Frugivory Updates 30

December 2004

AUSTRALIA

4th International Symposium/Workshop on Frugivores and Seed Dispersal

Griffith University, Brisbane, Australia 9-16 July 2005

www.learnaboutwildlife.com/Frugivory2005.htm

Registration is now open for the Symposium/Workshop.

It is gearing up to be a great and memorable event, and we hope as many as possible of you can share the experience.
Closing date for suggestions of workshop and symposia themes is January 31st, and closing date for registrations and abstracts is March 31st.

To assist with planning, if you wish to wait until March to register, please send an email (ronda.green@griffith.edu.au) as soon as possible to indicate whether you are intending doing so. Early registrations, complete with all details, would also make life a bit easier for us here than everything arriving at once at the end of March!

See the website for further details (there are still a couple of omissions and outdated items, but it will be continually updated from now until the Symposium)

For those seriously short on finance:
Ideally we don't want anyone barred from attending the conference through lack of finance, but we have not yet been able to secure anywhere near the amount of financial support for the Symposium as we would have liked, and can probably not assist much at all in travel expenses. We can however write letters of support for your attempts to find it elsewhere. We can also drop at least part of the registration fee and assist with some other expenses for a limited number who can demonstrate they have tried other avenues, that they have interesting work to present, and that they have at least the moral support from their own institutions (we would urge you to try to obtain funding as far as possible from your own institution or elsewhere for travel expenses, and if at all possible for other expenses as well - but do let us know if you really have been trying and still falling short of being able to attend).
If anyone has ideas on where to find additional sponsorship (within Australia or elsewhere), and especially if you're willing to put a bit of time into helping us apply, we're very willing to listen! We've already tried quite a few blind alleys, but a few have responded positively, and we'll be trying again in the new year. Let us know your ideas and we can say if we've tried them or discuss ways to approach them if we haven't done so yet. (If anyone feels like organzing raffle ticket sales in their homeland, we've had offers of prizes by potential sponsors who didn't wish to donate straight-out).

8th International Workshop on Seeds: Germinating New Ideas

Sheraton Hotel, Brisbane, Australia 8 - 13 May 2005

There will be sessions on:

Seed Biology,
Seed Ecology,
Seed Biotechnology,
Seed Germination and Dormancy,
Seed Dessication and Conservation,
Seed Biology of Australian Native Species

www.seedbio2005.asn.au
For more information: info@seedbio2005.asn.au

Australian Fig-wasps detecting figs

From Hugh Spencer,

(Sorry, Hugh, as I indicated yesterday, I've been unable to find a way of including the figures and tables that doesn't fill up my allotted email space - this would obviously cause problems to those receiving it also. I suggest that those who are interested in the Tables and Figures contact Hugh and ask that they be sent as an attachment , one or two at a time - the attachment I received with text, figures and tables was quite enormous)

Assessment of specificity of fig wasp attraction to host fig species.

Sara Brewster (School for International Training) and Hugh Spencer (Cape Tribulation Tropical Research Station).

In his paper, How to be a fig, (Janzen, D. 1979) Janzen hypothesized that when the figs are receptive for pollination, they release a species-specific pheromone that the agaonid wasps respond to. Since this prediction, several studies have been done that imply that different fig species released different volatile chemical cues (Song, Q et.al. 2001 and Grison-Pige, L. 2002, and Gibernau, M. 1997). These studies have also shown that both female and male figs during the receptive phase are equally attractive to the specific pollinating wasps (Song, Q et.al. 2001 and Grison-Pige, L. 2002). In a study done at the Chinese Academy of Sciences, the volatile compositions of receptive, post-pollinated, and post-parasitized figs of Ficus hispida (a dioecious species) were analyzed by steam-distilling the figs and collecting the oils. The chemicals in the oils were examined using a gas chromatograph. They concluded that each fig phase has a different chemical makeup; compounds either disappeared or decreased in amount, while others increased or appeared. Sticky traps were used to determine the fig wasp preference to male or female figs. They concluded that both sexes of fig were equally attractive to the wasps, supporting their findings that their volatile compositions are similar (Song, Q et.al. 2001).

