HAUSTORIUM

Parasitic Plants Newsletter
ISSN 1944-6969
Newsletter of the International Parasitic Plant Society,
Amsterdam, The Netherlands
(http://www.parasiticplants.org/)

July 2021 Number 80

PRESIDENT'S MESSAGE

Dear IPPS members

I hope you are all OK. We are still going through rough times and it is difficult to meet other people. Fortunately, we have electronic means of communication and the large attendance of the online IPPS seminars shows that there is a great need for this. And we have our newsletter, Haustorium, to stay in touch, with a wonderful selection again of parasitic plant related news.

Of course, as you have probably all experienced, the real exchange of ideas and creation of new plans and collaborations very much needs live interaction. I am therefore happy to announce **that our 16th WCPP is going to be held in Nairobi in Summer 2022.** The meeting will be held on location, offering the possibility of online attendance in case someone is not able to attend in person. Please keep an eye on our website, www.parasiticplants.org, for updates.

In the meantime we will continue to host the online IPPS seminars, every first Wednesday of the month, at 3:00 PM GMT (i.e., 8:00 AM Los Angeles, 10:00 AM Bogota/Brasilia, 11:00 AM New York/Santiago, 4:00 PM Abuja/London, 5:00 PM Amsterdam/Berlin/Cape Town, 6:00 PM Nairobi/Tel Aviv, 11:00 PM Beijing, next day 12:00 AM Tokyo, next day 01:00 AM Canberra). The latest seminar was on 4 August with Francisco Fontúrbel (Pontificia Universidad Católica de Valparaíso) – 'Cascade impacts of climate change on ecological interactions: lessons from a keystone mistletoe' and Min-Yao Jhu (University of California, Davis) – 'CcLBD25 functions as a key regulator of haustorium development in *Cuscuta campestris'*. See www.parasiticplants.org for the complete programme; we will post the abstracts of the talks on the Society page in the week before the seminar.

With regard to our website, I want to mention a change that we have implemented in the past half year: we now have a membership fee payment plug-in, which allows you to pay your IPPS membership fee in a super easy way. For the year 2021-2022 we have a reduced fee of 20 euro for regular members because we had to postpone the WCPP. For students we waive this year's membership fee. We use these fees to run the society and to support the organization of the WCPP and its attendance by young researchers, so please pay yours, if you did not already do so.

I want to invite you to also use the other possibilities of our website and reach out to other IPPS members and the society at large: login into the member area and post news, for example on your most recent paper or project funding. I would also greatly appreciate your updating, your profile as much as possible, with your picture and that of your institution and with a short description of your research area. You may want to add some expertise keywords as the member list is searchable, allowing others to find you based on your expertise. I also encourage you to check out the News and Society pages regularly, for member and society news. Also check out the homepage where we have two continuously refreshed feeds, from Google Scholar and Scopus, showing the most recent papers on parasitic plants, as well as a Twitter feed showing Tweets on parasitic plants; I encourage you to use the #parasiticplants hashtag if you Tweet then it will show up on our home page.

I would like to end with wishing you all a great summer.

Harro Bouwmeester
IPPS President

THE FUTURE OF HAUSTORIUM

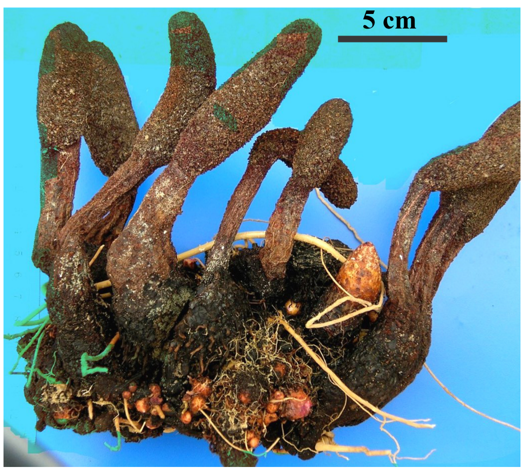
Haustorium is undergoing a change, reflective of increased interest in parasites and by the efforts of the International Parasitic Plant Society IPPS) and by the retirement of Lytton Musselman from his university position in 2022. Issues number 9-14 were published by the International Plant Protection Service at Oregon University. Issues 15 and 16 were published by INTSORMIL, all other issues, 17-80 up to the present, have been published by Old Dominion University. Publication will now come under the aegis of IPPS who will hold the ISSN number.

Secondly, on the occasion of a somewhat significant birthday, Chris Parker is considering easing up a little. After assisting Lytton in the establishment of the newsletter in 1978, Chris has been involved in the editing, production and distribution of the newsletter and has aimed to provide an increasingly comprehensive Literature section over the past 20 -25 years. He has recently reduced the range somewhat by (regrettably) excluding most purely therapeutical items, but is now having to consider cutting back further. **Any assistance in helping to maintain this service will be warmly welcomed**

RESEARCH NOTE

Aspects of the biology of the root holoparasite *Cynomorium coccineum* L.

The genus *Cynomorium* belongs to the monogeneric family Cynomoriaceae, which includes a single species *Cynomorium coccineum.* Sometimes *C. coccineum* is subdivided into two species or subspecies [ssp. *coccineum* L. and ssp. *songaricum* (Rupr.) Léonard]. The geographical distribution of *C. coccineum* depends upon the range of its hosts, which extend from the west in the Mediterranean salt marshes of the Middle East and Southern Europe and, to the east in Afghanistan, Mongolia/China (Leonti et al., 2020).



C. coccineum consists of a perennial subterranean branched fleshy rhizome which, during April and May sends several annual aboveground club-shaped inflorescences (Photo) bearing delicate tiny female, male, and bisexual flowers. The parasite is deep purple due to its rich contents of anthocyanins, and the red pigment cyanidin 3-*O*-glucoside (chrysanthemin), which is present in the flowers and bracts of the inflorescence and absent in its inner fleshy white tissues (Zucca *et al.,* 2013). The rhizome carries several secondary lateral haustoria (Fahmy and Hassan, 2021), which infect the roots of a wide range of host plants belonging to the Chenopodiaceae, Frankeniaceae, Plumbaginaceae and Zygophyllaceae.

Extensive research has dealt with the chemical composition, bioactive compounds, antimicrobial activities, and pharmacological effects of *Cynomorium* (see Leonti *et al.,* 2020; Patočka and Navátilová, 2020). The anatomical and ecophysiological relationships of the target parasite to its hosts, have received relatively little attention. For example, Fahmy and Hassan (2021) described for the first time the anatomy and ultrastructure of the haustoria of *C. coccineum* infecting two halophytes.

Close-up of flowers of *C. coccineum*. Photo L.J.Musselman.

I have investigated *C. coccineum* and its hosts in two geographically distinct habitats, firstly in a salt marsh in North Africa in Egypt in the Western Mediterranean coastal zone which has an attenuated sub desertic climate, and secondly in Asia in the inland desert of the state of Qatar, which has an extremely arid climate. The following points summarize my published and the unpublished research on the parasite-host relationships.
Ecophysiological aspects: The diurnal transpiration rate of the inflorescence of the parasite [expressed as mg H_2O kg^{-1} fresh mass s^{-1}] is low (5.3 mg) in comparison to its halophytic hosts *Limonium delicatulum* (21.9 mg) and *Arthrocnemum glaucum*

(12.8 mg), and the non-infected plants (Fahmy, 1993). The water potential and the osmotic potential of the underground rhizome of the parasite are significantly lower (more negative) than those in the host roots (Fahmy, unpublished data). These gradients facilitate the transport of water and solutes in the direction of the parasite. The high ratio of potassium/calcium in *C. coccineum* implies that it is a phloem-feeding parasite.

Anatomical and ultrastructural aspects: Many stomata are present on the perianth segments and bracts of the inflorescence of *C. coccineum* (Fahmy, 1986). The guard cells seem to be non-functioning since they are devoid of chloroplasts and potassium ions but contain starch grains. The haustorium of *C. coccineum* penetrates the tissues of the host root *Atriplex portulacoides* by exerting a mechanical pressure (Fahmy and Hassan, 2021). The ultrastructural studies indicated that connections are not present between the sieve elements of the host *Atriplex portulacoides* and parasite, while xylem (parasite)-to-xylem (host) contacts are either direct luminal or by their common walls.

References:

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Leonti, M., Bellot, S., Zucca, P., Rescigno, A., 2020. Astringent drugs for bleedings and diarrhea: the history of *Cynomorium*. Journal of Ethnopharmacology 249. https://doi.org/10.1016/j.jep.2019.112368.

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NEW PROJECT

Project to determine the extent of parasitic weed problems

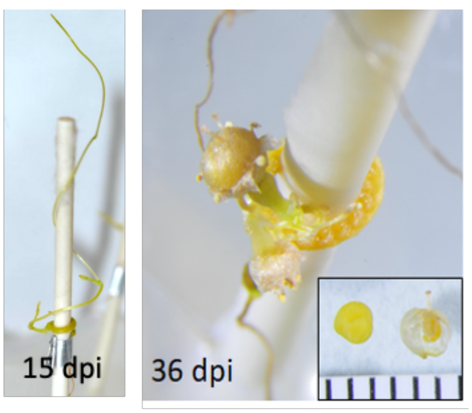
Dear colleagues, I am a senior research associate in Joanne Chory's lab at the Salk Institute in La Jolla, California. I would like to work on an update of the data concerning crop damage caused by *Striga* and *Orobanche* on a global scale, and possibly correlate such data with available climate records. Since sources about the spread of *Striga* and *Orobanche*, yield losses, economic impact, etc. are often limited and sometimes rough estimates, I would like to gather ideas from the parasitic plant community about the best ways to pursue such a project, e.g., using surveys, satellite data, or herbarium records. Any input will be greatly appreciated. I would like to make sure that I don't miss anything before I get started on this. If you wish to share your thoughts with me, please feel free to write to me: mburger@salk.edu.

Marco Burger

STUDENT PROJECT

Artificial hosts: a novel tool for research on the parasitic plant *Cuscuta campestris*

Cuscuta campestris, an obligate parasite, relies on a host to complete its life cycle. *Cuscuta* may be grown in tissue culture but does not develop typical parasite growth patterns or seeds under such conditions. To better study parasite growth and biology without a plant host, we developed an axenic system to grow *C. campestris* on an inert, fibrous stick that mimics a host stem, wicking water and nutrients to the parasite. *Cuscuta* growing in this artificial host system (AHS) displays all the stages typical of the parasite life cycle, including production of flowers and viable seeds. The most important components of the AHS are a solid support with capillarity capacity, a closed sterile container, exposure to far-red light to induce coiling and haustoria, and a liquid media with proper nutrients and phytohormones. Inclusion of an auxin and a cytokinin in the media increased parasite fresh weight and biomass, and media containing cytokinin increased parasite shoot length. Transcriptomic analysis comparing haustorial regions and new shoots of parasites growing in the AHS, independent of any interaction with a plant host, showed that haustorial regions present an enrichment in biological process related to circadian rhythm; metabolic and catabolic processes; lignin biosynthetic and xylem development; transport; response to abiotic and chemical stress, and defense response. On the other hand, stems present enrichment in gravitropism, cuticle and cell wall-related biosynthetic processes, organ morphogenesis, stomatal morphogenesis, among others.



