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Evaluation of the Territorial Dispute by the Freshwater Crab *Dilocarcinuspagei*Stimpson, 1861 (Crustacea, Brachyura, Trichodactylidae), in Laboratory

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ABSTRACT

The knowledge on freshwater decapods behavioral aspects is scarce, mainly, with respect to representatives of the family Trichodactylidae from South American. Thus, this study aimed to describe the territory dispute behavior of the freshwater crab DilocarcinuspageiStimpson; that is a common decapod from the "Pantanal" in Brazil; and it has been used as bait in amateur fishery. Experiments were carried out with seven repetitions using only with male crabs of similar sizes (CW= 39.26± 3.46mm), which were put in pairs inside the enclosures. Experiments were conducted two situations as follows: first treatment - a pair of crabs inserted at the same time into a circular vessel containing bottom sand, gravel, and brick with two holes and a small fish muscle piece; second treatment - a pair of crabs inserted at different times (30 minutes after the introduction of the first crab), with the same variables as in the first treatment. Experiments summed twenty behavioral acts, classified in six categories as follow: feeding, vessel exploration, stopped, social interaction, aggressive acts and self-grooming. The results suggested their aggressive behavior is directly related with the presence of food or shelter. The observed interactions might represent dispute for shelter preventing predation in its natural environment. The natural predators of this crab are known as follow: Rostrhamussociabilis (the snail kite, familyAccipitridae) and fishes of the region, i. e., Pseudoplatystomapunctifer, Brycon sp. and Piaractumesopotamicus; which were fished using living crabs as baits by fisherman. Further detailed studies should be accomplished to estimate the natural density of this crab species, which may provide more robust answers in relation to territoriality degree, besides an evaluation of its conservation status in the nature.

Keywords:*freshwater, aggressive behavior, male' crabs, brachyuran, BrazilianPantanal.*

INTRODUCTION

According to Yeo *et al.* (2008), the global diversity of freshwater crabs is estimated around 1,476 species belonging to 14 families. Brachyuran crabs from freshwater environments are grouped into four super families as follows: Potamoidea, Pseudo Thelphusoidea, Gecarcinidae and Trichodactylidae. This last taxon includes crabs of the family Trichodactylidae, which are important components of aquatic biota in estuaries, rivers and lakes (Martin & Davis, 2001).

The family Trichodactylidae consists of 50 species, among which there is the crab *Dilocarcinus pagei*Stimpson, 1861, a species occurring naturally in many rivers of Brazil (Magalhães 2003). As most of crab species, this crab has a rigid carapace, which involves the cephalothorax; it has five pairs of pereiopods, being the first pair modified in chelipeds. The species *D. pagei* is, in general, omnivorous and benthic, inhabiting lotic and lentic systems and eventually, wetland environments, next to water bodies (Magalhães 1999).According to Morrone & Lopreto (2001), in the basin of the Paraguay River (biogeographic sub region of Chaco) occur only representatives of the family Trichodactylidae. Most oftrichodactylids occurring in Brazil inhabits rivers from plains, at altitudes below 300 meters (Magalhães, 1999). In the Upper Paraguay basin, including the Pantanal, according to Magalhães (2000) there are six species of trichodactylids recorded, as follows: *Dilocarcinuspagei*Stimpson, 1861;

*Poppianaargentiniana*Rathbun, 1905; *Sylviocarcinusaustralis*Magalhães&Türkay, 1996; *Trichodactylusborellianus*Nobili, 1896; *Valdivia camerani*Nobili, 1896 and*Zilchiopsisoronensis*Pretzmann, 1968.

Among these species, the most known from the biological point of view is *D. pagei* that has been investigated on several biological aspects. This species shows a wide geographic distribution in the central region of South America; in Brazil it has been registered at Amapá, Amazonas, Pará, Mato Grosso,Rondônia, Acre, Mato Grosso do Sul, São Paulo and Minas Gerais (Magalhães, 2003; Magalhães et al., 2005; Azevedo-Santos & Lima-Stripari, 2010).

The publications on the biology of *D. pagei* that stand out for the region of Pantanal (State of Mato Grosso do Sul, Brazil) are the following: taxonomic information provided by Magalhães (2003); relative growth by Mansur & Hebling (2002) and Mansur *et al*. (2005). With respect to the region of São José do Rio Preto (State of São Paulo, Brazil), several studies were accomplished on the aspects of population growth (Pinheiro & Taddei, 2005a; Taddei & Herrera, 2010); weight/width ratio and condition factor (Pinheiro & Taddei, 2005b); population dynamics (Davanso *et al*, 2013); and the juvenile development (Vieira *et al*. 2013). More recently, Sant'Anna *et al*. (2014, 2015) studied the behavior of adult specimens and the growth density of these crabs, from a population obtained in the State of Amazonas (Brazil).