We used a behavioral technique to demonstrate the degree of host fig specificity shown by two species of Agaonid fig wasps, Ceratosolen rothropus (for Ficus congesta) and Ceratosolen appendiculatus (Ficus variegata) to the three common species of dioecious cluster fig trees in the Cape Tribulation area, Ficus variegata, F. congesta and F septica.

Method

A piece of clear, plastic acetate tubing approximately 120cm long, 3 cm diameter, with a wall thickness of 0.5mm, was cut and glued into the shape of a â€œT.â€ At each open end the lid of a 100 ml plastic sample vial was glued, leaving the end open. The sample vials could then be screwed on or off at convenience. A hole was cut into the bottom of the vial at the base of the â€œTâ€ and a small tube was attached that ran to a small, modified aquarium pump acting as a vacuum pump. A tiny hole was cut into each of the vials on the arms of the â€œT.â€   This setup permitted a very slow flow of air through the tubes bringing the volatiles from the target fig species to the wasps. The movement of air also prevented any condensation from building up in the tubes, which could cause the wasps to drown. The total airflow was kept at approximately 0.5 liters per minute, measured by a rotameter. The experiment was setup in a dark room so the light intensity could be controlled. As fig wasps were observed to be very strongly positively phototropic, a luminance meter was used to guarantee that an equal amount of light was falling on all parts of the â€œTâ€ tube, and this was set, using a Minolta LS110 luminance meter, at 12 cd/m2 (low room illumination level) across the entire apparatus.

Receptive figs (that is figs that were seen to be being visited by fig wasps on the morning of collection) from two different (target) species were put in the vials at the end of the arms of the â€œT.â€   Mature male figs with wasps about to emerge (source species) were placed in the vial at the base of the â€œT.â€   As the wasps emerge they start moving away from the host fig toward the choice point . Taking advantage of their positive phototropism, the initial half of the center tube of the â€œTâ€ was covered with black plastic sheet to encourage the wasps to move faster toward the light and the intersection, which they did, and this greatly reduced the testing time. These source figs were collected in the morning, and stored in sample vials with screened lid. The wasps were given two hours to move in their chosen direction and the number of wasps in each half of the tube was recorded.

Results

Sixteen experimental runs were made in total, ten with C. rothtopus with F. congesta and F. variegata as target species, five with C. appendiculatus using F. variegata and F congesta, and two more C. rothtopus with F. congesta and F. septica as the targets. The percentages of those wasps that travelled toward the correct target fig and those that went toward the incorrect fig were calculated from the total wasps for each experimental run. The percentages were put into bar graphs so each trial could be compared with the others. The average percentages for each group of similar runs was also calculated and graphed. No other statistical analysis was carried out.

Figure 1 (and Table 1) shows the information from the ten test runs with wasps from F. congesta as a bar graph. The target figs used were F. congesta and F. variegata. Each pair of bars represents the percentage of wasps that went toward the correct target fig compared to the percentage that turned toward the wrong target. All ten trials are shown as well as the average of all ten represented by the bars outlined in yellow. The percentages are listed at the end of each bar.
The results from runs 7 and 10 are equivocal, and probably result from not having used the same vial for the same target species, resulting in cross contamination.

Figure 2 (and Table 2) T shows the results from trials with wasps from F. variegata using figs from F. variegata and F. congesta as targets. It shows the percentages of wasps from F. variegata that chose to go toward the F. variegata target as compared to those that chose to head for the F. congesta. Again the average of the five trails is depicted with a yellow border.

Figure3 (Table 3) plots the results from the two trials with wasps from F. congesta against F. congesta and F. septica as target species.

4-0 Discussion

The results from the â€œTâ€ olfactory maze test show that the figs do emit
some kind of volatile chemical cues that attract the wasps to the figs. Each trial showed well over half of the wasps moving toward their species-specific host fig. The maze design used however, created a potential bias. If a wasp made an error and started travelling the wrong direction, there was no olfactory signal to inform it that it must turn around and go the other way. The airflow created by the pump pulled air over the target fruit and into the base tube where the wasps emerged. This created a mixing of air only in the initial tube, but when the wasps arrived at the intersection and had to make a decision, there was only one set of volatiles coming at them from each direction. After turning left or right, there were no further cues available for them to change direction.