C. campestris growing in an AHS

The AHS is a methodological improvement for studying *Cuscuta* biology because it avoids effects imposed by the host, and opens possibilities to new ways of experimentation.

Our findings prove the generalist nature of *C. campestris* given its ability to grow and display all its lifecycle stages on an artificial host, including production of viable new shoots and seeds.

For more information visit: https://doi.org/10.1101/2021.06.21.449293

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PROJECT UPDATE

Toothpicks – Kenya approves Kichawi Kill™ an important weed bioherbicide to combat *Striga*.

Kenya has become the first country in the world to commercialize a weed bio-herbicide technology, Kichawi Kill™ to combat *Striga hermonthica* (commonly known as *Striga*, Kayongo or witchweed), one of the worst threats to food security in Sub-Saharan Africa.

Striga is a destructive invasive parasitic weed that can cause up to 100% yield losses by attacking the roots of staple crops such as maize, sorghum, millet, cowpea and upland rice resulting in food insecurity and lack of income. It affects about 50 million hectares of African croplands, causing $9 billion in crop loss annually. In addition, approximately 40 million farms and 300 million people across Sub Saharan Africa are affected. In Kenya, in western region alone, *Striga* has infested over 217,000 ha of crop land, resulting in maize yield losses of up to 182,227 tons per year valued at USD 53 million. Conversely, research has shown that over 70% of maize smallholder farmers in Kenya are women, making *Striga* a gender-sensitive food security problem.

Although there are *Striga*-management technologies that exist, they have not been widely adopted by farmers due to mismatches between technologies, socio-economic conditions, effectiveness and availability. However, farmers and consumers have two concerns, one, the potential poisoning of food and the environment arising from chemicals currently used to manage pests. Secondly, weeds are increasingly becoming resistant to herbicides which is also a global concern. This is because *Striga* attacks the roots of the crop within 48 hours of planting, which means by the time weeding is done whether by hand or by using chemical herbicides it is too late to reverse the damage. Chemical coated hybrid maize seeds (such as with imazapyr) have not been proven safe and effective on *Striga* control. At farm level, *Striga*-tolerant crop cultivars, push-pull technology, and soil fertility improvement can improve crop yields but do not restore full yields or address the soil's *Striga* seed bank. Moreover, current costs of managing the pests often exceed the farmers' economic means.

Kenya Pest Control Products Board (PCPB) last week granted registration status of the bio-herbicide with the Kenya Agricultural and Livestock Research Organization (KALRO) as the registrant, paving the way for its unhindered use in Kenya. The registration and commercialization of *Kichawi Kill*™ follows a decade long collaborative research between KALRO and Montana State University (MSU - USA) that began in 2008. The bio-herbicide research focused on *Striga hermonthica*.

KALRO scientists led by Henry Sila Nzioki, utilized an innovative biocontrol technique developed by MSU's Professor David Sands to isolate a fungal pathogen from a wilted *Striga* plant. The fungal strains were selected for increased virulence through their overproduction of specific amino acids that harm the weed and not the crop.
The research team also developed a unique distribution system which involved growing the selected fungal strains on toothpicks. These were then transported to the village, where the researchers worked with a team of Village Inoculum Producers (VIPs) to make a fresh, live inoculum by cultivating the toothpicks in cooked rice for several days. During planting, a capful (cap of a bottle) of the inoculated rice was placed (paired up) with each maize seed. Paired-plot trials took place on 500 farms in 2014-2015 with funding by Gates Foundation. The trials showed 42-56% increase in crop yield, with similar results showing in the regulatory trials. While there have been other attempts at biological control of weeds, this is the first commercialized bio-herbicide to control *Striga*, and the first in the world to utilize this technological advancement.

'This is a major milestone for agricultural research in the country. Now that this biocontrol product is approved for use after meeting stringent standards of safety and efficacy, we expect that its rapid adoption will help us to reduce the negative impact of *Striga* and improve food security for the country. This project is an excellent example of a Public Private Partnership.' Dr Eliud Kireger; Director General, KALRO.

A social enterprise based in Kakamega, Toothpick Company Ltd (TCL) was incorporated in 2018 to undertake a successful commercialization of Kichawi Kill™, with guidance from an NGO partner, Welthungerhilfe (WHH). After a long and rigorous regulatory process, TCL hosted demonstration plots on nearly 1,000 farms and trained over forty (40) Village Inoculum Producers (VIPs) who will set up their own micro-enterprises. As Kenya enters the long rains season, these producers are currently taking Kichawi Kill™, orders from farmers for the inaugural commercial season. TCL will be using this season to work closely with VIPs to reach as many farmers as possible and to plan for expansion in future seasons.

'We are excited to be part of a process that places more ugali on the tables of households in the Western Kenya, and together we can win this fight against *Striga* weed.' Newton Kisala Chamwama, General Manager, Toothpick Co. Ltd.

'This development demonstrates a global sea change for bio-herbicides. Kenya is the forefront of this global advancement, ahead of the US, EU, and Asia. This home- grown solution will enhance foreign exchange for Kenya and elevate research opportunities. The product offers a safe, effective, and affordable solution to a devastating weed and is a positive alternative to synthetic herbicides. We celebrate the commitment to advance this innovation.' Claire Baker, Director TCL and Toothpick Project (international).

Mr. Nzioki who is a plant pathologist from KALRO-Katumani is continuing to work on the technology, including alternative application methods of the inoculum, and trials of *Striga* in sorghum. He is also part of the team training international scientists from research organizations in twelve other countries to adopt Kenya's model to identify their own locally-sourced fungal strains and to expedite regulatory processes.

Virginia Wangari, The Standard, 12th March 2021.

Also see/hear:
Promotional video - https://www.youtube.com/watch?v=YD38kjJqyiE&feature=youtu.be
Sands' interview with the BBC - https://www.bbc.co.uk/sounds/play/p09crtqq.

JOURNAL OF VISUALIZED EXPERIMENTS:
Methods and applications in parasitic plant research

Dear Colleagues at the IPPS,
To date, few journals accept video articles for submission/publication in our field, despite this type of article being very engaging and useful for sharing new techniques and approaches. For this reason, under an invitation from the Journal of Visualized Experiments (JoVE), I decided to serve as guest editor for a Collection titled 'Methods and applications in parasitic plant research'.

The purpose of the Collection is to offer a comprehensive overview of new and adapted techniques and approaches used in parasitic plant research. In this context, this collection invites researchers to submit method papers related to the multiple areas of Plant Science that converge into the study of parasitic plants. Contributions are expected from, but not limited to, developmental biology, ecology, evolution, physiology, and weed management.

The most recent Impact Factor for JoVE (ISSN 1940-087X) is 1.2, according to the 2019 Journal Citation Reports released by Clarivate Analytics. The Journal is currently indexed in the major databases, including PubMed, EMBASE, Scopus and Web of Science.
After submission, each manuscript will be editorially and peer reviewed, which is typically a 2-month process. JoVE is currently publishing text manuscripts after acceptance and will be filming and adding videos when university laboratories reopen. When filming is able to resume, JoVE will generate a script and schedule a filming date. A videographer will be sent to the authors' site to film the procedure.

If you are interested, either message me (lteixeiracosta@fas.harvard.edu) or submit an abstract on the Collection website (https://www.jove.com/methods-collections/1036). I look forward to building a strong methods Collection and to receiving contributions from IPPS members.

Luiza Teixeira-Costa

LITERATURE HIGHLIGHT

Masumoto, N. and 12 others. 2021. Three-dimensional reconstruction of haustoria in two parasitic plant species in the Orobanchaceae. Plant Physiology 185: 1429-1442.

Pardon a personal recollection. Almost fifty years ago, I studied the anatomy and development of haustoria of this family using the classic paraffin method to produce thousands of sections from which I attempted to reconstruct the development and structure of the parasitic organ. The paper by Masumoto et al. presents elegant data I sought and would never have dreamed possible! Using sophisticated software that concatenates microtomed sections, the authors provide striking three-dimensional images of the two main types of haustoria in the family. *Striga hermonthica*, an obligate root parasite, produces haustoria from the root tip, termed primary haustoria and is also able to produce lateral haustoria on their adventitious roots. The other parasite is *Phtheirospermum japonicum*, a facultative parasite increasingly popular with researchers, does not form primary haustoria, only lateral haustoria. Despite the difference in ontogeny, the primary and lateral haustoria have a similar anatomy at maturity. Regions of the haustorium and their purported function are described; intriguingly, the phloeotracheids, so prominent in haustoria from diverse families including the Orobanchaceae are absent in both species. The developmental stages from initiation to maturation as well as descriptions of the various regions of the adult haustorium are wonderfully displayed in the fifty or so images that enrich the paper.

Lytton J. Musselman

ZOOMINARS

IPPS

A series of monthly webinars has been arranged by IPPS. The first three of which are reviewed here.

12 May 2021.

Julie Scholes - Can Receptor-Like Protein (RLP) resistance genes in rice provide protection against *Striga hermonthica?* [Abstract not available]

Harro Bouwmeester - The role of rhizosphere signaling in the host-parasitic plant interaction. [Using a metabolomic approach for further study of the root exudates of 59 sorghum genotypes, identifying a number of new, bioactive, metabolites that had so far not been implicated in *Striga* infection processes, including new putative germination stimulants and inhibitors and haustyorial initiation factors. Findings include that while 5-deoxystrigol promotes germination of *Striga,* orobanchol is inhibitory (contributing to the resistance in var. SRN39). Discussing how the multiple roles of strigolactones could have contributed to their diversity. Also identifying a cytochromeP450 in *Nicotiana benthamiana* tyhat catalyses th firsdy step in conversion of orobanchol to solanocol in tomato; and demonstrating how Virus Induced Gene Silencing can be used to alter the balance of strigolactoners in root exudate.]

2 June 2021

Jianqiang Wu - Interactions between hosts and parasitic plant *Cuscuta* (dodder). [It was previously known that the *C. australis* genome had lost many flowering regulatory genes and thus not able to flower autonomously. Biochemical and genetical analyses indicates that among the interplant mobile proteins, the host-produced florigen protein, named FT, which can be transferred to the parasite where it interacts with *Cuscuta* FD transcription factor to activate flowering thus allowing *C. australis* to synchronize its flowering with that of its host.]