In Argentina (Paraná River at Santa Fe), Senkman *et al*. (2015) carried out a detailed study on the mating behavior of three crab' species of the family Trichodactylidae, namely, *Zilchiopsiscollastinensis*Pretzmann, 1968, *D. pagei*, and *Trichodactylusborellianus* Nobili, 1896. Such study included details on the courtship, copulation, incubation, spawning and parental care (female); and a registration of forced copulation by *D. pagei*males, a record not yet observed previously that study.

There are relatively few studies worldwide on the behavioral repertoire of crustacean decapods. Some of them are the following: Griffin (1968) on *Heloeciouscordiformis*Milne Edwards, 1852 (Brachyura,Ocypodidae); Donaldson & Adams (1989) on *Chionoecetesbairdi*Rathbun, 1924 (Brachyura, Majidae); Stamhuis*et al*. (1996) on*Chionoecetesbairdi*Montagu, 1808 (Thalassinidea) and Kunz *et al*. (2006) on *Palaemonetespugio*Holthuis, 1949(Caridea).

Studies on crustaceans' behavior are fundamental understanding the relationships among species and the environment, or even, intra species, as they may be relevant for the conservation of populations (Sant'Anna *et al*., 2014). Considering the available knowledge about the trichodactylid crabs is limited, studies clarifying their biology are essential.

In the majority of fiddler-crab species (family Ocypodidae), for instance, individuals defend strongly their territories against intruders, but they often show little aggression towards neighbors, which are previously established (see Jaeger, 1981 for details).

Crabs use their chelipeds to prey, and after that to manipulate the prey; its loss or damage can reduce predation or foraging success (Smith & Hines, 1991; Juanes & Smith, 1995). Likewise, Marshall *et al*. (2005) discovered that small individuals of *Portunuspelagicus* Linnaeus, 1766 were most vulnerable than larger ones.

Studies about the behavioral repertoire and observations in laboratory may contribute to a better understanding of the biology of populations for which field study are difficult (Alcock, 1997; Del-Claro, 2004). With the scarcity of investigations involving Trichodactylidae species, we hope to contribute for a better understanding of the behavioral biology of these crabs, as well as provide a basis for comparison with other freshwater decapods.This study describes the behavior of male territorial dispute in *D. pagei*. We analyzed the behavior in two distinct grouping conditions: a) two individuals placed at the same time in the observation enclosure; and b) other two individuals being placed at different times in the observation enclosure.

Material and Methods

We collected crabs using professional bait scavengers, during August 2017, at macrophytic banks established in the Paraguay River, in the municipality of Porto Murtinho, State of MatoGrossodoSul, Brazil(21°38'16.23"S;57°55'38.95"W).

Only male crabs were used in the experiments, summing 15 adult individuals of similar sizes. Crab' sex was recognized by observation of the shape of the abdomen as follow: males have abdomen subtriangular, while females, semi-oval abdomen (Magalhães, 1991). Each individual used in the experiment was measured with a caliper (0.01mm) at its carapace width

(CW), propod length of the major cheliped (PL) and dactyl length of the major cheliped (DL), as shown inFigure 1. Only individuals used in the experiment showed intermolt stage and no damage, with respect to the whole body and appendages. Crabs were kept in a room temperature under natural photoperiod conditions. Feeding consisted of commercial fish feed (Nutricon Pet-Bottom fish), and natural feed such as fresh carrots, roots of *Salvinia sp*., macrophytes and aquatic grass roots obtained from at the sampling site.

Before each experiment, the crabs were acclimatized in a 500 liters water box containing macrophytes and bricks as shelter. During this period, they were foraged, preventing cannibalism during experiments. Each individual was marked with nail polish in the dorsal region of the cephalothorax, using small patches of different colors, which allowed individual recognition.

The experiments were conducted as follow:

- First treatment - a pair of crabs inserted at the same time into a circular vessel (60 cm diameter) containing bottom sand, gravel, and brick with two holes and a small piece of fish muscle to evaluate the dispute over territory, shelter and food.
- Second treatment - a pair of crabs inserted at different times (30 minutes after the introduction of the first crab), with the same variables as in the first treatment.

All treatments started at night, always at the same time; and each one lasts in 24 hours of observation with seven replicates executed randomly. Video recordings (Sony Cyber-shot 16.1 mp cam) were done for 30 minutes, when the crabs were inserted into the observation vessels (together or separately) and then, in three times a day (morning at 8:00am, afternoon at 04:00pm, and night at 00:00 am). Additionally, four fixed schedules (9:00am, 12:00, 5:00pm and 11:00pm) were stablished for short observation, without recordings to determine the activity peak of the species.

The observations in each treatment were performed by the sequence sampling technique. This is the type of sampling, which the order of events is important and the observation of an event occurs in stages (Del-Claro, 2004), such as the territorial dispute. According to studies accomplished by Azevedo-Santos & Lima-Stripari (2010) and Davanso (2011) crabs show cryptic and nocturnal habits. Thus, we began the experiments at midnight, one hour after they were inserted in the enclosures.

