Striga       |
| Apagbaala  | Primal/Tvu4552/CBE                        | High fodder/grain yield                    |
| SARC-L02   | SARI Cross                                | Large grain size                           |
| Marfo-Tuya | Sumbrisogla /518-2                        | High fodder/grain yield                    |
| GH3684 Red | Landrace                                  | High fodder/grain yield                    |
| GH3684 Black| Landrace                                  | High fodder/grain yield                    |
| UC-01      | Breeding line (IT97K-499-35 SARC L02)     | Early maturing, high grain yield           |
| UCC-White  | Breeding line (Mutant)                     | Very early maturing                        |
| UC96-11    | Breeding line (IT97K-499-35 X SARC L02)   | Resistant to Striga                        |
| UC96-241   | Breeding line (IT97K-499-35 x SARC L02)   | Resistant to Striga                        |
| UC96-445   | Breeding line (IT97K-499-35 x Apagbaala)   | Resistant to Striga                        |
| UC96-513   | Breeding line (IT97K-499-35 x Apagbaala)   | Resistant to Striga                        |

*Source of traits: Asare et al. (2013)

placed in a rearing cage at 29 ± 1 °C and 86 % relative humidity. The beetles were removed 7 days after the introduction and the set-up left for the next generation of adults to emerge.

2.3. Screening of cowpea genotypes
Fifteen cowpea genotypes were screened for susceptibility to *C. maculatus* according to a protocol followed by Obopile et al. (2011), with little modification. Forty healthy seeds of each genotype were weighed and put in a 200-cc disposable culture tube. Newly-emerged adult (7-days) bruchids (five males and five females) were introduced into each culture tube and covered with a muslin cloth (with 0.1 mm mesh size) for ventilation and to prevent insects from escaping. The cultures were left undisturbed for 7 days to allow the bruchids to mate and lay eggs before being removed (Abebe et al., 2009; Magagula & Maina, 2012). The experiment was laid out in a randomized complete block design with 3 replicates for each cowpea genotype. A control tube (with no bruchids) was set up for each cowpea genotype, making a total of 60 tubes/—45 replicates and 15 control for the entire experiment. The setups were observed for 40 days when it is expected that all adults would have emerged.

2.4. Formulae used
The following data were obtained for the 40 days of infestation using the following equations:

Equation 1:

Percentage seed weight loss

\[
\text{Percentage seed weight loss} = \left(\frac{\text{Initial seed weight} - \text{Residual seed weight}}{\text{Initial seed weight}}\right) \times 100
\]

Equation 2:
Median development period (MDP) (days)

\[ MDP = \frac{X_1Y_1 + X_2Y_2 + \ldots + X_nY_n}{\text{Total adults emerged}} \]

Where \( X \) = number of adults emerged in a replicate

\( Y \) = number of days for emergence

**Equation 3:**

Percentage of adult emergence = \( \frac{\text{Number of emerged adults insects}}{\text{Number of eggs laid}} \times 100 \)

**Equation 4:**

Severity of seed damage = \( \frac{\text{Number of } F_1\text{ progeny adults}}{\text{Number of damaged seeds}} \)

* a damaged seed is recorded as a seed with at least one perforation from the adult (emergence)

Equations 1–4 were adopted from (Amusa et al., 2014).

**Equation 5:**

The susceptibility index for each cowpea accession was calculated using a formula proposed by Howe (1971) and later adopted and modified by Dobie (1973, 1974):

\[ SI = \frac{\log_{e} F}{D} \times 100 \]

* where:

\( F \) = Total number of \( F_1 \) progeny emerged

\( D \) = median development time (MDP) from equation 2.

3. Results

3.1. Seed weight loss

There was a significant difference (\( P \leq 0.05 \)) [LSD] in initial seed weight, residual seed weight measured, and the percentage of seed weight losses among the fifteen cowpea genotypes (Table 2).

The least weight loss (62.28%) was observed for Adom. The highest seed weight loss (72.46%) was recorded in UC96-241, followed by UC96-11 (71.8%) and Marfo-Tuya (66.9%; Table 2).

