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## Feather picking in pet parrots: sensitive species, risk factor and ethological evidence

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### ABSTRACT

The goals of this study were to estimate the prevalence of feather picking (FP) in Italian pet parrots and evaluate the risk factors and possible ethological correlation. A web survey was created and addressed to owners of all species of companion parrots, distributed through on line parrots association websites, social networks and by mail. The survey was available for compilation from June to October 2014. In 292 compiled surveys, 20 different parrots genera were indicated; *Psittacus* spp. (24.3%), *Agapornis* spp. (19.5%), *Nymphicus hollandicus* (18.0%) and *Amazona* spp. (9.0%) were the most represented species. Our study showed a FP prevalence of 17.5%, with the highest prevalence in *Agapornis* spp. (26.3%) and *Psittacus* spp. (22.5%). Living with other parrots was positively associated to FP ( $p < 0.05$ ), such as being fed in neonatal age and weaned by the breeder and not by the final owner ( $p < 0.001$ ). Moreover, 2.9% of non-FP parrots and 10.0% of FP parrots lived always caged ( $p = 0.06$ ). A significant difference in the feather picking site was detected ( $p < 0.001$ ). The most affected body region was the chest (58.8%), followed by the rump (41.2%) and under wing regions (25.4%). At the same time, we conducted another study to better understand some information from the hand-raised parrots through a comparison with the parent-raised parrots. We recorded 1488 parent-raised parrots, and only 1.3% were affected by feather loss. This finding confirm that FP is be considered a multi-factorial behavioral pathology in which factors of different origin may cause behavioral disorders associated to self-injuries.

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## Introduction

Feather picking (FP), also referred to as feather damaging behavior or feather plucking, is a behavioral disorder that is frequently encountered in captive parrots (van Zeeland et al. 2009). FP includes plucking, chewing, fraying and/or biting, and it results in the loss of or damage to feathers (van Zeeland et al. 2013). Many authors consider it as stereotypic behavior or an obsessive compulsive disorder (Jenkins 2001), and has been observed in a variety of captive species with differing levels of prevalence and severity (Chitty 2003, 2005; Seibert 2006). Grindlinger (1991) estimated that approximately 10% of the captive parrot population suffered from FP, but other works have reported contradictory data. McDonald Kinkaid et al. (2013), in a sample of 538 parrots, found a prevalence of 15.8%. As claimed by Rubinstein and Lightfoot (2012), the problem about understanding FP mechanisms is related to

the relative scarcity of controlled studies on the underlying causes of feather loss in pet avian species and the paucity of current veterinary medical knowledge regarding feather loss and feather destructive behavior. In fact, despite the numerous studies that have been conducted, there is not yet agreement among the scientific community on what the factors are that determine the appearance of this manifestation of discomfort and what the mechanisms are that modulate its expression. Lumeij and Hommers (2008) considered that FP may be the result of redirected foraging behavior. In his studies, the author showed a decrease in FP when the environment was enriched and foraging activity was promoted. However, the removal of feather is regarded as self-mutilation. In fact, one of the criteria that have allowed researchers to make a distinction between FP and other diseases, is the presence of feathers in good condition in areas of the body not directly reachable by the birds (Galvin 1983;

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Harrison et al. 1986; Westerhof & Lumeij 1987). Nevertheless, in many cases, there is also a loss of plumage in areas that cannot be reached by the birds, which has uncertainly been attributed to clinical causes. It is widely thought that FP is usually self-inflicted, but, when birds are housed in groups, in some cases it can be directed to cage mates or nestlings. In these circumstances also the head and face are affected (Wedel 1999; Fox & Millam 2004; Lightfoot & Nacewicz 2006) and this behaviors appear more similar to hair pulling, whiskers eating and barbering observed in mice (Garner et al. 2008).

The aim of this study was to estimate the prevalence of FP self-mutilation expression in the Italian population of pet parrots, but also of determining the most sensitive species and evaluating the risk factors. Another objective was to compare the prevalence of FP in pet parrots with the prevalence of FP in parent raised type parrots held in captivity, which had not been hand-raised and which lived in couples with the possibility of reproducing. We used a web questionnaire as data-gathering tool, in order to collect data from a wide study population across Italy.