The behaviors were analyzed in relation to the number of actions performed in each observation, which were recorded and grouped into categories, described as ethogram, based on Zimmermann *et al*. (2009) and Ayres-Peres *et al*. (2011); and analyzed for their frequency. For data analysis, the sum of all the behavioral acts distributed in their categories in the seven repetitions was calculated. The amount of confrontations was counted at scale level (exhibit, grab and push).

According to Clark & Backwell (2017), the stage of "exhibition" was described as being the first stage and of lower level (the males face each other and wave their chelipeds); grab, as the highest level on the scale. This is because it occurs when they are already conflicting (males interconnect their chelipeds, cling and face each other) and the final stage in which males line their chelipeds to push themselves away.

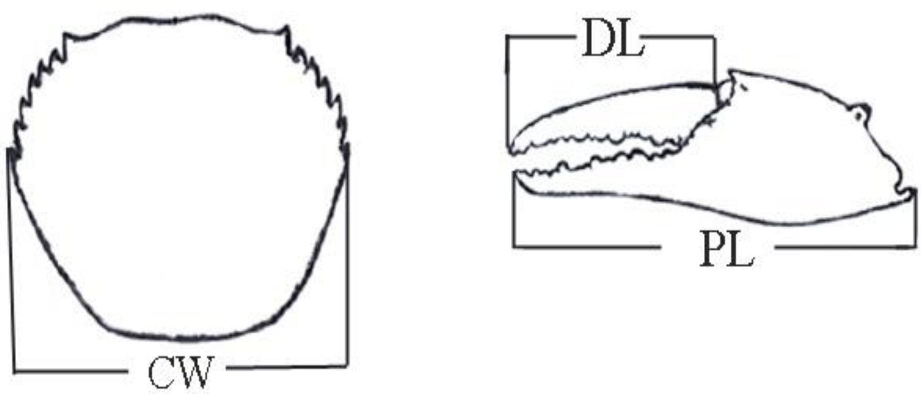

Fig1.*DilocarcinuspageiStimpson, 1861.* Dorsal view of a male specimen showing its carapace and its left cheliped. Carapace width (CW), propod length (PL) and dactyl length (DL) of the same cheliped.

RESULTS AND DISCUSSION

The average size (mm) of crabs used in the experiment was CW= 39.26 ± 3.46 mm; PL = 30.00 ± 6.30 mm and DL = 16.07 ± 5.13 mm. In a total, 42 sessions were conducted over 14 days, totaling 126 hours. During the experiments, the water temperature ranged from 12.1 to 32.2 °C and from 14.2 to 35.0 °C in the air.

Twenty behavioral acts were recorded, and classified into six categories: feeding, exploration, immobility, social interaction, aggressive acts and self-grooming (Tab. I). Self-grooming was the most common category of the first treatment, corresponding to a frequency of 29.06% of observations (Tab. II).

In the second treatment, the most common category was exploration with 22% (Tab. II). Crabs were more active in the second treatment (22% exploration, 16% immobility and 21.41% self-grooming; Tab. II) than in the first treatment (16.75% exploration, 21.73% immobility and 29.06 self-grooming; Tab. II).

In both treatments, the crabs were more active in the nocturnal period. Therefore, agonistic behaviors were also grouped in the nocturnal period (Fig. 3 and 4).

Crabs ate every time of food offer, independent of the photoperiod. Previous tests revealed that food should be offered several times a day to prevent mutilation and cannibalism occurred among individuals.

Dilocarcinuspagei presented strongly agonistic behavior marked by the use of the third maxilliped and chelipeds. The combats initiatedby approach and exhibition, progressing from a brief contact with repeated movements of chelipeds during a certain time.

Next, touch the opponent's carapace or chelipeds, using the chelipds to hold and immobilize the opponent (face to face).]After these initial acts, in many of the trials, the crabs invested in struggle, progressing to intense combat, which they both used the structures of their bodies (chelipeds, pereiopods and third maxillipeds) in an attempt to attack the other individual, or in some situations, one of them moves away from the opponent.