3.2. Seed damage and susceptibility

The mean number of damaged seeds did not vary significantly (\( P > 0.05 \)) among the genotypes. However, analysis of the severity of seed damage showed a significant variation (\( P \leq 0.05 \)) among the cowpea genotypes evaluated after the 40-day infestation period. Severity of seed damage ranged between 2.86 and 7.01. The most severe seed damage was recorded for UC96-513 (7.01), UC96-11 (6.54), UC-01 (6.59), UC96-241 (6.54), and UC96-445 (6.38). Adom suffered the least damage of 2.86 (Table 3).
Table 2. Seed weight analysis before and after 40-day bruchid infestation

| Genotype      | Seed weight (g) ± SE | Seed weight loss (%) |
|---------------|----------------------|----------------------|
|               | Initial             | Residual             |
| Adom          | 5.09 ± 0.09 hi      | 1.92 ± 0.09 de fg    | 62.28 ± 1.14 e          |
| Apagbaala     | 5.43 ± 0.13 g       | 1.56 ± 0.03 gh       | 71.23 ± 0.73 abc        |
| Bengpla       | 5.03 ± 0.07 i       | 1.69 ± 0.04 fg hj    | 66.35 ± 0.92 bcde       |
| GH3684 Red    | 5.19 ± 0.15 ghi     | 1.78 ± 0.08 ef gh    | 65.65 ± 0.72 cde        |
| GH3684 Black  | 6.8 ± 0.13 de       | 2.27 ± 0.09 bcd      | 66.59 ± 0.73 bcde       |
| IT97K-499-35  | 6.16 ± 0.07 f       | 1.85 ± 0.38 ef lg    | 69.82 ± 0.64 abcd       |
| Marfo-Tuya    | 4.44 ± 0.06 j       | 1.460.07 h           | 66.98 ± 1.88 ab         |
| UC96-11       | 6.74 ± 0.17 e       | 1.9 ± 0.03 defg      | 71.81 ± 0.27 ab         |
| UC96-241      | 7.34 ± 0.09 c       | 2.02 ± 0.08 cdef     | 72.46 ± 1.1 a           |
| UC96-445      | 7.01 ± 0.03 de      | 2.16 ± 0.04 bcde     | 69.22 ± 0.67 abcd       |
| UC96-513      | 6.90 ± 0.12 de      | 2.04 ± 0.06 cdef     | 70.43 ± 0.46 abcd       |
| Padi-Tuya     | 9.99 ± 0.04 a       | 3.30 ± 0.2 a         | 66.91 ± 2.09 abcd       |
| SARC L02      | 7.92 ± 0.02 b       | 2.48 ± 0.11 b        | 68.76 ± 1.43 abcd       |
| UC-01         | 7.10 ± 0.18 cd      | 2.38 ± 0.12 bc       | 66.58 ± 0.84 bcde       |
| UCC-White     | 5.38 ± 0.04 gh      | 1.89 ± 0.05 ef gh    | 64.96 ± 0.79 de         |

Means with different letters in the same column are significantly different at p < 0.05 level.

Table 3. Ranking of the 15 cowpea genotypes based on Susceptibility Index (SI)