Conclusion

Of the 326 wasps (of both species) that passed the choice point (total of all trials) an average of 68.5% made the correct choice, while 31.5% chose the wrong target species. Ceratosolen appendiculatus (from Ficus variegata) showed a higher degree of selectivity between the host and target species (79% correct response) than did C. rothtopus (F. congesta) (63%). Unfortunately no real conclusions can be drawn from these differences, since they may result from the design constraints in the simple olfactory maze design used (it was designed from first principles with material that were to hand at the Station).
However, the wasps certainly demonstrated selectivity in responding to their host species. Unfortunately no mature male figs of F. septica were available for test.

References

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with Australian Native Fig Species. TREAT News. July-Sept.

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** Weiblen, G., Douglas Y., and Stuart W. 2001. Pollination and Parasitism in Functionally Dioecious Figs. Proc R. Soc. London Series B 268:651-59

Frugivory paper included in Conservation book.

'Conservation of Australia's Forest Fauna' (2nd edition), ed. D. Lunney 2004. Royal Zoological Society of New South Wales.

Fate of feathered fruit-eaters in fragmented forests. (Pp 699-712)
C. Moran, C. P. Catterall, R. J. Green and M. F. Olsen

Abstract
Fruit-eating birds disperse many rainforest seeds, thereby influencing rainforest regeneration. The abundance of these birds may change following forest clearing, causing differences in seed disprersal between extensvely-forested and fragmented areas. We assessed the responses of 26 frugivorous bird species to forest fragmentation by comparing their abundance among extensive tracts, remnants and regrowth patches of rainforest (16 replicate sites in each) in subtropical southeast Queensland, Australia. There were five species that were recorded in much lower numbers and/or regrowth than in extensive forest ("decreasers"), seven that showed higher abundance in remnants and/or regrowth than in extensive forest ("increasers") and 14 whose abundance did not change

substantially between the three habitat types ("tolerant" species). The decreasers included three fruit-specialist rainforest pigeons (the wompoo, rose-crowned and superb fruit-doves Ptilinopus magnificus, P. regina and P.superus). The increasers were largely bird species with mixed diets, many of which use non-rainforest habitats. Two decreasers and two tolerant species were substantially more abundant during than winter whereas two increaser and two tolerant bird species were more abundant during winter. No effects of altitutde on seasonal abundance were apparent. The results of this study show that fragmented remnant and regrowth patches of rainforest do not adequately conserve the full set of frugoivorous avifauna. Furthermore, lower abundance of negatively-impacted birds in fragemented remnants and regrowth sites may lead to reduced regeneration of certain rainforest plant species due to a lack of seed dispersal in these habitats.

[it may incidentally surprise some readers who are not from Australasia or Asia that we have fruitdoves which lack the seed-grinding crop, and act as important dispersers, in contrast to most other members of the family - the wompoo referred to in the abstract above is the colourful bird which appears at the head of the Frugivory 2005 website pages, and is one of the largest-gaped frugivores in subtropical Australian rainforests]

Reviewers for Australian frugivory?

In 1989 I started collating information on what was known of frugivory and seed dispersal in Australia. At that time - not a lot (but with some notable work by a few researchers)! Since then, much info has accumulated, but in very fragmented places. After shelving my database for years, I took it up again a few years ago and now plan to have it available in some kind of format well before the time of the Symposium. A major part of it will be cross-linked family-by-family (both plant and animal) info on what eats what, with notes relevant to the interaction (e.g. what is known so far of the nutrient content of the fruit, or clues to the value of the animal as disperser), with other sections summarizing what is known (either published resulted or unpublished data with permission and acknowledgment) of the evoloutionary and biogeographical history of Australia relevant to frugivory, needs of Australian plants, choices made by Australian animals, conservation issues etc. If anyone is interested in reviewing sections (and - for nonAustralians - meantime perhaps learning a bit about the frugivory and seed dispersal interactions in the country they are soon to visit) please contact me (ronda.green@griffith.edu.au).