The patterns of aggressive acts described in this study are similar to those observed in other decapod crustaceans, such as freshwater crayfishes, lobsters, galatheid and porcellanidcrabs, which use their chelipeds to grab, attack, pull, and hold (because the well-developed chelipeds are important structures in the aggressive repertory of these crustaceans. In addition, to the activities displayed by male crab include avoiding combat, hitting with the pleon, fleeing, approaching, chasing, and contacts using antennae, such as whipping and touching (Molenock, 1976; Pavey & Fielder, 1996; Antonsen & Paul, 1997; Karavanich & Atema, 1998; Tierney *et al.*, 2000; Baeza *et al.*, 2002).The crabs in this study showed a high frequency of use of such appendices, which is usually reported as being a dominant attitude, among them, raising and/or spinning the opponent (Fig. 5). According to Ayres-Peres*et al*. (2011), specimens of *Aeglalongirostri* exhibited acts of low dominance, compared to the acts of dominance of *D. pagei.*

The figure 2 represents a comparison of the frequency between the two treatments. There was a higher percentage of agonistic contact in the second treatment, because the brachyuran had already settled in the habitat and, after that, an "intruder" was inserted. In this case, the dispute over territory was more pronounced.

In all the trials, the agonistic encounters occurred alwaysone of the individuals approached and made physical contact, probably causing a reaction in the opponent.

In five of the seven replicates of the first treatment, competition occurred between the individuals; and from five repetitions, in four of them the winner was the individual who initiated the combat. In the second treatment, from seven repetitions, only one of them there was no combat and the winner was always the individual that initiated the combat.

According to Briffa & Elwood (2004), who analyzed the use of energy reserves in hermit crabs combat, observed that individuals facing a potential struggle make a succession of decisions as the encounter progresses.

The same authors assumed that first, the individuals decide if they should begin the fight; this decision, in the first instance, will be taken by the initiator in the form of provocation or attack, but the non-initiator may be able to mediate the decision if it is possible to escape. After that, once the fight has begun, each competitor may have to decide whether to continue using more and more intensive or dangerous activities; and third, the competitor will decide whether to end the fight for quitting or attacking. Thus, the struggles are solved by a series of decisions that may differ between the two competitors.

Table1.*Dilocarcinuspagei*Stimpson, 1861. Description of the behavioral acts showed by male crabs, under laboratory conditions. Adapted from Zimmermann et al. (2009) and Ayres-Peres et al. (2011).

Behavioral categories	Behavioral acts
Feeding	**Stirring the substrate -**using the chelipeds and taking it to the maxilliped. (Crabs use the pair of cheliped to manipulate the food and take them to the third maxilliped and, than to the mandible. **Manipulating the food with the third maxilliped -**after taking the food to the maxilliped with the help of the chelipeds, crabsuse only the third maxilliped to manipulate the food up to the mandible to ingest it**.** **Moving away of other crab with food -**in the approach of another crab, the specimen moved away with the food with the third maxilliped, manipulating the food, or using one of the chelipeds.
Exploration	**Foraging -** fast or slow movement with all appendices (five pairs of pereiopods), or with the chelipeds flexed close to the body, sometimes moving the chelipeds to search food particles and in this act, stretch the chelipeds move itself. **Climbing the shelter -** use all pairs of pereiopods and chelipeds (first pair of legs) to pinch (grab) and support climbing and staying on top of the shelter. **Inside the shelter -** the specimens enter the shelter, laterally, with the appendices closed to the abdomen. **Next to the shelter (side) -** the specimens remained immobile on the side of the shelter with the chelipeds flexed close to the abdomen.
Stopped	**Inside the shelter -** the crabs remained motionless after entering the shelter. **Staying motionless, moving some of the appendices -** individual movements such as movement in the antennae, pedunculated eyes, pereiopods or maxillipedes. **Staying completely immobile -** absence of any movement.
Social interaction	**Friendly contact -** one specimen touches other crab with its appendices, or even remains at the side, but there is no sign of aggression. **Aggressive contact -** group of physical interactions between crabs represented mainly by interactions involving the use of one of the chelipeds (first pair of appendices) and ritualization (display, grasp, immobilize, push and dance of the appendices).
Aggressive act	**Size display of chelipeds, first agonistic act -** with the approach of another individual, a specimen lifts the pair of chelipeds (or first pair of appendices), stretches all appendices, and remains in this position until other crab moves away or initiates physical interaction. **Grabbing with the chelipeds, second agonistic act-** after the exhibition, individual who see advantage in the cost of an agonistic act, follows with the use of one of the chelipeds (without preference) against the other crab. **Immobilizing with the chelipeds -** the specimen uses the chelipeds to immobilize the other individual, both are face to face. Immobilization can result in the submissive crab being scaled by the dominant. Act can occur for minutes (counted by shooting), behavior can be a strategy to be followed by escape. **Pushing third agonistic act -** after the previous acts, to move depart away the specimens that the behavior of pushing the individual with the chelipeds and other pairs of legs, to escape (run away). **Dance of Appendices -** as the agonistic act occur the individuals make a back and forward movement with the pereiopods from left to right and with the chelipeds in display position (the other crab always ran away after the "dance").
Self-grooming	**Cleaning the antennae with the maxillipeds -**the crab passes the maxillipeds on the antennae cleaning them. **Passing the chelipeds in the cephalic appendices -** moving the chelipeds to the antennae or to the compound eyes. **Passing the chelipeds on the pereiopods and maxillipedes (2^{nd} and 3rd)-** movement of chelipeds to the pereiopods and maxillipeds (2^{nd} and 3^{rd})

Table2. *Dilocarcinuspagei*Stimpson, 1861. Frequency of observed behaviors in the seven repetitions of the first treatment (TRT-I), i. e., crabs inserted at the same time; and of the second treatment (TRT-II), i. e., crabs inserted in different times.Adapted from Zimmermann et al. (2009) and Ayres-Peres et al. (2011).