Songkui Cui - Host infection is mediated by ethylene signaling in the parasitic plant *P. japonicum.* [Using whole genome sequencing-based SNP analysis the responsible genes were identified that encode an ethylene receptor ETHYLENE RESPONSE1 (ETR1) and ethylene signaling mediator ETHYLENE INSENSITIVE 2 (EIN2), respectively. Further analysis reveals that ethylene signaling is crucial for parasitic plants to infect host by regulating haustorium development via cell division and differentiation at the haustorial apex region.]

7 July, 2021.

Vivian Bernal-Galeano, **Jim Westwood and Natalia Pabón-Mora -** An artificial host system for growing and studying *Cuscuta.* [See STUDENT PROJECT above.]

Natalia Pabón-Mora - Natural history and genomics in *Pilostyles* (Apodanthaceae), the smallest endoholo-parasitic plants on Earth. **(Abstract included in full because of its novelty)** ABSTRACT: The Apodanthaceae comprises two genera and eleven endoholoparasitic species. The exclusively New World, monospecific *Apodanthes* parasitizes various Salicaceae, whereas the 10 species of the widespread *Pilostyles* parasitize a broad range of legumes. All Apodanthaceae are achlorophyllous and have undergone extreme morphological reduction resulting in the lack of root and shoot apical meristems, stems, and leaves. Their vegetative phase is reduced to a mycelium-like endophyte formed by strands of parenchymatous cells that are in close contact to the host vasculature. Floral development occurs entirely inside the host stems. The Apodanthaceae become apparent only when their tiny gregarious, mostly unisexual, flowers emerge breaking through the host cortex. Our case study, *Pilostyles boyacensis*, has been chosen as a representative species of the genus, in order to study a number of structural traits and genomic fingerprints that help us to better understand its holoparasitic lifestyle; the species is found in dry inter-Andean valleys parasitizing *Dalea cuatrecasasii* (Fabaceae). We have sequenced both its genome and representative transcriptomes from the endophytic tissue of *P. boyacensis* growing inside the *D. cuatrecasasii* host stem, in mixed (PbE+D) host-parasite samples, as well as individual emerging preanthetic flowers (PbFl) and fruits (PbFr) of *P. boyacensis*. In this talk we will: (1) present genome content and structure, especially that corresponding to the highly reduced plastome, with some insights into the nuclear genome; (2) assess the evolution of shoot apical meristem (SAM)-related genes in the absence of a typical vegetative SAM; and (3) assess the evolution of flowering integrators and floral organ identity genes in this endoholoparasitic plant with intact floral transition. So far, our results have confirmed extreme plastome reduction, both in size and gene content, without broad scale changes in the mitogenome or the nuclear genome. Plastome reduction is highly conserved in African and Australian *Pilostyles* spp., which strongly suggests that the legume-*Pilostyles* endoholoparasitism was already in place before the Gondwana split. In addition, the endoparasitic lifestyle of Apodanthaceae appears to correlate with a substantial reduction in the transcriptomic machinery linked to initiation and maintenance of SAMs, whereas the genes involved in flower fate have remained intact. Finally, we have preliminary data that suggest the recruitment of host flowering signals to activate endogenous floral organ identity genes, similar to what has been observed in other parasitic plants. Additional studies are underway to address the same questions in *Apodanthes casearieae* in order to test common and convergent features during the evolution of the two members of the family Apodanthaceae, which has taken place in two unrelated hosts.

EWRS

Parasitic Weeds: know the enemy to combat it. June 29th, 2021.

This very successful International Webinar was jointly organized by Maurizio Vurro (CNR-ISPA) and Alessandro Nicolia (CREA-OF), with the support of the BIOTECH project (Mipaaf) and the sponsorship of the European Weed Research Society (EWRS) - Working Group 'Parasitic Weeds', was to make a general overview of the research on parasitic weeds, a very serious and often underestimated problem in many countries all over the world, being responsible for serious qualitative and quantitative damages to numerous crops.

The webinar was opened by the welcome of the Organizers, and of the Institutional representatives, namely:

Dr. Jukka Salonen, President of the European Weed Research Society (EWRS)

Dr. Antonio Logrieco, Director of the Institute of Sciences of Food Production (ISPA), National Research Council (CNR)

Dr. Teodoro Cardi, Director of the Council for Agricultural Research and Economics, Research Centre for Vegetable and Ornamental Crops (CREA-OF)

Dr. Luigi Cattivelli, Director of CREA-GB e Coordinator Project BIOTECH

The morning session consisted in four lectures held by eminent and internationally renowned experts who covered various topics concerning parasitic plants, such as strigolactones, physiology, biology and management, interactions with the host, genetics improvement, and crop resistance, namely:

Koichi Yoneyama -Strigolactones as germination stimulants for root parasitic weeds. [Referring to 30 structurally different strigolactones. Typical or canonical SLs contain the ABCD ring system but non-canonicals lack A, B, or C ring. Maize, wild oat, and sunflower produce only non-canonicals. Discussing their biosynthesis and the influence of phosphate. And questioning the reason for their wide diversity, their evolution and their original function and how more information could lead to improved parasite management.]

Harro Bouwmeester - The role of chemical communication in parasitic plant infection and its prevention [Describing the range of compounds invoved in the interaction berween *Striga* and other parasitic plants, and their hosts, including the strigolactones (commenting on their diverse structure and roles) and hasutorial inintiation factors. Using a metabolomics approach in sorghum to find some new putative germination stimulants, inhibitors and HIFs.]

Julie Scholes - Identification of resistance genes for smart breeding of durable defence against *Striga hermonthica*. [Abstract not available]

Hanan Eizenberg -The use of multi-spectral sensors and modeling approach for early broomrape detection and management. [Abstract not available]

PRESS REPORTS

A weird underground plant has been rediscovered after 151 years

A peculiar plant has been found in the rainforests of Borneo after having been lost for over 150 years. *Thismia neptunis* was discovered in 1866 by the Italian botanist Odoardo Beccari in the Gunung Matang massif in western Sarawak, Malaysia. He formally described it a few years later. There are no records of anyone seeing it since, so it was assumed extinct. But in January 2017, Michal Sochor of the Crop Research Institute in Olomouc, Czech Republic and his colleagues found a few specimens in the same area and photographed them for the first time.

T. neptunis belongs to a group of plants that shun the light. Instead, they live underground and steal food from fungi. This behaviour has evolved independently about 40 times. There are around 500 species of ‘underground plant’, says Vincent Merckx of the Naturalis Biodiversity Center in the Netherlands, who studies these ‘mycoheterotrophs‘. They have lost their leaves and chlorophyll, and cannot photosynthesize like normal green plants. ‘They completely rely on fungi,’ Merckx says. The fungi in question are called mycorrhiza. They have symbiotic relationships with plants, helping them get water and nutrients in exchange for food. So mycoheterotrophs like *T. neptunis* ultimately get their food from other plants. It’s assumed the fungi the mycoheterotrophs take food from don’t benefit, meaning the plants are parasites, says Merckx. However, no one has demonstrated this.

Journal reference: Phytotaxa, DOI: 10.11646/phytotaxa.340.1.5

Michael Le Page, New Scientist 2 March 2018

Secrets of mistletoe to be uncovered by Scottish scientists

It has been a frivolous part of Christmas festivities for centuries, but now scientists sense that untangling mistletoe’s complex make-up could lead to lasting benefits. Edinburgh scientists are set to be the first to sequence mistletoe (*Viscum album*)’s genome – the sum total of its entire DNA – which is more than 40 times the size of the human genome.
The mistletoe genome will contribute to the Darwin Tree of Life Project, which aims to sequence the genomes of over 60,000 British and Irish species within the next 10 years.

The research is pioneering the use of ground-breaking gene sequencing technology that could also be used to better understand diseases and cancers in humans and animals.
Researchers at the University’s Edinburgh Genomics facility will be one of the first in Europe to use the PacBio Sequel IIe System, which is designed to read long fragments of DNA from virtually any species, with extremely high accuracy. The system produces eight-times more data than earlier sequencers, making sequencing complex genomes more affordable. Experts will use the technology to rapidly decode the mistletoe’s entire DNA.

Mistletoe is a hemi (partial) parasite which attaches to a tree via suckers roots and absorbs some water and nutrients from its host plant. However, it also produces some of its own food via photosynthesis in its green leaves. It can be found in the UK on a variety of host plants including apple, lime, poplar, sycamore, ash and hawthorn. However, it is rarely found on oak. The results from the study could reveal how mistletoe has evolved to become a parasite in the first instance. Project partners, the Royal Botanic Garden Edinburgh, will provide the mistletoe sample, collected from near the Scottish Gallery of Modern Art. Dr Javier Santoyo-Lopez, Service Manager at Edinburgh Genomics sequencing facility, said: ‘PacBio’s Sequel IIe System is a very powerful addition to our battery of sequencers at Edinburgh Genomics, enhancing the sequencing services we provide to researchers at the University at the same time as reducing costs. Its capability to accurately read large fragments of DNA will allow us to fully characterize the genetic information of many organisms, such as the mistletoe, as well as detect complex genomic alterations that could be the cause of rare diseases or cancers.’

Dr Alex Twyford, Lecturer in Botany at the School of Biological Sciences and Darwin Tree of Life University lead, said: ‘We’re excited to be the first to attempt to sequence the complex genome of the mistletoe, using the new PacBio Sequel IIe System. The results will become part of the Darwin Tree of Life Project, to sequence the genomes of all 60,000 British and Irish species within the next ten years. Jonas Korlach, PhD, Chief Scientific Officer of PacBio, said: ‘We are proud to support the Darwin Tree of Life project and excited to see the complexity of a festive holiday plant like mistletoe revealed with HiFi reads. Projects and initiatives such as these are vital to generating complete reference genomes that advance research focused on understanding and preserving Earth's biodiversity.'

This equipment was funded by a grant from the Biotechnology and Biological Sciences Research Council (BBSRC). The Darwin Tree of Life project is funded by Wellcome.

Iain Pope, The Scotsman
17th December 2020

Kenya looks to gene editing to grow its key food crops

Kenya's agriculture is set to benefit from several gene-editing projects that target some of the country's key food crops and livestock. Farmers raising sorghum, maize, bananas, pigs and cattle can expect good news from ongoing research projects that aim to improve disease resistance and build more robust crop and animal varieties.

Gene editing, also known as genome editing, is a set of advanced plant and animal breeding techniques that can help to produce crops and livestock that can thrive in diverse ecological settings. Genome editing comprises a group of technologies that give scientists the ability to change an organisms DNA. The technologies allow the addition, removal or alteration of genetic material at specific locations in the genome.