ASIA

Dispersal by birds in China

From LI Xin-Hua (whom some of us met at the Workshop in China early this year)

Seed dispersal by birds in Nanjing Botanical Garden Mem. Sun Yat.-Sen in spring and summer

LI Xin-Hua1 and YIN Xiao-Ming2 ?1. College of Life Sciences?Nanjing Agricultural University?Nanjing?210095?China?2. College of Resources and

Environmental Sciences?Nanjing Agricultural University?Nanjing?210095?China
?. Acta Ecologica Sinica, 2004,24 (7):1452?1458

Abstract: Nanjing Botanical Garden Mem. Sun Yat.-Sen is a semi-natural place located at the southern foot of Zhongshan Mountain, Nanjing, Jiangsu Province, China. It is rich in seed plants, both cultivated and wild, and contains diversified habitats within its 186 hectares area. To examine the ecological significance of mutual interactions between fruit-eating birds and fleshyâ€“fruited plants, seed dispersal by birds was investigated in the garden during spring and summer from 2000 to 2002.198 fecal samples from birds were collected in the garden between April and August 2002. In total 9 589 intact seeds were found in these birdsâ€™ faeces. Among the seeds, 9 573 seeds were identified as belonging to 20 plant species in 15 genera and 12 families, the other 16 seeds belonged to an unknown species. Seed species found in each fecal sample varied from 1 to 4, mean Â±SD = 1.5Â±0.7, while seed number in each fecal sample varied greatly from 1 to 583, meanÂ±SD = 48.4Â±70.7. Seeds of the 7 plant species comprising the highest occurrence frequency in the 198 bird fecal samples were Broussonetia papyrifera (82), Duchesnea indica(44), Morus alba(44), Rubus corchorifolius(26), Viburnum awabuki(26), Rubus hirsutus(22) and Phytolacca americana(19). These accounted for 86.2% of the total 305 occurrence frequency of the 21 seed species, and their seed number accounted for 96.1% of the total 9 589 seeds.

Eight bird species were observed feeding on the fleshy fruits of 18 plant species from 2000 to 2002. Four resident birds,Cyanopica cyana, Turdus merula, Pycnonotus sinensis and Streptopelia orientalis , acted as the main frugivores and fed on fruits of 8 to 16 plant species. They may be considered as the most important seed dispersers in the garden during spring and summer. Among the 18 fruit species consumed by birds, seeds of 14 plant species were found from the fecal samples.Few of the large seeds of Osmanthus fragrans and Magnolia denudata were detected in the fecal samples, although their fruits were frequently eaten by Pycnonotus sinensis and the other bird species, because their intact seeds were usually regurgitated later by the birds. In addition, some birds may also disperse seeds by picking the fruits up away from the parental plants. Monthly

changes in occurrence frequency of seeds from the fecal samples may indirectly indicate, to some extent , both the fruiting phenology of the plant speciesand the visiting frequency of birds to the ripe fruits.
Under conditions of sufficient food supply of animal (e.g. insect) resources around the botanical garden in late spring and summer, some birds, both resident and summer migrant, still frequently visited the fleshy fruits, and then defecated or regurgitated the intact seeds in diverse habitats. Such results suggest that certain relatively stable, mutually beneficial ecological relationships may exist between the avian frugivores and fleshy-fruited plant species.
Avian seed dispersers have promoted natural regeneration and have also broadened the distribution of some fleshy-fruited plant species, especially of some cultivated plants in the botanical garden. Seedlings or saplings of a few cultivated tree species, such as Mahonia bealei, Cerasus pseudocerasus, Rubus chingii andOsmanthus fragrans, have escaped from the botanical garden, and have successfully spread into a natural Pinus thunbergiiâ€"Liquidambar formosana community on a hillside at the edge of the
garden, as a result of avian seed dispersal.
American pokeweed (Phytolacca americana), an introduced North American species, has successfully invaded some disturbed habitats around the botanical garden, has regenerated very well in new habitats, and has continued to spread as an exotic weed. This is probably largely due to seed dispersal by frugivorous birds, eg. Streptopelia orientalis, Cyanopica cyana and Turdus merula. Consequently, it is suggested the rapid spread of this alien plant could be controlled by taking measures to prevent related birds from eating the berries of Phytolacca americana.