Behavioral categories	Behavioral acts	Frequency (%)	
		TRT-I	**TRT-II**
Feeding	Stirring the substrate	8.64	11.14
	Manipulating the food with the third maxilliped	5.76	4.99
	Moving away of other crab with food	1.31	0.59
	Subtotal	**15.71**	**13.78**
Exploration	Foraging	8.64	9.68
	Climbing the shelter	2.88	4.11
	Inside the shelter	1.57	2.64
	Next to the shelter (side)	3.66	5.57
	Subtotal	**16.75**	**22**
Stopped	Inside the shelter	1.57	2.93
	Staying motionless, moving some of the appendices	13.35	8.51
	Staying completely immobile	6.81	4.99
	Subtotal	**21.73**	**16.42**
Social interaction	Friendly contact	0.52	0.88
	Aggressive contact	1.82	3.81
	Subtotal	**2.34**	**4.69**
Aggressive acts	Size display of chelipeds, first agonistic act	4.71	7.62
	Grabbing with the chelipeds, second agonistic act	6.28	5.28
	Immobilizing with the chelipeds	1.04	2.05
	Pushing third agonistic act	1.84	2.64
	Dance of Appendices	0.52	1.17
	Subtotal	**14.4**	**18.76**
Self-grooming	Cleaning the antennae with the maxillipeds	23.56	14.66
	Passing the chelipeds in the cephalic appendices	3.66	2.05
	Passing the chelipeds on the pereiopods and maxillipeds	1.83	4.69
	Subtotal	**29.06**	**21.41**
	Total (sixbehavioralcategories)	**100**	**100**
	Total (twentybehavioralacts)	**100**	**100**

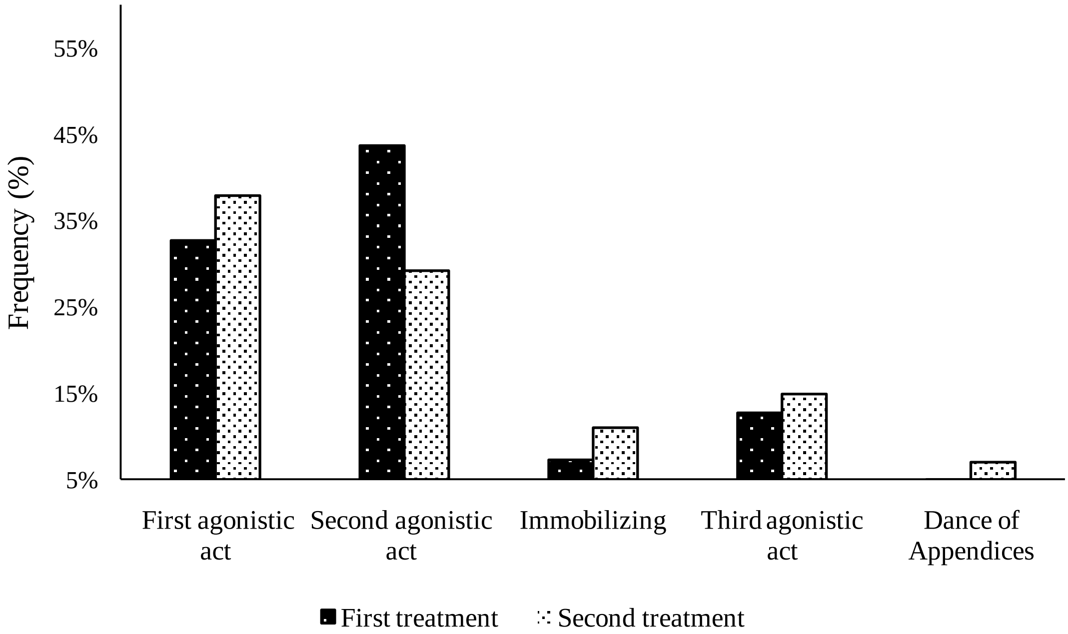

Fig2.*Dilocarcinuspagei*Stimpson, 1861. Mean frequency of the agonist behavior (category – Aggressive Acts, AT)comparative between both treatments.