| Genotype     | Number of damaged seeds ± SE (N = 40) | Severity of Seed damage | Susceptibility index (SI) | Rank based on SI* |
|--------------|---------------------------------------|-------------------------|---------------------------|-------------------|
| Marfo-Tuya   | 39.33 ± 0.3                          | 4.25 ± 0.07 cd          | 18.99                     | 1                 |
| UC96-11      | 40 ± 0                                | 6.93 ± 0.03 a           | 19.02                     | 2                 |
| Apagbaala    | 40 ± 0                                | 5.7 ± 0.01 abc          | 19.44                     | 3                 |
| IT97K-499-35 | 40 ± 0                                | 4.57 ± 1.8 bcd          | 19.48                     | 4                 |
| UC96-513     | 39.67 ± 0.3                          | 7.01 ± 0.02 a           | 19.53                     | 5                 |
| GH3684 Black | 40 ± 0                                | 5.98 ± 0.03 abc         | 19.87                     | 6                 |
| GH3684 Red   | 40 ± 0                                | 4.61 ± 0.04 bcd         | 20.43                     | 7                 |
| UC96-445     | 40 ± 0                                | 6.38 ± 0.04 ab          | 20.47                     | 8                 |
| Bengpla      | 40 ± 0                                | 4.73 ± 0.02 bcd         | 20.48                     | 9                 |
| UC-01        | 39.67 ± 0.3                          | 6.59 ± 0.04 ab          | 20.52                     | 10                |
| SARC L02     | 40 ± 0                                | 5.52 ± 0.05 abc         | 20.69                     | 11                |
| UC96-241     | 39.67 ± 0.3                          | 6.54 ± 0.07 ab          | 20.78                     | 12                |
| Padi-Tuya    | 40 ± 0                                | 5.34 ± 1.7 abc          | 22.17                     | 13                |
| UCC-White    | 40 ± 0                                | 5.37 ± 0.03 abc         | 22.23                     | 14                |
| Adom         | 40 ± 0                                | 2.86 ± 0.04 d           | 22.96                     | 15                |

Means with different letters in the same column are significantly different at p < 0.05 level; *1-15 indicates the least to the most susceptible genotype among the 15 under study.

3.3. Reproductive and development parameters of C. maculatus

The number of eggs laid on seeds did not differ significantly with genotype (P > 0.05; Table 4). However, more eggs (355 ± 25.5) were laid on UC-01 than the remaining cowpea genotypes, with the least number of eggs recorded for IT97K-499-35 and Adom (226.7 ± 80.9 and 132 ± 17.5, respectively). The emergence of adult C. maculatus from seeds of the fifteen cowpea genotypes is
| Cowpea genotype | Mean ± SE | $F_1$ Progeny emerged | Adult emergence (%) | MDP |
|-----------------|-----------|-----------------------|---------------------|-----|
| Adom            | 132 ± 17.5 c | 114.33 ± 17.1 d | 86.62 ± 6.77 | 2064 ± 4.71 b |
| Apagbola        | 317.7 ± 41.7 ab | 228 ± 4.04 abc | 73.83 ± .83 | 26.19 ± 0.70 a |
| Bengpla         | 299.7 ± 52.3 ab | 189 ± 7.77 bcd | 67.1 ± 11.8 | 26.19 ± 0.70 a |
| GH3684 Red      | 270.7 ± 55.4 ab | 184.33 ± 15 bcd | 71.28 ± 8.04 | 25.49 ± 0.49 a |
| GH3684 Black    | 299.3 ± 18.6 ab | 239 ± 13.1 abc | 80.33 ± 5.68 | 27.33 ± 0.42 a |
| IT97K-499-35    | 226.7 ± 80.9 bc | 182.67 ± 70 bcd | 76.19 ± .36 | 27.70 ± 0.93 a |
| Marfa-Tuya      | 236.3 ± 54.5 abc | 166.67 ± 25.5 cd | 73.99 ± 8.35 | 26.94 ± 0.99 a |
| UC96-11         | 333.3 ± 20.3 ab | 277.33 ± 12.7 a | 83.36 ± 1.35 | 27.42 ± 0.84 a |
| UC96-241        | 292 ± 31.1 ab | 259.33 ± 27.1 ab | 88.9 ± 1.55 | 26.36 ± 0.26 a |
| UC96-445        | 272.7 ± 18.7 ab | 255.33 ± 14.8 ab | 93.78 ± 1.03 | 26.79 ± 0.66 a |
| UC96-513        | 331 ± 15 ab | 278 ± 6.08 a | 84.46 ± 5.29 | 27.49 ± 1.02 a |
| Padi-Tuya       | 270.3 ± 85.9 ab | 213.67 ± 68.5 abc | 78.75 ± 1.54 | 25.37 ± 0.74 a |
| SARC L02        | 293 ± 21.9 ab | 220.67 ± 19.3 abc | 75.73 ± 6.77 | 26.86 ± 1.00 a |
| UC-01           | 355 ± 25.5 a | 261.67 ± 17.7 ab | 74.6 ± 8.3 | 27.01 ± 0.65 a |
| UCC-White       | 290.3 ± 19 ab | 214.67 ± 13.1 abc | 74.67 ± 6.89 | 25.31 ± 0.17 a |