Key words: frugivorous birds;birdsâ€™ feceses; seed dispersal; cultivated

plants; non-native plants; natural regeneration and distribution; escaped

plants

Dispersal by Asiatic black bear in India

Dear All,

Please find enclosed as attachment the reprint "Observations on food habits of Asiatic black bear in Kedarnath Wildlife Sanctuary: Preliminary Evidence on their role in seed germination and dispersal" by Sathyakumar, S & Viswanath, S (2003) that was published in the journal URSUS:14(1): 103-108 for your records and comments.

Best wishes and regards,
S.Sathyakumar

Observations on food habits of Asiatic black bear in Kedarnath Wildlife Sanctuary, India: Preliminary evidence on their role in seed germination and dispersal

S. Sathyakumar 1,3 and S. Viswanath 2, 4

1 Wildlife Institute of India, P.O. Box 18, Chandrabani, Dehradun 248 001 India

2 Institute of Forest genetics & Tree Breeding, Forest Campus, Coimbatore 641002 India

Abstract: We made observations on the food and feeding habits of Asiatic black bear and on the germination of bear food plants in Kedarnath Wildlife Sanctuary, Western Himalaya, during 1989-92. We observed Asiatic black bears on six occasions and collected 20 scats. Bear was observed feeding on Rhododendron aroboreum, Berberis asiatica and on remains of a cattle kill made by common leopard (Panthera pardus). We had indirect observations of bears such as feeding signs and remains in scats on acorns of oak (Quercus leucotrichophora, Q. semecarpifolia), montane bamboo (Arundinaria falcate, Thamnocalamus spathiflorus), fruits and berries of Symplocos theifolia. Secondary information from several forest staff and local villagers indicated that black bears also feed on Juglans regia, Prunus cornuta, Myrica nagi, Aesculus indica, Rubus elipticus, Fragaria indica and cultivated crops like maize and amaranth. In October 1990, 2 bear scats with intact seeds of Symplocos theifolia - a small evergreen understorey tree species, were encountered in Mandal area at 1,900m. Germination tests were conducted in the laboratory and field nurseries on the seeds recovered from the scats and compared with freshly collected manually depulped seeds from mature standing trees. Observations on field germination trials of Symplocos theifolia in field nurseries were also recorded. Results indicated that freshly matured seeds were dormant and did not germinate until 3rd week in laboratory test. In contrast, the matured seeds with pulpy outer layer (control) showed very little signs of germination and deterioted very fast at 25/10oC and 25oC. Observations in laboratory showed increased germination of seeds that were ingested by bear when compared to control and freshly depulped seeds subjected to the same germination treatments. The proportion of seeds that germinated from the bear scat kept at 25oC was significantly higher than the proportion that germinated from the depulped seeds kept at 25oC. Under field nursery conditions, the seeds took nearly five months to germinate with poor germination percentage. Feeding by Asiatic black bear on S. theifolia appeared to have shortened the mean length of dormancy of the seeds and improved its overall germination percentage. Removal of fruit material around seeds by bears through feeding may have increased the germination rate over those with intact fruit material because in the latter case, the pulpy seed coat created favourable conditions for bacterial infestion and insect attack.

Ursus 14 (1): 99-104 (2003)

Key words: Asiatic black bear, food habits, germination tests, seed dispersal, seed germination, seed predator, Symplocos theifolia, Ursus

thibetanus

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LATIN AMERICA

From Mauro Galetti, Brazil:

Dear ALL Friends

Our new web page of the Plant Phenology and Seed Dispersal Research Group is about to be ready.

You can find lots of download papers and projectÂ´s abstracts.

http://ns.rc.unesp.br/ib/ecologia/fenologia/

Regards

Mauro

Also from Mauro:

Frugivory Course in Brazil

Curso de Frugivoria e DispersÃ£o de Sementes
Data: 7 MarÃ§o-17 MarÃ§o 2005
Parque Estadual Ilha do Cardoso, CananÃ©ia, S.P., Brasil
Curso teÃ³rico-prÃ¡tico para interessados em estudo de interaÃ§Ãµes animal-planta, restauraÃ§Ã£o de ambientes degradados e conservaÃ§Ã£o da biodiversidade.

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Christmas Greetings to all

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