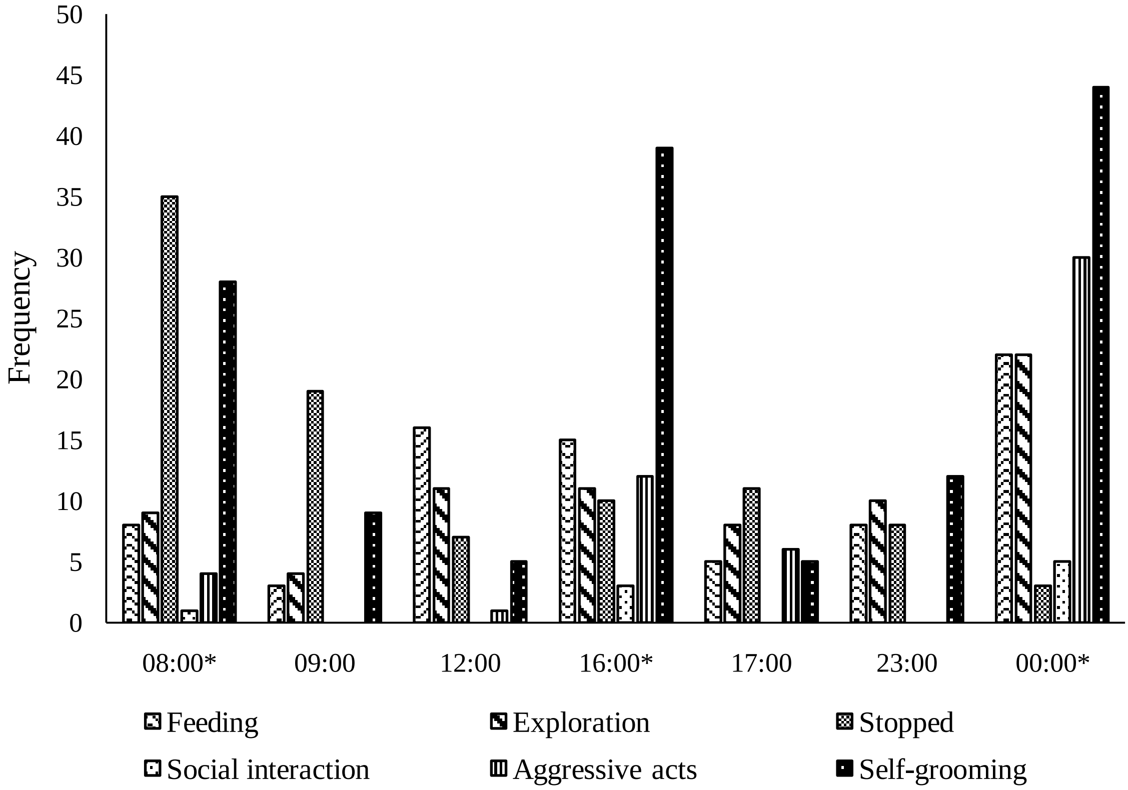

Fig3.*Dilocarcinuspagei*Stimpson, 1861. Activity peak of the observed behaviors in the seven repetitions of the first treatment(*short observation, to determine the activity peak of the species).