## Materials and methods

A web questionnaire, addressed to the owners of all species of pet parrots, was distributed throughout Italy through on-line parrot association sites, social networks and e-mails. The web questionnaire was drawn up through a Google Drive application. This questionnaire was on line from June 2014 to October 2014 and a total of 31 questions were created. The title of the questionnaire was 'Questionnaire for companion parrots owners' and the participants discovered that there was a feather picking part only during the compilation. The questionnaire was divided into two parts: one addressed to all parrot owners and the second to the owners of feather plucking parrots. The first part of the questionnaire was divided into two section. First sections was on general information (name of owner, contact details, parrot species, age, etc.), while the second section was dedicated to information about the history and management of the parrot. The second part of the questionnaire, on the feather picking information, featured appropriate questions about feather picking parrots, such as behavior, stereotypic behavior, feather picking regions, etc. All the owners who filled in the questionnaires about their feather plucking parrots were followed by the owners' clinician veterinary who had diagnosed the problem and excluded other possible pathologies. In order to confirm their diagnoses,

all the veterinarians were contacted to obtain verbal confirmation of the data. The questions were based on hypothetic risk factors for feather picking and were formulated on data and hypotheses published on this subject. Any incomplete questionnaires (e.g. the absence of the owner's name or contact details, the species of the parrot, etc.) were excluded from the analysis. The questionnaire contained closed questions. The owners, after choosing among the possible closed answers, could provide a descriptions about its observation and this data were analyzed for evaluated objectively the answers. The questions about behavior observation were only in FP section and were created for to be simples, not interpreted by owners and directly linked to data that we wanted to get. The choice of terms and words to describe the abnormal behavior were based on the description of the movements that abnormal behavior show, on the basis of the descriptions currently available in the literature. The question about aggressiveness were created in according to actually knowledge on aggressiveness in companion parrots. The possible choices were linked to only aggressiveness type: dominance aggressions over the owner (specifying to which human family member) and dominant behaviour towards conspecifics (Schmid et al. 2006), that the participants could further describe in 'other' section. Also sexual behavior questions were created with this methods. In Table 1 the overview about the FP questions.

In order to have a control sample and verify any differences between hand-raised and parent-raised parrots (those kept in pairs and not hand-reared), a second questionnaire, addressed to parent-raised type parrot breeders, was created. The aim was to have a comparison parrot group of birds that had not been hand-reared and which were living in more suitable ethological conditions (they were living with a conspecific partner and had the opportunity to reproduce). Nine questions were asked about the number of parrots present on the farm, their species, and on the number of animals showing signs of feather loss.

All the data acquired from the questionnaires were registered in a database and analyzed. Genera prevalence, feather picking region prevalence, and any associations between the feather picking behavior and categorical risk factors were evaluated using the chi-square test, and were considered to be significant when  $p < 0.05$ . A statistical trend was considered for  $p$  values below 10%. The data were processed through the use of SAS<sup>®</sup> (Statistical Analysis Software). The results were presented with their  $p$  value and a 95% confidence interval (C.I.).

**Table 1.** Overview of 31 questions of questionnaire for pet companion parrots.

First part – addressed to all pet parrots
<b>General data</b>
Name, address, email address and phone
<b>Parrots curriculum</b>
Age, sex, ringed, feather picking or not
<b>Social life</b>
Hand-rearing method
Weaning with other chicks or not
Live with other parrots
Hand-rearing history
<b>Management</b>
Management method (lives caged when owners absent; lives always free; lives always caged, live always in home or live too in garden)
Placement of the cage (indoor; outdoor; indoor in winter and outdoor in summer; parrot management climate depending)
Perches materials (plastic; wood; natural branches; metal and other)
Use of environment enrichments (parrot's toys, natural items or either; nothing)
Possibility of washing (every day; at least two time/week)
<b>Diet</b>
Diet (mainly dry seed, mainly fresh feed or either in equal parts)
Eat extruded feed (always; many times in weeks; don't administered; it don't eat them)
Eat human food (always; sometimes in week; rarely and never)
<b>Second part – addressed to feather picking pet parrots</b>
<b>Knowledge</b>
What is the feather picking for participants (virus disease; bacterial disease; fungi disease; abnormal behavior; don't now)
<b>Beginning of feather picking</b>
Events linked FP before feather loss (owner change; other animals attack; change in number of human family; added or disappeared other parrots; no events; parrots adopted FP already)
Feather loss (owners seen feather traction; owners seen body's regions without feather; owners seen increase in time of preening; increase aggressiveness; other)
<b>Signal of feather picking: presence and evolution</b>
Body's areas (chest; rump; wings; tail; under wing regions; paws; head)
Feather picking evolution (start to biting and damaging feather; immediately start to traction feather; immediately compared body's regions naked; increase aggressiveness behavior it-self, such as peck it wings or other parts)
<b>Sexual behavior</b>
Sexual behavior showed (It is displayed on perches or objects in the birds' surroundings or parts of human body; in owners presence parrot regurgitates; owners don't seen sexual behaviors; other)
<b>Aggressiveness</b>
Presence of aggressiveness (bites owners hands; the parrots assumes an attack posture and tries to come in against to bite; don't presence of aggressiveness; other)
Victim of aggression (everybody; only owners; toward everybody except owners; toward only person; other)
<b>Self-injuries behavior</b>
Presence of self-injuries behavior (slaps it-self; bite it wings; it traction feather in nervous expression when the owners or any human approaches; bite it feet; other)