Kenya is a market leader among African countries in this area of biotechnology. The country has begun drafting guidelines to regulate gene-edited products, applying procedures that have been formulated in Argentina. A report produced by the International Service for the Acquisition of Agri-biotech Applications (ISAAA AfriCenter) and titled 'Genome Editing in Africas Agriculture 2021: An Early Take-off,' details some of the gene editing projects underway in Africa.

Kenya is among three countries in the eastern African region that have ongoing projects in genome editing in agriculture, with eight scientists working on various projects. Uganda and Ethiopia are the other two. One of Kenya's gene editing projects seeks to build resistance in the sorghum plant against the parasitic *Striga* weed. The project is by Prof. Steven Runo, a professor of molecular biology at Kenyatta University. The project is evaluating knocking out the LGS1 gene to confer *Striga* resistance in sorghum. *Striga* is a huge constraint to the production of sorghum and other cereal crops. Most cultivated cereals, including maize, millet, sorghum and rice, are parasitized by at least one *Striga* species, leading to enormous economic losses. Sorghum is an important crop in Kenya that is in high local demand not only for food and fodder, but also in the brewing industry, which requires over 30,000 metric tonnes of white sorghum.

Joseph Maina | Cornell Alliance for Science | May 19, 2021

Pilbara mistletoes face sub-regional extinction

A new study from the Department of Environment and Conservation suggests long-term modern fire regimes could pose a threat to Western Australia mistletoes (Loranthaceae sp). Single fires ignited by lightning, arson or by prescribed burning often destroy thousands of hectares in the region. This scale of damage poses a problem for mistletoe species because of their physical vulnerability and regeneration methods.

Across species, mistletoe foliage and fresh seed are killed when scorched. As none have a mechanism of long-term in situ seed storage and limited capacity for long-distance seed dispersal, they are highly dependent on seed being imported and deposited in burnt areas by avian populations. Given the increasingly vast range of fire damage, regeneration is at risk.

According to study author Dr. A.N. Start, 'when pastoralists settled the area little more than a century ago, radical changes were imposed on land tenure...' 'Former fire regimes were abandoned and fire was used for novel purposes, including the manipulation of pastures. Anthropogenic fire is still common across northern and central Australia where the trend has been to hotter and more extensive burns.'

Dr. Start notes that concern about the environmental effects of long-term, modern fire regimes has been present since the 1980s and mistletoes appear to be one group adversely affected. Mistletoe varieties comprise a key component of Pilbara biodiversity, with many insects dependant on them for larval food, including butterfly genera *Ogyris* (Lycenidae) and *Delias* (Pieridae). Mistletoes also support the highly adapted mistletoebird (*Dicaeum hiundinaceum*) as well as spiny-cheeked and grey honeyeaters, important pollinators within the region.

Though there's no evidence of an extinction threat at the bioregional or national level, there has been sub-regional contraction, especially where modern fire regimes for highly flammable hummock grasslands exist. 'The outlook is bleak for mistletoes growing in areas dominated by hummock grasslands,' Dr. Start says. 'Sub-regional extinction is likely and there are broader implications for biodiversity.' The study found that mistletoes have adapted to fire risk in various and imperfect ways.

Twelve taxa reduce risk by favoring hosts that grow in fire-sheltered sites. However, when host stems are killed, the length of host reestablishment often appears prohibitive to mistletoe regeneration. Two species have very low host specificity, which increases the likelihood that imported seed can be deposited on suitable hosts, allowing for faster regeneration following fire. However, these species are located in hummock grasslands, bringing the issues of fire frequency and seed replacement distances into play.

Rob Payne, ScienceNetwork, Western Australia, December 19, 2011

An unexpected consequence of climate change: heat-waves kill plant pests and save our favorite giant trees.

Australia is sweltering through another heatwave, and there will be more in the near future as climate change brings hotter, drier weather. In some parts of Australia, the number of days above 40°C will double by 2090, and with it the tragedy of more heat-related deaths. In the complex world of plant ecology, however, heatwaves aren't always a bad thing. Rolling days of scorching temperatures can kill off plant pests, such as elm beetles and mistletoe, and even keep their numbers down for years. This is what we saw after the 2009 heatwave that reached a record 46.4°C in Melbourne and culminated in the catastrophic Black Saturday bushfires. Years later, the trees under threat from the pest species were thriving. Here are a few of our observations.

In the days following Black Saturday, botanists, horticulturists and arborists noticed a curious heatwave side-effect: the foliage of native Australian mistletoes (*Amyema miquelii* and *A. pendula*) growing on river red gums lost their green colour and turned grey. The two species of mistletoe are important in the ecology of plant communities and to native bird and insect species. But infestation on older trees can lead to their deaths, particularly in drought years.

Australian mistletoe is not related to the northern hemisphere mistletoes of Christmas kissing fame. They are water and nutrient parasites on their host tree and can kill host tissues through excessive water loss. Often mistletoes go largely unnoticed, only becoming obvious when they flower. This is because many have evolved foliage with a superficial resemblance to the host species, a phenomenon known as host mimicry or 'crypsis.'

During the Black Saturday heatwave, many mistletoes growing on river red gums died. The gums not only survived, but when record rains came in 2010, they thrived. A decade on, the mistletoe numbers are gradually increasing, but they're still not high enough to threaten the survival of older, significant red gums. We want both mistletoes and red gums to persist. But often the old red gums are last survivors of larger populations that have been cleared—a seed source for future regeneration.

Gregory Moore, The Conversation, Feb 1 2021.

Native trees play host to rare plant species in North Canterbury (New Zealand) bush

Tiromoana Bush at Kate Valley is home to three different mistletoe plants, including the rare dwarf mistletoe, which grows on kānuka (*Kunzea ericoides*) in this area. New Zealand's rarest mistletoe species are making a comeback thanks to a regeneration project at Tiromoana Bush in North Canterbury. The native forest, owned and funded by Transwaste Canterbury, is the result of 15 years of work to restore the area, which also boasts a 12-hectare wetland, supporting a range of flora and fauna. More than 200 native species are now growing in the bush, including matai, whekī and titoki, the mistletoes are an extraordinary part of the regenerating native bush. Rarest of all is the dwarf mistletoe (*Korthalsella salicornioides*), which occurs on kānuka (also on *Leptospermum scoparium*)..

Korthalsella salicornioides Photo Delbert Wiens

White mistletoe or tāpia (*Tupeia antarctica*), which grows on five-finger, and green mistletoe or pikirangi (*Ileostylus micranthus*), which is found on mingimingi, matagouri and a few other hosts, are also growing in the area. Professor David Norton, from the University of Canterbury's Te Kura Ngahere/School of Forestry and author of The Tiromoana Bush Restoration Management Plan, said considering the exacting conditions required for their growth it was pretty special to have three mistletoe species in Tiromoana Bush.'So many factors have to come together to enable our rare native mistletoes to survive,' he said. 'Birds are required to spread their seeds, and deposit them accurately onto specific native hosts for them to establish and grow'. 'Dwarf mistletoe only grows on kānuka here making it incredibly rare, yet a significant number are growing in Tiromoana Bush.'

Mistletoe varieties are unusual as they are arboreal parasites – instead of germinating on the ground they require a host species to live on. *K. salicornioides* is ranked nationally critical, the highest threat level in New Zealand, because of concerns its main host species kānuka might be affected by myrtle rust. *T. antarctica* is ranked as at risk - declining nationally, and is also quite sparse in many areas of New Zealand, whereas *I. micranthus* is widely distributed nationally and the only mistletoe not threatened or at risk.

Tiromoana Bush and the native forest restoration project are owned and funded by Transwaste Canterbury, which owns and operates the adjacent Kate Valley Landfill in Waipara.

Emma Dangerfield, Stuff, Feb 3rd 2021.

Oxford (New Zealand) wetland to be protected.

The Waimakariri Water Zone Committee is supporting biodiversity funding of NZ$23,600 to restore approximately two hectares of remnant podocarp forest, wetland and a stream located near Oxford. Environment Canterbury and the QEII Trust are working together with the landowner to assist with land retirement, fencing, weed control and planting to enhance this important ecological habitat. The landowner will also contribute to funding the project, which has a total cost of $35,400.

The project aims to protect several types of flora including two species of pygmy mistletoe (*Korthalsella clavata* and *Korthalsella lindsayi*), along with two critically endangered species of evergreen myrtle/ rōhutu (*Lophomyrtus obcordate*) and (*Neomyrtus pedunculata*). Myrtle/ rōhutu bark and berries have anti-inflammatory antioxidant properties and are used in traditional Māori medicines/ rongoā.
The bush also contains mānuka (*K. clavata*) which is classified as a species in decline across New Zealand.

A pygmy mistletoe (*Korthalsella lindsayi*) growing on weeping matipo (*Myrsine divaricata*) in the forest block.

The regenerated forest block will provide an ideal environment for native birds, while fencing to remove stock access to the stream will provide a suitable habitat for the vulnerable Canterbury mudfish/kowaro which prefer swampy lowland habitats such as wetlands and swamp forests.

Environment Canterbury Biodiversity Officer Zipporah Ploeg said the project had a high ecological score and would allow the landowners to continue their positive work to improve the environment and waterways. ‘One of the areas of bushland was retired from farming and turned into a QEII covenant several decades ago and the funding will enable further protection works to enhance existing biodiversity values,’ she said. Waimakariri Water Zone Committee Chair Michael Blackwell said the restoration project tied in well with the growing understanding of the importance of protecting biodiversity in the local community. ‘Wetlands and native forests are the organs of our land and deserve to be protected and enhanced so that we can improve the overall health of our waterways,’ he said. ‘Being able to help landowners to carry out further environmental initiatives to improve biodiversity is a vital part of the one Committee's work.’

NZHerald, 26 May, 2021

New mistletoe species found in Davao Oriental’s Mt. Hamiguitan

A new species of a mistletoe, was discovered in Mt. Hamiguitan Range Wildlife Sanctury in Davao Oriental by researchers from the National Museum and Central Mindanao University in Bukidnon. A statement released by the Department of Environment and Natural Resources (DENR)-Davao on Saturday, June 5, World Environment Day, said the new floral species called *Amylotheca cleofei* Tandang, Galindon, & A.S.Rob. belongs to the family Loranthaceae. It said this new plant species was the first of this genus of mistletoe to be recorded in the Philippines and the fifth in the world. The plant, first documented in 2019, is endemic to Mt. Hamiguitan.