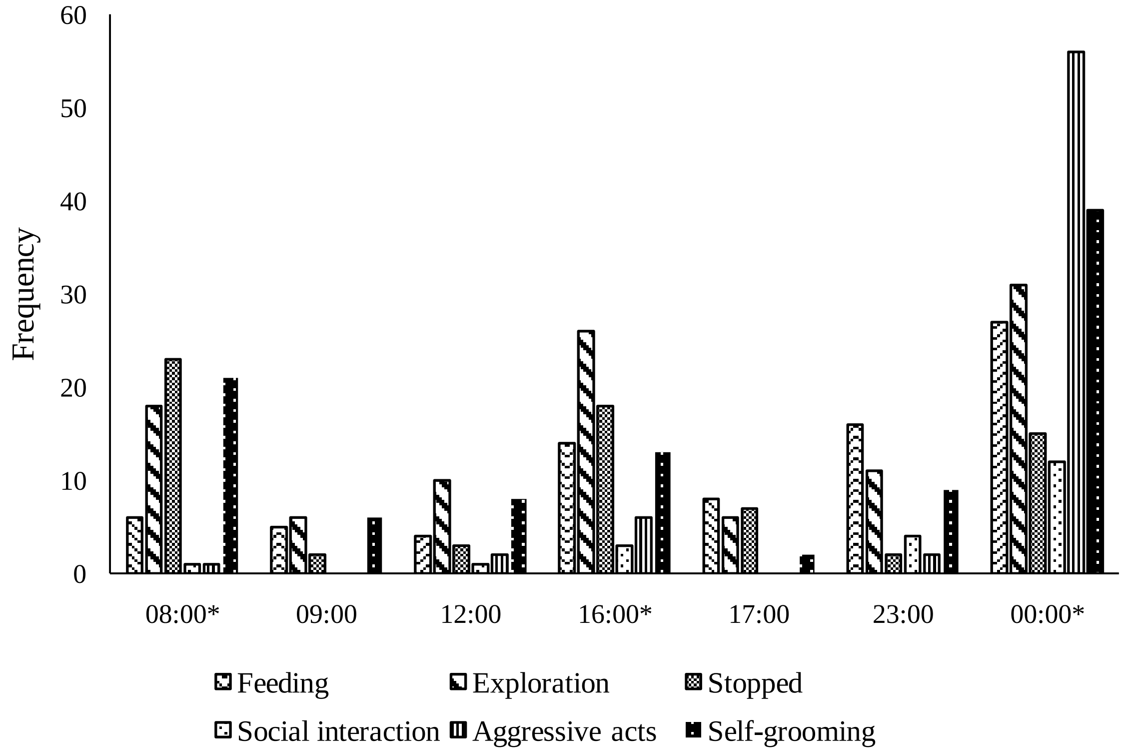

Fig4.*Dilocarcinuspagei*Stimpson, 1861Activity peak of the observed behaviors in the seven repetitions of the second treatment (*short observation, to determine the activity peak of the species).

Some differences were observed concerning the pattern of beginning of the dispute in some anomuran decapods. Molenock (1976) observed in a representative of the genus *Petrolisthes* that the first individual who frequently initiated an "approaching" and "beating with antennae" interaction continued to approach the battle. A similar pattern was observed by Ayres-Peres (2011) in *Aeglalongirostri*, in which combats initiated by the approach of an opponent. But the approach of this freshwater anomuran was followed by different behaviors, such as moving away from the opponent, or both males investing in more aggressive contacts (with chelipeds), always with the use of the antennae. On the other hand, Antonsen & Paul (1997) did not observe consistent antennae movements at any time during agonistic interactions in the marine anomuran*Munidaquadrispina* Benedict, 1902.

The behavior of *D. pagei* did not differ among previous decapod species cited here, regarding the movement of the antennae.

The crab moved its antennae more often as it was partially immobile or self-cleaning; and in all the observed agonistic acts, the individuals used the antennae (which are sensorial appendage) and used the third pair of maxillipeds (which are mechanical structures).

Freshwater decapods often participate in struggles to obtain resources such as shelter and food.

The factors that determine the outcome of these struggles include size, sex, past experience; and also whose individual initiates the combat (Bovbjerg, 1956; Scrivener, 1971; Rubenstein & Hazlett, 1974; Guiasu & Dunham, 1997; and Issa *et al*. 1999).

In the present study, shelter and food availability were factors that may have influenced *D. pagei*'s struggles. According to Zimmermann *et al*. (2009), was also observed for the freshwater crab *T. panoplus*, in which most of the disputes were related to feeding and to the substrate site.

The initiating factor starting the combat, apparently, was extremely important in deciding who would win. Ahvenharju & Ruohonen (2007), in their observations on the freshwater crayfish*Pacifastacusleniusculus* Dana, 1852,

reported that the initiator won most encounters, even when there was no size difference between opponents. In *D. pagei*, the approach behavior may be a good indicator of a male's ability to dominate others, or other factors such as the sequence of acts, the frequency of "dance" and endogenous factors such as hormones, which may contribute to determining the outcome in combat.

Studying *M. quadrispina*, Antonsen & Paul (1997) observed that no consistent movement or action preceded the appearance of aggressive exhibition. Ayres-Peres *et al*. (2011) observed that individuals showed bodies lifted from the substrate, while the abdomen was slightly flexed.

The first behavior occurred while the individuals were distanced.

It consisted in holding the chelipeds in front and intermittently shaking them rapidly horizontally. Such procedure seemed to be an exhibition warning.

The second way of aggressive behavior, i.e., the behavior raising chelipeds, occurred when individuals were close or in contact, rarely grasping.

Aggressive behaviors ended when an individual retreated or clearly showed it submissive, or when both lost interest. Based on the results obtained here, it is verified that *D. pagei* presented the pattern of agonistic behavior similar to those observed by Ayres-Peres *et al.* (2011) for *A. longirostri*.

The behavioral and agonistic acts described in this study are similar to those observed in other crustaceans, such as freshwater crayfish, lobsters, crabs, which use their chelipeds to pinch, attack, pull and hold (since developed chelipeds are important structures in the aggressive repertoire of these crustaceans).

In addition to acting, even avoiding combats, they hit the abdomen, fleeing, approaching and pursuing the opponent, as well as making contacts using antennae, such as hitting and touching (Molenock, 1976; Pavey & Fielder, 1996; Antonsen & Paul 1997; Karavanich & Atema, 1998; Tierney *et al*., 2000 and Baeza *et al.* 2002).

There is also a record of a crab climbing on its opponents (Sneddon *et al*. 1997), in the same way as observed for *D. pagei* (Fig. 5).