## Results

### General data returned

A total of 335 surveys was obtained, of which 292 (87.2%) were useful for the statistical analysis and all regions of the country were represented. The acquired data referred to 20 different genera of parrots (Table 2) kept as pets distributed throughout all the regions in

**Table 2.** Parrot genera represented in our studied population ( $n = 292$  parrots) and percentage of feather picking parrots in each genus.

Genus	Prevalence of population, %	Feather picking, %	(95% CI)
<i>Psittacus</i> spp.	24.3	22.5	12.8–32.2
<i>Agapornis</i> spp.	19.5	26.3	14.9–37.7
<i>Nymphicus</i> spp.	18.0	7.6	0.4–14.7
<i>Amazona</i> spp.	9.0	15.4	1.5–29.2
<i>Ara</i> spp.	6.5	15.8	0.0–32.2
Other genera <sup>a</sup>	22.7	–	–
$p$	–	0.09	–

<sup>a</sup>Other genera each represented below 5% prevalence: *Aratinga*, *Cacatua*, *Cyanoramphus*, *Diopsittaca*, *Eclectus*, *Eolophus*, *Eos*, *Melopsittacus*, *Myiopsitta*, *Nandayus*, *Pionus*, *Psephotus*, *Psittacula*, *Poicephalus*, *Trichoglossus*.

Italy, genera representing less than 5% prevalence were not presented in the table. The most popular species kept as pets are *Psittacus erithacus* (24.3%), *Agapornis* spp. (19.5%), *Nymphicus hollandicus* (18.0%) and *Amazona* spp. (9.0%). In the sample, 40.2% of the parrots were female and 59.7% male.

In regards to breeding, 80.2% of the parrots have been hand-reared; in particular, 41.8% were fed at the neonatal stage, by the breeder and weaned by the buyer; 38.4% were fed at the neonatal stage and weaned by the breeder and was then sold when weaning had been completed (Table 3). It emerged that 84.3% of the parrots were caged when the owners were absent and left free when they were present and that 66.4% of the pet parrots were left free from 1 to 6 hours/day; while lives always caged 4.1%. Most of the roosts were made of wood (43.1%), 22.7% were natural branches and 21.6% plastic perches. It was also found that 90.4% of the parrots were able to wash their plumage every week, because the owners nebulized their bodies or put special bowls with water into their cages or near their roosts. As far as eating habits are concerned, 40.4% of the birds eat dry seeds and fresh vegetables in equal amounts; 23.5% eat more dry seeds (4 times a week) than vegetables. As for extruded feed consumption, 37.9% of the birds were not fed this type of feed, because the owner does not provide it or the parrots do not like it. Finally, 71.2% of the birds were occasionally or regularly fed human food (e.g. cookies, bread, yogurt, meat, etc.) (Table 3).

### Feather picking general data, prevalence and symptoms

This study has shown a FP prevalence rate of 17.5% (Table 3). A statistical trend showed that FP has been found to mostly affect males (70% of the FP parrots,  $p = 0.10$ ) (Table 3). It has emerged that 52.9% of the owners stated that the birds had not suffered from

**Table 3.** Variables investigated in the sampled Italian pet parrots ( $n = 292$ ) population and in Italian feather picking parrots ( $n = 51$ ) of the sample.