Photo courtesy of DENR-Davao

The DENR said the mistletoes, known for their exceptional lifestyle as a hemiparasite, propagate through birds that spread their seeds to other host plants. ’When a bird eats the mistletoe fruit and poops (excretes), the sticky seed will attach to the branch and a specialized root-like structure called haustorium will emerge and penetrate to the host tree or shrub to extract water and nutrients for its growth and nourishment,’ it added.
In a post on social media on Saturday, the National Museum of the Philippines said its researchers, Danilo Tandang and John Michael Galindon of the Botany and National Herbarium Division, discovered the plant species. Their research on this new plant species was published in Phytotaxa. The co-authors of the paper included Noel E. Lagunday, Fulgent P. Coritico, Victor B. Amoroso and Alastair S. Robinson.

Antonio L. Colina IV, Minda News, 6 June, 2021.
See Lagunday *et* al., 2021 in LITERATURE, below.

Ugadi pachadi half-done as Hyderabad runs low on neem flowers

Until a few years ago, neem - an evergreen tree species known for its medicinal properties - was available all over the city. ‘Ugadi pachadi’ is a popular dish consumed in every Telugu household on Ugadi, or the Telugu New Year’s Day, which is just three days away. Prepared using raw mango, tamarind and jaggery, the recipe’s chief ingredient is quite special - flowers from the neem tree. Unfortunately, for many Telugus in Hyderabad, finding a neem teem, that too one bearing flowers, is an arduous task.

Until a few years ago, neem - an evergreen tree species known for its medicinal properties - was available all over the city. But their numbers have consistently come down. Case in point is the Nimboli adda near Kachiguda in the city. The locality, which supposedly got its name for being home to many neem trees, does not have more than a couple of young neem trees now. Flower-bearing trees are a rarity here.

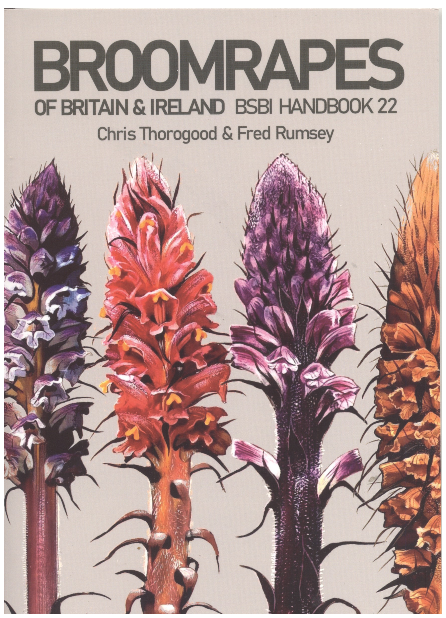
One reason behind the decline in the number of neem trees, apart from deforestation, is the infestation of a parasite creeper called loranthus or Honey Suckle Mistletoe (*Dendrophthoe falcata*) , as per officials of the Greater Hyderabad Municipal Corporation dealing with urban biodiversity. The parasitic creeper anchors itself onto the branches of neem trees and sucks water and nutrients directly from them, weakening the host.

To protect the neem tree, control measures against the parasite are imperative. The creepers must be removed in the early stages of infestation, or they should be sawn off from the branches of its host. Officials admit that the dwindling number of neem trees in the city is a cause of concern and they, along with the HMDA, are taking up plantation of neem saplings as part of the Telangana Ku Haritha Haram programme.

S. Bachan Jeet Singh, New Indian Express, 11 April 2021.

BOOK REVIEWS

Broomrapes of Britain & Ireland. 2021. by Chris Thorogood and Fred Rumsey. ISBN 9780901158598. Paperback. £17.50. Botanical Society of Britain and Ireland, Durham, United Kingdom. 152 pages.



Broomrapes of Britain & Ireland. Botanical Society of Britain and Ireland. Handbook 22. Chris Thorogood and Fred Rumsey. 2021. ISBN 9780901158598. Paperback. £17.50. Botanical Society of Britain and Ireland, Durham, United Kingdom. 152 pages.

Both authors have extensive experience with the broomrapes and the family as a whole in the field and in the herbarium and share this through lucid text and a wonderful array of well-reproduced colour images of all species as well as Thorogood's incomparable drawings. Features of the corolla are important for species determination, features that are very difficult to determine from herbarium specimens.

The book begins with an introduction to the family Orobanchaceae and a lucid discussion of the complex life cycle of broomrapes, *Orobanche* and *Phelipanche.* There are sections also on the related *Lathraea* species and on other non-photosynthetic plants that could be confused with broomrapes—plants like dodders (species of *Cuscuta* in the Convolvulaceae); pine drops (species of *Hypopitys* of the Ericaceae); and achlorophyllous orchids (species in the genera *Neottia* and *Corallorhiza*). This is followed by terse but informative information on ecology. Many broomrapes are endangered in Britain and Ireland. Particularly helpful is the section 'Identification' which provides the user with the criteria for distinguishing species. A short section on taxonomic history is especially germane for this genus which has suffered by fragmentation through splitting but is now receiving attention through careful field studies coupled with molecular studies. Yet the authors state—with British understatement-- that until further studies occur 'taxonomy in the genus is likely to remain in a state of some flux.'

The bulk of the book is made up of species accounts following the format of the Botanical Society of Britain and Ireland's (BSBI) handbooks. In addition to conservation status, description with key characters, there is information on the hosts, colour photographs of plants and their habitats as well as exceptional line drawings for each of the fourteen species. The requisite BSBI maps with grids are included for each of the species, subspecies, and varieties. The parasite distribution is helpfully mapped along with the distribution of the hosts.

Orobanche minor receives special attention because of difficulty, as noted earlier, separating it from distinct but similar appearing species. No doubt Broomrapes of Britain and Ireland will be used to correct determinations in herbaria. The four sub-specific taxa of *O. minor* are treated in detail. This will be of potential value to weed scientists dealing with this widely spread parasite reported from North America and Australia and perhaps elsewhere where crop and forage plants are damaged. Do some of the invasions of this parasitic weed involve distinct varieties?

A helpful glossary and references cited conclude what will undoubtedly be the 'go to' reference for anyone interested in these beautiful and fascinating plants. As the back cover states: 'It is hoped that this book will stimulate interest in broomrapes broadly, and promote their much-needed conservation focus in the region.' It will accomplish that for users in Britain and Ireland and regions far beyond.

Lytton Musselman and Chris Parker

Mistel in der Tumortherapie 5: Aktueller Stand der Forschung und klinische Anwendung. 2020. Edited by Dr. Rainer Scheer and 10 others. KVC Verlag –NATUR UND MEDIZIN e. V.,Essen.www.kvc-verlag. 607 pp.

Oncology is changing rapidly and new successful therapies are raising hopes. As oncology is changing, the contribution of mistletoe therapy must evolve and redefine its place. For this reason, the role of mistletoe in tumour therapy is scientifically re-examined at regular intervals in the so-called Mistletoe Symposia, which have been held since 1995 (www.mistelsymposiume.de), and subsequently presented in a book.
The new book in this series contains 49 contributions from the fields of biology, pharmacy and pharmacology, preclinical and clinical studies with findings from therapeutic experience and clinical trials, as well as reviews presented at the 7th Mistletoe Symposium in November 2019. The clinical part of the symposium is focussed on bronchial and breast carcinoma: What is the potential of conventional tumour therapy, what contribution does mistletoe make, e.g., in different dosages and forms of application, and how does mistletoe therapy also help patients in the psychological dimension? A further focus is on checkpoint inhibitors and modern immunological therapies with which mistletoe is used. The abstracts in German and English preceding each article provide a good overview of the respective topic.
All contributions are vividly supplemented with graphics, diagrams and photos. Detailed reference lists and correspondence addresses facilitate further, more in-depth work. The book is a contribution to integrative oncology, the medicine of the future. Like its 6 predecessor volumes, it is an important reference work for all those who wish to inform themselves about the state of theoretical and practical knowledge and clinical evidence of mistletoe therapy.

Dr Rainer Scheer,
Carl Gustav Carus-Institut, Germany

CABI INVASIVE SPECIES COMPENDIUM

Readers may wish to be aware of this valuable resource, providing detailed data sheets on virtually all the significant parasitic weed species in Orobanchaceae, Viscaceae, Loranthaceae, Convolvulsceae and Lauraceae. Each data sheet includes comprehensive coverage of distribution, host range, biology, ecology, taxonomy, control, together with photos. https://www.cabi.org/ISC

COMPOSITE FILES

All issues of Haustorium are available in two PDF documents, 'Haustorium1-48' and 'Haustorium49-79' (shortly to be amended to 49-80) on Lytton Musselman's Haustorium website https://ww2.odu.edu/~lmusselm/haustorium/index.shtml - these can be searched for species, author etc.

FORTHCOMING MEETINGS

The 16th WCPP will be held in Nairobi in Summer 2022. Further details will appear on the ipps website (http://www.parasiticplants.org/)

Bioherbicides 2021 – Overcoming the barriers to adoption of microbial bioherbicides. Bari, Italy, 22-24 Sept, 2021. https://ewrs.org/en/info/Upcoming-events/Bioherbicides-2021

Agribalkan 2021 III Balkan Agricultural Congress. August 29th - September 1st, 2021, Edirne, Turkey www.agribalkan.net

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE
* these websites may need copy and paste.

For information on the International Parasitic Plant Society, past issues of Haustorium, etc. see: http://www.parasiticplants.org/
For Dan Nickrent's 'The Parasitic Plant Connection' see: http://www.parasiticplants.siu.edu/
For the Parasitic Plant Genome Project (PPGP) see: http://ppgp.huck.psu.edu/

For Old Dominion University Haustorium site: see https://ww2.odu.edu/~lmusselm/haustorium/index.shtml

For information on the new Frontiers Journal 'Advances in Parasitic Weed Research' see: http://journal.frontiersin.org/researchtopic/3938/advances-in-parasitic-weed-research

For a description of the PROMISE project (Promoting Root Microbes for Integrated *Striga* Eradication), see: http://promise.nioo.knaw.nl/en/about

*For PARASITE - Preparing African Rice Farmers Against Parasitic Weeds in a Changing Environment: see http://www.parasite-project.org/

For the Toothpick Project – see https://www.toothpickproject.org/

For the Annotated Checklist of Host Plants of Orobanchaceae, see: http://www.farmalierganes.com/Flora/Angiospermae/Orobanchaceae/Host_Orobanchaceae_Checklist.htm

For a description and other information about the *Desmodium* technique for *Striga* suppression, see: http://www.push-pull.net/

For information on the work of the African Agricultural Technology Foundation (AATF) on *Striga* control in Kenya, including periodical 'Strides in *Striga* Management' and 'Partnerships' newsletters, see: http://www.aatf-africa.org/

For Access Agriculture (click on cereals for videos on *Striga*) see: http://www.accessagriculture.org/

*For information on future Mistel in derTumortherapie Symposia see: http://www.mistelsymposium.de/deutsch/-mistelsymposien.aspx (NB see above re 7th Symposium)

For a compilation of literature on *Viscum album* prepared by Institute Hiscia in Arlesheim, Switzerland, see: http://www.vfk.ch/informationen/literatursuche (in German but can be searched by inserting author name).