Means with different letters in the same column are significantly different at $p < 0.05$ level
presented in Table 4. The mean number of F₁ progeny (determined by number of adults emerged each day from first day of emergency through the 40 days observation) was generally high among the cowpea genotypes, ranging from 114 to 277. A significantly (P ≤ 0.05) higher mean number of F₁ adults emerged from the breeding lines like UC96-513, UC96-11, UC-01, UC96-241, and UC96-245 than the released varieties. Adom, Bengpla, GH3684 Red, and IT97K-499-35 recorded the lower mean number of F₁ progeny, compared to the rest of the cowpea genotypes in this study. There was no significant difference (P > 0.05) among the cowpeas concerning the percentage of adult emergence (Table 4).

4. Discussion
A few cases of varietal seed resistance against bruchid attack have been reported (IITA, 1990; Lale & Kolo, 1998; Maina et al., 2006). However, the extent of the difficulty in achieving more lasting bruchid resistance by varietal resistance approach is such that most cultivars usually possess monogenic resistance and are thus overcome by changes in pathogen and pest populations (Amusa et al., 2014; Leach et al., 2001). The establishment of lasting resistance or tolerance of locally improved cowpea cultivars and landraces is still very limited since only a few higher resistance sources exist to be incorporated into breeding (Dongre et al., 1996). It has been reported that eggs laid, adult emergence, development period, growth index, weight loss, and seed damage are reliable indicators for varietal resistance in cowpea (Jackai & Asante, 2003).

Although, the mean numbers of eggs laid by adult female C. maculatus were not significantly different (P < 0.05) amongst the cowpea genotypes considered in the current work, more eggs were laid on the breeding lines UC-01, UC96-11, UC96-513, UC96-241, landrace (GH3684 Black) and the cultivars Apagbaala and Bengpla than were laid on the cultivars Adom, IT97K-499-35 and Marfo-Tuya. Unlike in the studies by Lale and Makishi (2000), Idoko and Adesina (2012), and Jackai and Asante (2003), the mechanistic explanation for reduced oviposition in Adom or higher oviposition in UC-01, UC96-11, UC96-53, Apagbaala, Bengpla, GH3684 Black, was not studied in this work. However, egg deposition on cowpea seeds by C. maculatus has been shown to increase with increasing insect density (Idoko & Adesina, 2012) or increasing seed density, where the number of eggs per seed was inversely related to the number of seeds used (Jackai & Asante, 2003). In this work, the number of seeds exposed to C. maculatus was fixed (40 seeds per replication) to reduce the variation in oviposition associated with seed density. Moreover, Callosobruchus spp. are known to deposit their eggs evenly on seeds (Credland & Wright, 1990; Mbata, 1992), and thus the assumption that the equal distribution of seeds to the cowpea seed bruchid (40 seeds by 5 females = 8 seeds/bruchid) will somewhat reduce variation in oviposition and superparasitism (i.e. laying eggs on previously parasitized seeds; Cope & Fox, 2003; Horng, 1994, 1997; Wilson, 1994) and induce uniform distribution of eggs (Horng, 1994; Messina, 1989). This is because C. maculatus has been reported to discriminate between seeds bearing eggs and those not bearing eggs (Fox & Savalli, 1998; Messina & Renwick, 1985). Nonetheless, egg counts alone would not be sufficient to predict promising genotypes in studies of varietal resistance to C. maculatus. Moreso, Jackai and Asante (2003) found that the percentage of adult emergence, development period, growth index, and weight loss were the most reliable indicators for resistance to bruchid damage in cowpea seeds. Azeez and Pitan (2014a) also identified some cowpea accessions as highly susceptible to C. maculatus based on eggs laid, adult emergence, seed damage, and loss in seed weight.