Variable	% Prevalence (95% CI)
<b>First part (<math>n = 292</math>) – addressed to all pet parrots</b>	
<b>Social Life</b>	
Lives with others parrots	46.2 (40.5–51.9)
Lives alone	52.74 (47.0–58.5)
Grew up alone	21.6 (16.9–26.3)
Grew up with other chicks	71.0 (47.4–58.9)
Hand-rearing and weaned from breeders	38.4 (32.8–43.9)
Hand-rearing from breeders and weaned from owners	41.78 (36.1–47.4)
<b>Management</b>	
• Lives caged when owners absent	84.3 (78.6–87.2)
• Lives always free	11.7 (8.0–15.3)
• Lives always caged	4.0 (1.9–6.4)
• Lives always in owners home	83.0 (78.6–87.2)
• Lives outdoor	4.8 (2.3–7.2)
<b>Cage enrichments</b>	
<b>Materials of roosts:</b>	
• Wood	43.1 (37.4–48.8)
• Plastic	21.6 (18.9–27.0)
• Natural branches	22.7 (18.0–27.4)
• Other materials	11.3 (7.7–15.0)
<b>Other information:</b>	
• Presence of toys and natural object	89.7 (86.2–93.2)
• Possibility of bathing water	90.4 (87.0–93.7)
<b>Environment</b>	
• Lives in home and outdoor	83.0 (78.6–87.2)
• Lives always in closed	25.3 (20.3–30.3)
<b>Diet</b>	
• Eat human food	71.9 (66.7–77.0)
• Eat dry seed and vegetables in equal quantities	40.4 (34.8–46.0)
• Eat extruded feed	60.6 (55.0–66.22)
<b>Second part (<math>n = 51</math>) – addressed to feather picking pet parrots</b>	
<b>Feather picking</b>	
• Prevalence <sup>a</sup>	17.5 (13.1–21.8)
• Male	70.0 (55.8–84.2)
• Female	30.0 (15.8–44.2)
• No episode linked feather picking	52.9 (39.2–66.6)
• Removal of plumage without feather damage	33.3 (20.4–46.3)
• Sexual behaviour	45.1 (31.4–58.7)
• Aggressive behaviour	60.7 (47.4–74.2)
• Self-injury behaviour showed	39.2 (25.8–52.6)
• Owners claim that feather picking is linked to behavioral disorder	98.0 (94.2–100.0)

<sup>a</sup>Calculated on the whole sampled Italian pet parrots population ( $n = 292$ ).

episodes that could have caused FP, such as trauma, fear or changes in family. A significant difference in the feather picking site was detected ( $p < 0.001$ ). The most affected body region was the chest (58.8%), followed by the rump (41.2%) and under wing regions (25.5%) (Table 5). It has emerged that 98.0% of the FP parrot's owners consider feather picking to be a behavioural disorder. This study has not shown any link between type of diet and abnormal behavior.

### Sensible species

A statistical trend ( $p = 0.09$ ) was observed in differences among FP prevalence in parrot's genera, the

**Table 4.** Risk factors associated with the feather picking behavior in the sampled Italian pet parrots population ( $n = 292$ ).

Risk factor	Healthy pet parrots, % ( $n = 241$ )	Feather picking pet parrots, % ( $n = 51$ )	$p$
Living with other parrots	42.7	62.7	$< 0.01$
Hand-rearing and weaned from breeders	42.3	82.0	$< 0.001$
Hand-rearing from breeders and weaned from owners	57.7	18.2	$< 0.001$
Lives always caged	2.9	10.0	0.06

**Table 5.** Areas of the body that are mainly pecked or plucked in feather picking pet parrots ( $n = 51$ ).

Regions	Prevalence, %	CI
Chest	58.8 a	(45.3–72.3)
Rump	41.2 ac	(27.7–54.7)
Under wing regions	25.4 bc	(13.5–37.4)
Wings	21.6 bcd	(10.3–32.9)
Feet	21.6 bcd	(10.3–32.9)
Tail	19.6 bd	(8.7–30.5)
Head	7.8 d	(0.5–15.2)
$p$	$< 0.001$	–

a–d:  $p < 0.05$ .

highest prevalence was reported for *Agapornis* spp. (26.3% of the FP) and *Psittacus* spp. (22.5%) (Table 2).

### Imprinting, neonatal age and grow-up

The 82.0% of FP parrots and 42.3% of non-FP parrot ( $p < 0.001$ ) were fed and weaned by the breeder after birth and were then sold after weaning had been completed. By contrast the 18.2% of FP parrots and 57.7% of non-FP parrot ( $p < 0.001$ ) were fed after birth by the breeder and weaned by the owner (Table 4).

### Age

The average age in all FP parrots were 82 months; in particular, in sensible species, were *Agapornis* spp. 60.5 months, in *Psittacus* spp. 75.4 months and in *Amazona* spp. 78 months. In one case the age was not known (*Agapornis roseicollis*); all other cases were sexual mature.

