

Insect have varied preferences for different hosts.
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Insect populations that use different local host plants frequently show divergent egg laying or feeding preferences on those hosts (Bernays and Chapman 1994). Because plants represent habitats as well as food, host-plant variation could also affect behaviors not directly related to finding or consuming plants (Carroll et al. 1998). Several authors have recently addressed the microevolutionary change is deemed predictable if replicate populations in a new environment converge towards populations already adapted to that environment (Messina 2004). Our results demonstrate that both a juvenile trait and an adult trait (host discrimination) in *C. maculatus* population can be rapidly and predictably modified by an ancestral host shifting. Furthermore, results revealed that *C. maculatus* behaviors were largely affected by the host choice tests, hosts and generation number.

In no host choice tests, female *C. maculatus* were highly attracted by the seeds of chickpea and cowpea. However, they showed a strong preference for seeds of cowpea only in free host choice test. This fitted with Rees (2004) who indicated that the bruchids have varied preferences for different hosts. Previous works indicated that bruchid species are known to exhibit specificity in the choice of legumes they attack (Rees 2004). *C. maculatus* is primarily a pest of cowpea but has many alternative hosts among leguminous seeds (Haouel-Hamdi et al.

2017a). Being a field-to-store pest suggests that dispersing individuals are guided by specific cues to their preferred hosts (Ajayi et al. 2015).

According to Messina (2004) the oviposition preference is rather labile but that a new host is readily accepted after 40 generations. In addition, even after many years of laboratory culturing, there is still considerable plasticity in traits related to host use in *C. maculatus* (Guedes et al. 2003). However, a host shift exposes larvae to a completely new environment causing changes in larval feeding behavior (Guedes et al. 2003), larval competitive behavior (Tuda and Iwasa 1998; Messina 2004), and adult life-history traits (Messina 2004). Thus, host shifts lead to adaptations to new food sources both in the laboratory and in the wild conditions (Tuda et al. 2006).

Female oviposition behavior is known to show heritable genetic variation and egg-laying preferences in *C. maculatus* seems to be quite evolutionarily labile in general (Messina 2004). On the other hand, Sankara et al. (2010) showed that females of *C. maculatus* were able to recognize odors from their egg-laying substrates and to find their way to the sources of these odors. When these females have the choice between clean air and air containing seed odors, they are significantly more attracted to the smell of seeds.

This would be explained by the volatile substances emitted by the seeds. In addition, Ignacimuthu et al. (2000) confirmed that these chemicals would have an attractive effect on *C. maculatus* females. In this study, we found rapid evolution of female oviposition behavior with an increase in novel host acceptance, in agreement with Wasserman and Futuyma's (1981) as well as Messina and Karren's (2003) findings. Most importantly, we observed acceleration in mean growth rate and an increase in weight and body size. Thus, evolution of demographic traits to the novel host occurred in

concert during adaptation, together with elevating population fitness on cowpea and lentil.

Previous study of Agosta (2008) indicated that in the free host choice test both the survival of offspring and the host seed size showed a positive relationship with the numbers of eggs laid on the seed. However, in the no host choice test, only the survival of offspring and the numbers of eggs laid showed a positive relationship, while there was a significant correlation between seed size and the number of eggs laid on the seed. The developmental plasticity is illustrated in this study by several biological indicators, which gave evidence of an important potential for a relatively rapid adaptation of *C. maculatus* on the three tested hosts. Other indicators of *C. maculatus* adaptability to cowpea seeds came from the extent of larval survival inside the hosts and the intrinsic rate of natural increase.

Although both parameters were higher on chickpea until the 4 generation, the increase in the intrinsic rate of increase was faster and higher when developing on chickpea compared with cowpea. Furthermore, Sankara et al. (2016) showed that larval mortality was important inside Bambara seeds, whatever the number of eggs laid, indicating that acceptability is not always correlated with suitability (Giga and Smith 1987; Shazali 1989). The chemistry of seeds may be the most important factors determining interactions between the development of bruchids and their host plants (Tuda et al. 2006). Besides, Sankara et al. (2016) showed that females of *C. maculatus* seem to remember the volatile signals from cowpea, the original

host, even after three years of adaptation or development on the *Arachis hypogaea* and *Cajanus cajan*.

For instance, if a population has a means to detoxify a particular secondary compound in a novel host, it may be able to exploit closely related hosts that contain similar compounds (Agrawal 2000). According to Nicole (2002), an insect is specific to a plant if it can first recognize it. This author has shown that *C. maculatus* was able to recognize its original host cowpea and to deposit its eggs in all tested situations (free choice, semi choice and no choice). In addition, this author has reported that the transfer of *C. maculatus* to other legumes and its maintenance on these hosts for a relatively long time influences its penchant for this host, but does not alter its ovipositional preference for the host plant.