For an excellent publication by the Universidade Federal do Rio Grande de Sul on Southern Brazilian Mistletoes (Dettke, G.A. and Waechter, J.L. 2013) see: https://fieldguides.fieldmuseum.org/sites/default/files/rapid-color-guides-pdfs/493.pdf

For the work of Forest Products Commission (FPC) on sandalwood, see: http://www.fpc.wa.gov.au/sandalwood

LITERATURE

We thank CAB Direct for access to their abstract data base.

Abdalllah, F. and 9 others. 2020. Wild *Lathyrus* species as a great source of resistance for introgression into cultivated grass pea (*Lathyrus sativus* L.) against broomrape weeds (*Orobanche crenata* Forsk. and *Orobanche foetida* Poir.). Crop Science 61(1): 263-276. (https://acsess.onlinelibrary.wiley.com/doi/10.1002/csc2.20399) [Noting severe losses from *Orobanche* spp. in Morocco and Tunisia. Screening 285 accessions of 13 *Lathyrus* spp. revealed complete resistance to both species in *L. articulatus* and moderate resistance in *L. aphaca* and *L. ochrus.* Two *L. sativus* accessions, IG64782 and IG65197 showed complete resistance to *O. crenata.*)

*Abdel-Wahab, S.I. and Abdel-Wahab, E.M. 2021. Cropping systems of fenugreek with faba bean to reduce broomrape infestation. Legume Research LR621. (https://www.arccjournals.com/journal/legume-research-an-international-journal/LR-621) [Testing various combinations of fenugreek and faba bean and concluding that growing two rows of faba bean in both sides of 120 cm wide ridges with four rows of fenugreek in the middle of the ridge could be an integrated control strategy to increase faba bean productivity, land usage and economic return under heavy infestations of *Orobanche crenata.*]

*Ablazov, A., Mi JiaNing, Muhammad Jamil, Jia KunPeng, Wang JianYou, Feng QiTong and Salim Al-Babili. 2020. The apocarotenoid zaxinone is a positive regulator of strigolactone and abscisic acid biosynthesis in *Arabidopsis* roots. Frontiers in Plant Science 11: (https://www.frontiersin.org/articles/10.3389/fpls.2020.00578/full) [Showing that, in contrast to rice, in which zaxinone suppresses strigolactone production and release, it stimulates them in *Arabidopsis*.]

Abu, P., Badu-Apraku, B., Ifie, B.E., Tongoona, P., Ribeiro, P.F., Obeng-Bio, E. and Offei, S.K. 2020. Genetics of extra-early-maturing yellow and orange quality protein maize inbreds and derived hybrids under low soil nitrogen and *Striga* infestation. Crop Science 61(2): 1052-1072.

*Akaogu, I.C. and 9 others. 2020. Genetic diversity and inter-trait relationships among maize inbreds containing genes from *Zea diploperennis* and hybrid performance under contrasting environments. Agronomy 10(10):

(https://www.mdpi.com/2073-4395/10/10/1478) [The study provided an opportunity for selecting divergent parents for tagging candidate genes and quantitative trait loci for marker-assisted introgression of *Striga* resistance genes into early maturing tropical maize breeding populations. The most reliable secondary trait for indirect selection for grain yield under *Striga* infestation was the ear aspect.]

Al-Gburi, B.K.H. 2021. Effect of different control applications on *Cuscuta campestris*, and biochemical content of eggplant. Journal of the Saudi Society of Agricultural Sciences 20(4): 209-216. [A range of nutrients applied with sulfosulfuron apparently improved the control of *C. campestris* on eggplant. Results not easy to interpret.]

*Aly, R., Matzrafi, M. and Bari, V.K. 2021. Using biotechnological approaches to develop crop resistance to root parasitic weeds. Planta 253(5): (https://doi.org/10.1007/s00425-021-03616-1) [Reviewing the main areas of research leading to the discovery and functional analysis of genes involved in host-induced gene silencing that target key parasite genes, transgenic host modification, and host gene editing to generate sustainable resistance to root parasitic weeds.]

Amani M.H. Abu-Shall. 2021. Effect of infestation density with *Phelipanche aegyptiaca* on the efficiency of bio-agent, *Phytomyza orobanchia* and infestation by *Tuta absoluta* on tomato crop at El-Beheira Governorate, Egypt. Alexandria Science Exchange Journal 18(42):445-452. [Infestation of tomato with *P. aegyptiaca* had no influence on infestation by *P. orobanchoides*. But moderately infested plants with 11-20 parasites per host resulted in lower infestation by the leaf miner, *T. absloluta,* and significantly increased yields compared with less infested tomato with 1-10 parasites per host.]

Ančić, M.**,** Pernar, R.**,** Bajić, M.**,** Krtalić, A.**,** Seletković, A.**,** Gajski, D. and Kolić, J. 2020. Spectral signatures (endmembers) some of forest species in the Republic of Croatia. Šumarski List 144(3/4): 119-127. [Recording the spectral signatures of several species including *Viscum album* and *Loranthus europaeus*.]

*Anteyi, W.O. and Rasche, F. 2021. Role and in vivo localization of *Fusarium oxysporum* f. sp. *strigae* and *Bacillus subtilis* in an integrated *Striga hermonthica* biocontrol system. Phytofrontiers (https://apsjournals.apsnet.org/doi/10.1094/PHYTOFR-08-20-0011-R) [Various combinations of *F. oxysporum* f. sp. *strigae* and rhizobacterium, *Bacillus subtilis* increased sorghum biomass, but inclusion of the rhizobacterium did not improve suppression of *S. hermonthica* attachment.]

Aquino, B., Bradley, J.M. and Lumba, S. 2020. On the outside looking in: roles of endogenous and exogenous strigolactones. The Plant Journal 105(8): 322-334. [Reviewing the various roles of strigolactones with emphasis on the influence of low phosphate conditions.]

*Avila, A.T., van Laara, T.A., Constable, J.V.H. and Waselkov, K. 2020. 16S rRNA gene diversity of bacterial endophytes in parasitic *Cuscuta campestris* and its *Helianthus annuus* host. Microbiology Resource Announcements 9(43): (https://mra.asm.org/content/ga/9/43/e00968-20.full.pdf)

Atkinson, M.D. and Atkinson, E. 2020. Biological flora of the British Isles: *Lathraea clandestina*. Journal of Ecology (Oxford) 108(5): 2145-2168. [A very detailed description of this colourful western European species, parasitic most frequently on *Populus* spp., *Salix* spp. and *Alnus glutinosa*, pollinated by long-tongued bees. Seeds are explosively ejected, up to 8m.]

Aybeke, M. 2020. *Aspergillus alliaceus* infection fatally shifts *Orobanche* hormones and phenolic metabolism. Brazilian Journal of Microbiology 51(3): 883-892. [Describing the steady reduction in phenolic substances leading to the eventual death of *O. cernua*.]

Banerjee, A. and Stefanović, S. 2020. Reconstructing plastome evolution across the phylogenetic backbone of the parasitic plant genus *Cuscuta* (Convolvulaceae). Botanical Journal of the Linnean Society 194(4): 423-438. [Analysis of changes in plastome composition and structure across the phylogenetic backbone of *Cuscuta* spp. leads to a step-by-step model of plastome evolution and highlight remarkable retention of most photosynthetic genes in these parasitic plants].

Bao GenSheng, Song MeiLing, Wang YuQin and Li ChunJie. 2020. Effects of parasitism by a root hemiparasite on mutualistic relationship between host grasses and their *Epichloë endophytes*. (in Chinese) Acta Prataculturae Sinica 29(2): 42-51. [Studies with two grasses, *Stipa purpurea* and *Elymus tangutorum* suggest that the effects of combined infection with *Pedicularis kansuensis* and *Epichloë tangutorum* are species specific.]

Bao GenSheng**,** Wang YuQin**,** Song MeiLing and Wang HongSheng. 2020. **(**Effects of *Pedicularis kansuensis* parasitism on physiological characteristics of symbiont under different hemiparasite density.) (in Chinese) Acta Microbiologica Sinica 2020(3): 590-600. [The endophyte, ‘grass-epichlo?symbiont’ which normally favours the growth of its host, *Stipa purpurea* was found to also favour its growth when parasitised by *P. kansuensis*.]

*Baoua, I., Rabé, M.M., Murdock, L.L. and Baributsa, D. 2021. Cowpea production constraints on smallholders' farms in Maradi and Zinder regions, Niger. Crop Protection 142: (https://www.sciencedirect.com/science/article/pii/S026121942100003X?via%3Dihub) [Noting *Striga gesnerioides* among serious restraints to cowpea yields in Niger, occurring in 50% of all fields surveyed.]

Barbour, L. 2020. Enhancing the formation of heartwood in sandalwood in Vanuatu final report. ACIAR Final Reports FR2020/021: 62pp.

*Baskin, J.M. and Baskin, C.C. 2021. Germination and seed/embryo size in holoparasitic flowering plants with "dust seeds" and an undifferentiated embryo. The Botanical Review 9 February: (https://doi.org/10.1007/s12229-020-09242-y) [[A detailed review of the morphology and germination of species in all lineages of holoparasite plants. Includes extensive references.]

Bilgili, E., Coskuner, K.A. and Ozturk, M. 2020. Leaf area - sapwood area relationship in Scots pine (*Pinus sylvestris* L.) under mistletoe (*Viscum album* ssp. *austriacum*) infection. Dendrobiology 84: 1-11. [Results confirmed that *V. album* caused significant reduction in needle size (length, width, area and weight) in Scots pine.]

*Bonanomi, G., Salvatori, N., Zotti, M., Stinca, A., Motti, R., Idbella, M., Cartenì, F., Mazzoleni, S. and Giannino, F. 2020. Parasitic plant causes an ephemeral "rainbow" pattern in a reservoir bank. Journal of Vegetation Science 32(1): (https://onlinelibrary.wiley.com/doi/epdf/10.1111/vs.12931) [As a reservoir level fell, the newly exposed soil was dominated by pure *Xanthium italicum*; above that band it was yellow with infestation of *Cuscuta campestris*; above that band was brown where the *Xanthium* had died.]

*Boukar, O., Abberton, M., Oyatomi, O., Togola, A. Tripathi, L. and Fatokun, C. 2020. Introgression breeding in cowpea [*Vigna unguiculata* (L.) Walp.]. Frontiers in Plant Science 11: (https://doi.org/10.3389/fpls.2020.567425) [*Vigna vexillata* lines were resistant to *Striga gesnerioides* but are cross-incompatible with cultivated cowpea.]