### Aggressiveness, abnormal and sexual behavior

In regard of abnormal behavior, 64.6% of the parrot owners claimed they had seen their parrots pulling at their feathers; 51.0% of the owners observed abnormal behavior before the birds attempted to remove their feathers (e.g. feather chewing and biting, increase aggressive behavior and self-injuries), but others reported a sudden appearance of feather removal behavior (48.9%). Of the feather picking parrots, 50.0%

showed behavior stereotypes and most sexual behavior disorders observed was feed regurgitation in front of the owner (30.5%); aggressiveness was observed in 60.7% of case. Other self-injuring behavior (such as biting their legs, hitting their face, etc.) was observed in 39.2% of the feather picking parrots. In general, FP frequency has been shown to vary according to the parrot species.

### **Environments and human relationship**

The 62.7% of FP parrots and 42.7% of non-FP parrot ( $p < 0.01$ ) live with another parrot (Table 4). Moreover, 2.9% of non-FP parrots and 10.0% of FP parrots lived always caged (Table 4), and this difference show a statistic trend ( $p = 0.06$ ).

### **Parent-raised type parrots data**

At the same time, we conducted another study to better understand some information from the companion parrots through a comparison with the parent-raised type parrots (genera: *Nymphicus*, *Agapornis* spp., *Amazona* spp., *Ara* spp., *Psittacus* spp.). With the help of the second questionnaire, 18 parrot breeders were found with 1488 parrots in the most suitable ethological conditions (not hand-reared, not alone and with the possibility of reproduction). Of these 1488 parrots, only 19 birds showed feather loss (1.3% of the parent-raised type population).

### **Discussion**

The use of web questionnaires to collect data in surveys can be a limit since they suffer response bias (Dohoo et al. 2003). However, our questionnaire attained a good response rate, enabling a valid data collection from a wide study population.

Given the nature of the conduct underlying the FP brought to light by the present data, it is possible to consider the damage and the removal of the plumage as a behavioral pathology, in which factors of different origin (aberrant imprinting, hand-rearing techniques, environment isolation, sexual frustration) can cause behavioral changes that give rise to the manifestation of quite similar abnormal behavior to that of the common forms of self-injury. On the other hand, the relationship between emotional stress and self-injury is also seen in captive non-human primates and Bordnick et al. (1994) compared feather-picking behavior in parrots to compulsive and impulsive human disorders, such as human trichotillomania. In other animals it has been observed that self-injuring rhesus macaques

display greater emotional responsiveness than their non-injurious counterparts do (Novak 2003), and the stress of relocation to novel housing has been shown to produce long-lasting increases in self-biting behavior in these animals (Davenport et al. 2008).

### **Feather picking general data and sensible species**

FP is a behavioral disorder that is frequently encountered in captive parrots (van Zeeland et al. 2009). Many authors have shown relatively low FP rates (10% Grindlinger 1991; 13% Gaskins & Bergman 2011), but the present results are similar to those found by McDonald Kinkaid et al. (2013) who determined a FP prevalence rate of 15.8%. The present survey suggests that the prevalence of FP in Italian parrots is 17.5%. This prevalence was much higher than in parrots bred in more ethologically suitable conditions (1.3%), i.e. those bred from biological parents, were living in a couple and without direct human contact. Such a finding could suggest that the hand-rearing of parrots may be a risk factor for the development of FP, together with other living conditions of pet parrots.

The present results, in agreement with these authors, show FP in 22.5% of *Psittacus* spp; in the sample of *Cacatua* genus the prevalence of FP was high (40%), but the sample was small (2% of the parrot population; data not shown in the table). Our results show that the *Agapornis* genus is also sensitive to FP (26.3% prevalence). *Agapornis* spp. has become a very popular pet parrot in Italy in the last few years. This data suggest that the species may be a risk factor for FP onset.

### **Post natal period and sexual behaviour**

The mean age of the FP parrots examined in our study was 82 months; this observation is supported by van Hoek & Ten Cate (1998), who reported that most of the birds showed significant behavioral distortions upon reaching sexual maturity. Many authors agree that FP is more common in African grey parrots (*Psittacus* spp.) and in the *Cacatua* genus (Chitty 2003; Rosenthal et al. 2004; Garner et al. 2008; van Zeeland et al. 2009, 2013).