There was a significant (P < 0.05) reduction in the number of F₁ adults that emerged on Adom (a released variety), towards the end of the 40 days observation, compared to two breeding lines, UC96-11 and UC96-513. The bruchid emergence ranged between 67.1–93.8% across the 15 genotypes screened. The percentage of adult emergence was not significantly different (P > 0.05) among the cowpeas evaluated in this work. Obopile et al. (2011) proposed that a reduction in the percentage of adult emergence would lower the number of progenies, contributing to population growth from generation to generation. Other previous studies also found that reduced adult emergence had a consequential delay in the development period (Appleby & Credland, 2004; Edde & Amatobi, 2000; Ofuya & Credland, 1995). Substantial delay in development might have to
be confirmed by lower growth index values in all resistant cultivars compared to susceptible ones. In the current study, not all the cowpea genotypes had a combination of delayed development period and lower growth index.

All fifteen cowpea genotypes showed significant (P < 0.05) seed weight loss above 60% and severity of seed damage ranging between 2.8 and 7.0. Percentage seed weight loss significantly (P < 0.05) correlated positively with the bruchid development period and the number of adult bruchids that emerged, while the bruchid development period showed a significant inverse correlation with the seed susceptibility index (19–23). This indicates that seed size, weight, and volume may be associated with the female bruchid’s choice for oviposition and larval development. In this study, a seed with at least a perforation from adult bruchid emergence is considered a damaged seed. The bruchid oviposition rate (number of eggs laid per replicate per day) had a strong positive correlation (r = 0.82) with the number of F1 progeny (adults’ infestation), as well as with the severity of seed damage observed on the fifteen cowpea genotypes at the 1% level [SUPPLEMENTARY TABLE 1]. There was an indication of a strong relationship between the rate of bruchid infestation and percentage of seed weight loss and severity of seed damage observed among the cowpea genotypes. The implication is that C. maculatus can have a significant effect on the food value and quality of these cowpea genotypes, hence severe economic losses of these cowpea genotypes when stored without strict precautions.

5. Conclusion
The reproductive and developmental parameters usually associated with the fitness of C. maculatus were not adversely affected except for Adom. All the fifteen cowpeas supported a relatively shorter bruchid development period and consequently higher susceptibility index ranging from 19–23, with Marfo-Tuya having the least SI and Adom the highest SI (Table 3). Percentage seed weight loss correlated with several emerged F1 adults and the development period of bruchids. Oviposition rate had a strong positive correlation (r = 0.82) with F1 progeny and severity of seed damage. A perfect positive correlation (r = 1.0) existed between the bruchid population and the severity of cowpea seed damage. On the whole, the fifteen cowpea genotypes were susceptible to infestation by C. maculatus. Susceptible cowpea genotypes experience a higher percentage of seed weight loss and damage due to higher bruchid infestation, which promotes faster bruchid development (shorter generation time) in storage which may threaten the conservation of the crop. However, two of the local cultivars, Adom, Bengpla, the breeding line, GH3684 Red, and the IITA cross I797K-499-35, screened among these 15 genotypes, are promising for hybrid breeding against bruchid infestation at storage. We recommend further phenotyping of more Ghanaian cowpea cultivars for resistance to bruchid infestation. Besides, there is a need for breeders to incorporate exotic C. maculatus resistant cowpea genotypes into breeding and transfer the resistant genes into local cowpea cultivars and breeding lines to improve the crop.

Acknowledgements
The authors are grateful to the schools of Agriculture and Biological Sciences of the University of Cape Coast (Ghana) for their research farm and laboratory spaces for the field and laboratory work for this project. Thanks for the assistance of laboratory technicians at the Departments of Conservation Biology and Entomology (CBE), and Molecular Biology and Biotechnology of the university.

Funding
The authors received no direct funding for this research.

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Disclosure statement
No potential conflict of interest was reported by the author(s).

Citation information
Cite this article as: Assessment of the response of fifteen cowpea [Vigna unguiculata L. (Wolp.)] genotypes to infestation by Callosobruchus maculatus Fab. (Coleoptera: Bruchidae), Jackson Nyarko, Aaron T. Asare, Benjamin A.
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