The results showed that *D. pagei* presents a series of defined behavioral acts.

Many of these acts are similar to those described for chelated decapods.

However, some peculiarities were observed, such as during the *D. pagei* combats that climbed up in the adversary and in other cases in which did a ritualizing dance in a "come and go" movement, vertically with its chelipeds.

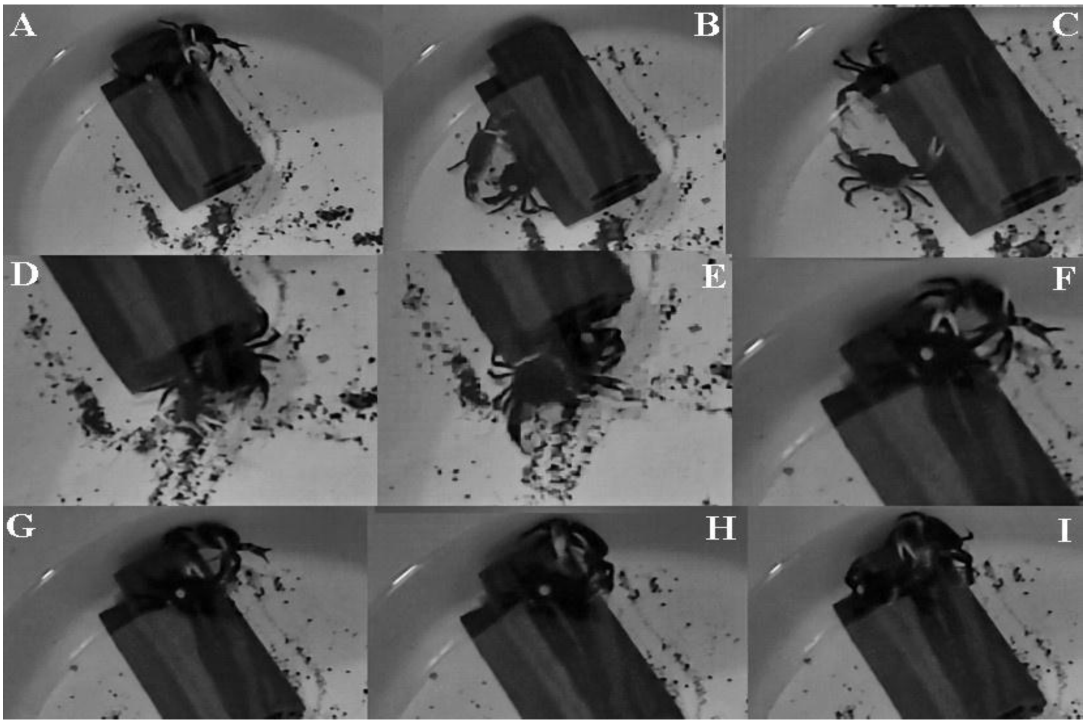

Fig5.*Dilocarcinuspagei*Stimpson, 1861. Selected photographyof thevideos, which documented theagonistic behavior of male crabs. A-C, Display of the chelipeds size, grasping other crab with chelipeds, second agonistic act and stopping other crab with chelipeds; D-E, Climbing on the enemy ; F-I, Fight, followed by food capture.

Conclusion

There is little information on the behavioral aspects of freshwater crustaceans in South America and, considering the results obtained here, we conclude that the aggressiveness of *D. pagei* is outstanding in evidencing disputes over shelters and/or burrows and food. They are territorial crustaceans, given the frequency of the agonistic acts that were superior in the first treatment, in which the individuals were inserted at different times. Such behaviors may be related with crabs' interaction in the natural environment where they live, close to the roots of the aquatic plants or in the dispute over shelters against natural predators.For instance, we can point outsome animals, which prey on *D. pagei* are as follow: *Rostrhamussociabilis* (popular name, the snail kite, familyAccipitridae), whose representatives feed on crabs during the rainy season (from January to April), when their preferred prey, snails are scarce (Heming & Jezuíno, 2016); and fishes of the region, i. e., *Pseudoplatystomapunctifer*,*Brycon* sp., and *Piaractusmesopotamicus*; which were fished using living crabs as baits by fisherman(Machado, 2003).Further studies estimating the density of this species could provide more robust responses in relation to the degree of territorialism of the same species.

This study, as by Zimmermann *et al*. (2009), who evaluated the behavioral repertoire of *Trichodactyluspanoplus*, is one among a few that evaluate the behavior of freshwater crabs in laboratory. Many questions about the behavior of *D. pagei* remain unanswered, and some peculiarities observed as the "dance of the appendages" may be related to the reproductive behavior in courtship and copulation phases, and may be divergent from other species. With the scarcity of studies on Trichodactylidae crabs, we to provide here some basis for comparison with other freshwater crustaceans that can contributes to a better understanding of the behavioral biology of these decapods.

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