This difference between FP parrots and non-FP parrots could be determined by the imprinting process that evolved during the hand-rearing period. In particular, the sexual imprinting (which develops later than parental imprinting) may play a role in the onset of FP. Sexual imprinting refers to the process by which animals learn the characteristics of appropriate mates by learning the characteristics of their parents or

siblings (Fox 2006). FP often develops after the onset of sexual maturity (Wedel 1999) and the data recorded in this study confirmed this thesis. In fact, on the average, the age of the two sensible species was 60.5 months in *Agapornis* spp. and 75.4 months in *Psittacus*. Sexual maturity is reached earlier in budgerigars, at 5 months (Kavanau 1987), while many of the large-bodied species of cockatoos, do not reach sexual maturity until approximately four to five years of age (Forshaw 1981). These data could be also confirmed from the observation of the behavior of the birds by the owners: those who had observed sexual behavior directed toward humans claim that the most frequent habit was food regurgitation (30.5%). In fact, food regurgitation is typical sexual behavior in parrot couples (courtship feeding or allofeeding, Spoon 2006) and this fact leads to the hypothesis that FP parrots show redirected sexual behavior due to a lack of partner, in according to Lantermann (1989) that claim that this behaviour is the expression of the parrots' sexual frustration. This hypothesis is based on the fact that parrots probably develop sexual imprinting toward humans during the hand-rearing or weaning period. According to Fox (2006), these results confirm that an abnormal sexual imprinting and a strong social preference for humans may cause behavioral problems in hand-raised parrots, which are probably more likely to inappropriately direct sexual behavior toward their owners and the presence of other parrots don't change this preference. In addition, our results showed that the parrots that are more in contact with humans showed higher prevalence of FP than the parrots that live always in cages. In addition, it seems that FP mostly affects males (70% of the FP parrots). Jayson et al. (2014) considered that the sex of the bird was a significant factor in the occurrence of FP. Fox (2006) suggested that hand-rearing apparently influences sexual imprinting in males more strongly than in females.

Although popular literature suggests that hand-raised parrots make better pets than parent-raised parrots (Blanchard 1999), hand-rearing has the potential of producing physical as well as behavioral problems in parrots (Harcourt-Brown 2004). Different methods of breeding can affect the onset of behavioral problems, such as FP, to a great extent (Lightfoot 2002). This indicates that various hand-rearing techniques could influence the prevalence of FP and that is reduced if the sexual imprinting is directed to the final owner (this is possible if the final owner is responsible of the last phase of hand-rearing). In particular, it is probably the imprinting mechanism that causes the bird to deviate incorrectly. In the course of the classical sensitive phase in early development of zebra finches, the birds

establish a social bond with their parents. Under normal circumstances, this narrowing of social preference to the parent species guides young male zebra finches in their first courtship attempts when they are sexually mature (Oetting et al. 1995).

### **Environment and human relationship**

As already observed by Jen-Lung Peng et al. (2014), inadequate socialization may be a factor of feather picking in some birds. They claim that using conspecific rather than human exposure do not have effect on FP reduction. Our results showed that the presence of other parrots in the same environment was more high in FP parrots (62.7%), compared to non-FP parrots (42.7%). Preiss and Frack (1974) and van Zeeland et al. (2009), claimed that these abnormalities in behavior resulted from the isolation of hand-raised birds during the fledgling period, which fail to become integrated into a conspecific social group later on. If parrots construct their sexual imprinting to humans (in absence of other parrots during the weaning period) they can develop an adaptation to human that does not find the same stimulatory satisfaction.

### **Conclusions**

This study has shown that there is a significant prevalence of FP in Italian pet parrots. Many species are sensitive to this abnormal behavior and, in particular, the most common genus sensitive to FP is *Agapornis*. The collected data suggest that FP can be caused by the imprinting process during the fledgling period and we could hypothesize that sexual frustration plays an important role in developing FP. For these reasons, it is proposed that FP should be termed Parrot's Self-Damaging Neuroses. As FP is a distinctly pathological condition related to captive-kept parrots, as shown by our study, it is quite likely that defective environmental stimuli, aberrant imprinting and a lack of sexual satisfaction and reproduction could lead to a higher incidence of the onset of the disease. In fact, it is possible to ascertain that the onset of this condition is particularly high in hand-raised birds, namely those subtracted from the biological parents and hand fed by breeders, while in the parent-raised type is almost absent. Further studies should be performed to further analyze the present results. Further studies could help in clarifying the complex of FP behavior. The research of physiological parameters is necessary for assess many thesis published from authors in the last years. For our study and the hypothesis of the sexual

behavior role, e.g. could be worthwhile study the consequence and/or influence on stress condition.

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## Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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