Bouwmeester, H., Changsheng, Li, Thiombiano, B., Rahimi, M. and Lemeng Dong. 2021. Adaptation of the parasitic plant lifecycle: Germination is controlled by essential host signaling molecules. Plant Physiology 185(4): 1292-1308. [A comprehensive review of the different classes of germination stimulants, how they are produced and their role in host specificity, and how this knowledge may contribute to improved control methods.]

Briache, F.Z., Ennami, M., Mbasani-Mansi, J., Lozzi, A., Abousalim, A., El-Rodeny, W., Amri, M., Triqui, Z.E.A. and Mentag, R. 2020. Effects of salicylic acid and indole acetic acid exogenous applications on induction of faba bean resistance against *Orobanche crenata*. Plant Pathology Journal 36(5): 476-490. [Reporting significant protection of faba bean against *O. crenata* infestation from seed soaking with salicylic acid or IAA. Foliar sprays were not effective.]

Buah, S.S.J., Denwar, N.N., Kanton, R.A.L. and Kombiok, J.M. 2021. Participatory approach to variety selection using soybean production in Ghana as a model. West African Journal of Applied Ecology 28(2): 14-30. [Based on farmers' opinions, 4 lines of soybean are recommended - TGx 1799-8F, TGx 1834-5E, TGx 1445-3E and TGx 1844-22E – based on a combination of desirable characteristics, including their value as trap crops for control of *Striga hermonthica*.]

*Cai HongYue, Lu HongFang, Tian Yang, Liu ZhanFeng, Huang Yao and Jian ShuGuang. 2020. Effects of invasive plants on the health of forest ecosystems on small tropical Coral Islands. Ecological Indicators 117: (https://doi.org/10.1016/j.ecolind.2020.106656) [Discussing the impact of *Cassytha filiformis* on Chinese off-shore islands.]

Caires, C.S. and Dettke, G.A. 2021. *Passovia bracteata*, a new species of Loranthaceae endemic to the Brazilian Amazon**.** Phytotaxa 490(1): 114-117. [Describing *P. bracteata* characterized by its terete stems, ovate leaves, racemose inflorescences and pedunculate triads with a long-foliaceous bract subtending the median flower of the triad and/or the whole triad.]

*Calkins, S.J., Shaw, D.C. and LanYung-Hsiang. 2020. Transformation of western hemlock (*Tsuga heterophylla*) tree crowns by dwarf mistletoe (*Arceuthobium tsugense,* Viscaceae). Forest Pathology 51(1): (https://publons.com/publon/10.1111/efp.12664/) [Noting that over 10% of all western hemlock trees in Oregon are infected by *A. tsugense.* Heavy infestation could involve over 3000 individuals per tree. Finding that infections tended to reduce branch foliage and lead to increased proportion of foliage distal to the infection.]

*Cartry, D., Steinberg, C. and Gibot-Leclerc, S. 2021. Main drivers of broomrape regulation. A review. Agronomy for Sustainable Development 41(17):

(https://doi.org/10.1007/s13593-021-00669-0) [A review concluding that methods for control of *Orobanche* and *Phelipanche* have shown limited success. Combining different control methods needs to be considered in an integrated system, including new methods of biocontrol and modeling approaches.]

Casadesús, A. and Munné-Bosch, S. 2021. Holoparasitic plant–host interactions and their impact on Mediterranean ecosystems. Plant Physiology 185(4): 1325–1338. [A review discussing current knowledge on the impact and ecophysiology of holoparasitic plants e.g. *Orobanche* spp. and *Phelipanche* spp., economically important in Mediterranean agroecosystems. Also highlighting the role of such as *Cytinus hypocistis* in shaping natural Mediterranean ecosystems via their interaction with *Cistus* etc.]

Chandrashekharaiah P.S., Paul, V., Kushwaha, S., Sanyal, D. and Dasgupta, S. 2021. Biotechnological approaches for enhancing stress tolerance in legumes. Sustainable Agricultural Reviews 51: 247-293. [Describing development of biotechnological tools in model leguminous crops such as *Medicago truncatula* and *Lotus japonicus*, with potential for the regulation of stress related genes, including those involved in biotic stresses due to such as *Orobanche* spp.]

Chandrashekar Sandeep, Amit Kumar, Rodrigues, V., Syam Viswanath, Shukla, A.K. and Velusamy Sundaresan. 2020. Morpho-genetic divergence and population structure in Indian *Santalum album* L. Trees: Structure and Function 34(5): 1113-1129. [Revealing the presence of low genetic variability in *S. album*, which mandates immediate attention towards its sustainable utilization, propagation, and long term conservation.]

*Chen PoHao, Chung AnChing, and Yang ShengZehn. 2020. First report of the root parasite *Cansjera rheedei* (Santalales: Opiliaceae) in Taiwan. Biodiversity Data Journal 8: e51544 (https://bdj.pensoft.net/article/51544/) [Describing *C. rheedei*, a liana occurring from India and Nepal to southern China and western Malaysia.]

Chileen, B.V., McLauchlan, K.K, Higuera, P.E., Parish, M. and Shuman, B.N. 2020. Vegetation response to wildfire and climate forcing in a Rocky Mountain lodgepole pine forest over the past 2500 years. Holocene 30(11): 1493-1503. [Studying fire occurrence and post-fire vegetation change in a *Pinus contorta* forest over the past 2500 years to from pollen preserved in a sediment core from Chickaree Lake, Colorado, USA. Showing that the pine population had been quite stable throughout, though *Arceuthobium* had increased over the past 1000 years, associated with wetter winters.]

Cho WonBum**,** Han EunKyeong**,** Lee JungHyun and Son DongChan. 2020. The complete chloroplast genome sequence of *Taxillus yadoriki* (Loranthaceae): a hemi-parasitic evergreen shrub in East Asia. Mitochondrial DNA Part B 5(3): 3172-3173. [109 genes encode 68 proteins, 8 rRNAs, and 33 tRNAs. All ndh genes have been lost and the SSC region consists of only 4 genes similar to other *Taxillus* species. In ML phylogenetic, monophyly of *Taxillus* was strongly supported with high bootstrap value and formed a sister group with *Scurrula*.]

Cirocco, R.M., Facelli, J.M. and Watling, J.R. 2020. The impact of a native hemiparasite on a major invasive shrub is affected by host size at time of infection. Journal of Experimental Botany 71(12): 3725-3734. [Results show that the native *Cassytha pubescens* strongly decreases growth of the major invasive shrub, *Ulex europaeus* especially when hosts are small, suggesting it could be used most effectively as a biocontrol when deployed on smaller hosts.]

Comanici, R. and 13 others. 2020. (Rare plants and forest habitats from Crucea Forest District (Suceava Forest Direction.) (in Romanian) Revista de Silvicultura si Cinegetica 25(465): 61-69. [*Rhinanthus alectolorophus* recorded for the first time in the Bistrița Mountains.]

Costa, C.deM., Boaretta, A., Ferreira, P.P.A., da Silva, S.S., Nepomuceno, S.C., Silva, D.B. and Alves, F.M. 2020. New records of *Cuscuta* L. (Convolvulaceae) in Central-West Brazil. Checklist 16()6): 1725-1731. [Noting new records for *Cuscuta platyloba, Cuscuta partita* and *Cuscuta xanthochortos* var. *carinata*.]

*Cui SongKui, Kubota, T., Nishiyama, T., Ishida, J. K., Shigenobu, S., Shibata, T.F., Toyoda, A., Hasebe, M., Shirasu, K. and Yoshida, S. 2020. Ethylene signaling mediates host invasion by parasitic plants. Science Advances 6(44): 44. (https://advances.sciencemag.org/content/6/44/eabc2385) [Studies with *Phtheirospermum japonicum* reveal that two mutants have point mutations in homologs of *ETHYLENE RESPONSE 1* (*ETR1*) and *ETHYLENE INSENSITIVE 2* (*EIN2*), signaling components in response to the gaseous phytohormone ethylene, and concluding that parasitic plants use ethylene as a signal to invade host roots.]

Das, T.K., Sonaka Ghosh, Kamlika Gupta, Suman Sen, Biswaranjan Behera and Rishi Raj. 2020. The weed *Orobanche*: species distribution, diversity, biology and management. Journal of Research in Weed Science 3(2): 162-180. [A general review.]

Dayou, O., Kibet, W., Ojola, P., Irappa, P., Wicke, S. and Runo, S. 2021. Two-tier witchweed (*Striga hermonthica*) resistance in wild pearl millet (*Pennisetum glaucum*) 29Aw. Weed Science 69(3): 300-306. [Finding that the resistance of line 29Aw is thanks to much lower stimulant exudation and also to post-attachment resistance in cortex and endodermis.]

*De St Germain and 16 others. 2021. A *Phelipanche ramosa* KAI2 protein perceives strigolactones and isothiocyanates enzymatically. Plant Communications 5 February: 100166. (https://www.sciencedirect.com/science/article/pii/S2590346221000419?via%3Dihub) [Identification of five putative strigolactone receptors in *P. ramosa* showing that PrKAI2d3 is involved in the stimulation of seed germination.]

De Sedas, A., Turner, B.L., Winter, K. and Lopez, O.R. 2020. Salinity responses of inland and coastal neotropical trees species. Plant Ecology 221(8): 95-708. [Including results for *Minquartia guianensis* (Olacaceae).]

Demir, I., Kaya, I., Usta, M. and Sipahioğlu, H.M. 2020. Molecular phylogeny based on its sequences of nrDNA of some species belonging to dodder (*Cuscuta* L.) genus from various ecological sites of Turkey. Notulae Botanicae, Horti Agrobotanici, Cluj-Napoca 48(3): 1332-1340. [ITS sequences provided phylogenetically informative results in combination with the secondary structures. Successfully identifying *C. hyalina* , *C. monogyna*, *C. europaea* , *C. palaestina*, *C. approximata*, *C. kurdica*, *C. kotschyana* and *C. babylonica*.]

Di Na, Ju XiangYu, Han HaiJun, Wang Jing, Cui Chao and Zheng XiQing. 2020. Effects of preculture conditions on the germination of sunflower broomrape seeds. (in Chinese) Chinese Journal of Oil Crop Sciences 42(3): 486-492. [Finding the optimal pre-culture conditions were a temperature of 25°C, pre-culture time 7 days, osmotic potential at 0 MPa, pH 7.0, and concentration of gibberellins of 30 mg/mL]

Divakara, B.N. and Tewari, V.P. 2021. Distribution, growth and yield of *Santalum album* L. in Karnataka, India. Indian Forester 147(1): 42-50.

*Duca, M., Clapco, S. and Port, A., Boicu, A., Martea, R., Krupp, A. and Spring, O. 2021. Comparative analysis of two *Orobanche cumana* Wallr. accessions with a different virulence. Acta Physiologiae Plantarum 42(11): (https://doi.org/10.1007/s11738-020-03152-7) [A morphologic, genetic, transcriptomic, and proteomic analysis of two *O. cumana* accessions with different level of virulence (races E and H) showed 19 differentially expressed proteins, including 6 specific for race E and 13 specific for race H.]

Duca, M., Clapco, S. Boicu, A., and Port, A. 2020. Morphological variability of broomrape's seeds collected from different host plants. Journal of Botany X11 NR. 2(21): 13. [Studies of seed morphology in samples of *Orobanche cumana* in Moldova, where the species has occurred for over 50 years, found no variation in length:width ratio in races occurring on sunflower over time (from 1921). But there were significant differences in seed from *Artemisia* and *Matricaria* spp.]

Ellis, J., Ellis, B., Velez-Estevez, A., Rweichel, M.P. and Cobo, M.J. 2020. 30 years of parasitology research analysed by text mining. Parasitology 147(14): 1-58. [A broad review covering all aspects of parasitology, noting that the major research themes are dynamic and continually changing with time.]

*Elsakhawy, T., Alkahtani, M.D.F., Sharshar, A.A.H., Attia, K.A., Hafez, Y.M. and Abdelaal, K.A.A. 2020. Efficacy of mushroom metabolites (*Pleurotus ostreatus*) as a natural product for the suppression of broomrape growth (*Orobanche crenata* Forsk) in faba bean plants. Plants 9(10): (https://www.mdpi.com/2223-7747/9/10/1265) [Recording good suppression of *O. crenata* and increase in faba bean yield from application of a ten-fold dilution of 10% (w/v) spent mushroom substrate extract (SMSE) of *Pleurotus ostreatus* and the same dilution of culture filtrate of mushroom (MCF) grown in potato dextrose broth (PDB) at a rate of 48 l hectare^{-1}.]

*Fahmy, G. M and; Hassan, A.H. 2021. Haustorial structure of the holoparasitic angiosperm *Cynomorium coccineum* L. invading host roots. Flora (Jena) 274: (https://www.sciencedirect.com/science/article/pii/S0367253020302309?via%3Dihub) [Detailed description of the haustoria of *C. coccineum* invading the roots of *Limonium narbonense* and *Atriplex portulacoides.* **See Research Note above**.]

Fang-Lei Gao, Alpert, P. and Fei-Hai Yu. 2020. Parasitism induces negative effects of physiological integration in a clonal plant. New Phytologist 229:585-592. [(An advantage clonal plants have is sharing of resources so that when one ramet is growing in unfavorable conditions, resources can be shut off to that ramet. Studies indicated that cutting these ramets benefitted the clone. Using two species of *Sphagneticola* (Asteraceae) the authors applied *Cuscuta australis* (dodder) to test the effect of parasitism on biomass. The overall biomass of *S. calendulacea* was not reduced while the connected ramet was reduced by 60%. Dodder biomass increased by 50%. Intriguingly, no effect on either dodder or *S. trilobata* was seen.]

Farrokhi, Z., Alizadeh, H. and Alizadeh, H. 2021. Egyptian broomrape sucrose metabolism in response to different host plants. Weed Research (Oxford) 61(2): 137-145. [Investigation of developmental patterns of enzymes involved in the osmoregulation of *Phelipanche aegyptiaca* showing differences in sugar metabolism according to different host species.]

*Feleke, G. and Addisu, S. 2021. Distribution and importance of *Cuscuta campestris* on lentil growing areas: a preliminary survey from Ethiopia. International Journal of Agriculture and Biosciences 10(1): 60-64. (http://www.ijagbio.com/.../60-64.pdf) [Noting that *C. campestris* mostly parasitizes noug (nigerseed), linseed, some vegetable crops and coffee trees in Ethiopia, but now occurs on lentil especially in Shewa province causing up to 15% yield loss. Local control methods include crop rotation and deep ploughing.]

*Fernández-Aparicio, M., Cimmino, A., Vilariño, S. and Evidente, A. 2021. Allelopathic effect of quercetin, a flavonoid from *Fagopyrum esculentum* roots in the radicle growth of *Phelipanche ramosa*: quercetin natural and semisynthetic analogues were used for a structure-activity relationship investigation. Plants 10(3): 543. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8001586/) [Results indicated quercetin was tenfold more active than DMBQ in stimulating haustorial initiation in *P. ramosa.*]

*Fernández-Aparicio, M., Masi, M., Cimmino, A. and Evidente, A. 2021.Effects of benzoquinones on radicles of *Orobanche* and *Phelipanche* species. Plants 10(4):746. (https://pubmed.ncbi.nlm.nih.gov/33920368/) (Confirming the activity of *p*-benzoquinone and 2,6-dimethoxy-*p*-benzoquinone (BQ and DMBQ) on radicles of *Orobanche cumana*, *O. minor* and *Phelipanche ramosa*.]

*Fernández-Aparicio, M., Masi, M., Cimmino, A., Vilariño, S. and Evidente, A. 2021. Allelopathic effect of quercetin, a flavonoid from *Fagopyrum esculentum* roots in the radicle growth of *Phelipanche ramosa*: quercetin natural and semisynthetic analogues were used for a structure-activity relationship investigation. Plants 10(3): (https://doi.org/10.3390/plants10030543) [Showing that quercetin, exuded from the roots of buckwheat reduced radicle growth and induced haustorium formation in *P. ramosa*, showing 10 times the activity of DMBQ.]

Fernández-Aparicio, M. and Rubiales, D. 2021. Advances in understanding plant root response to weedy root parasites. In: Gregory, P.J. (Ed.) Understanding and improving crop root function. BDS Publishing: Cambridge, UK. [A review of seed dispersal and germination, and discussing host plant pre-penetration and post-penetration defence mechanisms.]

*Férriz, M., Martin-Benito, D., Cañellas, I. and Gea-Izquierdo, G. 2021. Sensitivity to water stress drives differential decline and mortality dynamics of three co-occurring conifers with different drought tolerance. Forest Ecology and Management 486: (https://www.sciencedirect.com/science/article/abs/pii/S0378112721000530?via%3Dihub) [Noting more widespread decline (defoliation, mistletoe, presumably *Viscum album,* and high mortality) of *Pinus pinaster* than of the more drought-tolerant *Pinus pinea* and *Juniperus oxycedrus* in a xeric Mediterranean ecotone in Spain since extreme droughts in the past 10 years.]

Garcia, L.E., Edera, A.A., Palmer, J.D., Sato, H., and Sanchez-Puerta, M.V. 2020. Horizontal gene transfers dominate the functional mitochondrial gene space of a holoparasitic plant. New Phytologist 229(3) 1701-1714. [Finding no evidence for functional gene transfer to the nucleus in *Lophophytum mirabile* (Balanophoarceae), but mitochondrial DNA shows an unprecedented level of functional replacement of native genes by foreign copies. This raises important questions concerning population-genetic and molecular regimes that underlie such a high level of foreign gene takeover.]

Garggi, G., Girija, T. and Sureshkumar, P. 2020. Host parasitic interaction studies in genera of Loranthaceae using radioactive ^{32}P. Plant Physiology Reports 25(3): 432-435. [The study postulates bidirectional movement of phosphorus as mineral nutrient and as signalling molecule between host tree and mistletoe (unspecified in abstract.]

Gebrekidan Feleke and Shugute Addisu. 2021. Importance of *Cuscuta campestris* on lentil growing areas: a preliminary survey from Ethiopia. International Journal of Agriculture and Biosciences 10(1) 60-64. [Noting that *C. campestris* is well-established in several parts of Ethiopia on noug, linseed, some vegetable crops and coffee trees. In Oromia, a survey recoded up to 96% of lentil fields infested, causing up to 30% yield loss. Hand weeding, crop rotation and deep ploughing are considered the most important control measures.]

*Goldwasser, Y., Rabinovitz, O., Gerstl, Z., Nasser, A.,Paporisch, A., Kuzikaro, H., Sibony, M. and Rubin, B. 2021. Imazapic herbigation for Egyptian broomrape (*Phelipanche aegyptiaca*) control in processing tomatoes—laboratory and greenhouse studies. Plants 10(6): 1182. (https://doi.org/10.3390/plants10061182) [Testing the influence of the herbicide imazapic on *P. aegyptiaca* and tomato plants, as well as a method of herbicide application via irrigation systems. Results show that imazapic does not prevent *P. aegyptiaca* seed germination and that in tomato roots inoculated with the parasite seeds, *P. aegyptiaca* is killed only after its attachment to the host]

*Gonzalez-Ollauri, A., Hudek, C., Mickovski, S.B., Viglietti, D., Ceretto, N. and Freppaz, M. 2021. Describing the vertical root distribution of alpine plants with simple climate, soil, and plant attributes. Catena 203: (https://doi.org/10.1016/j.catena.2021.105305) [Three species studied including *Euphrasia minima*.]

*González-Verdejo, C.I., Fernández-Aparicio, M., Córdoba, E.M. and Nadal, S. 2020. Identification of *Vicia ervilia* germplasm resistant to *Orobanche crenata*. Plants 9(11): (https://doi.org/10.3390/plants9111568) [From 102 accessions screened, 16 selected with lower susceptibility to *O. crenata*. See also the following.]

*González-Verdejo, C.I., Fernández-Aparicio, M., Córdoba, E.M., López-Ráez, J.A. and Nadal, S. 2021. Resistance against *Orobanche crenata* in bitter vetch (*Vicia ervilia*) germplasm based on reduced induction of *Orobanche* germination. Plants 10(2): 348. (https://pubmed.ncbi.nlm.nih.gov/33673056/) [Noting that bitter vetch is seriously damaged by *O. crenata* and reporting the discovery of 2 accessions with resistance based on low stimulant exudation which should be valuable in a breeding programme.]

Gowda, M., Makumbi, D., Das, B., Nyaga, C., Kosgei, T., Crossa, J., Beyene, Y., Montesinos-López, O.A., Olsen, M.S. and Prasanna, B.M. 2021. Genetic dissection of *Striga hermonthica* (Del.) Benth. resistance via genome-wide association and genomic prediction in tropical maize germplasm. TAG Theoretical and Applied Genetics 134(3): 941-958. [Results demonstrated the polygenic nature of resistance to *S. hermonthica*, and that implementation of genomic prediction in *Striga* resistance breeding could potentially aid in increasing genetic gain for this important trait.]

Gulwaiz Akhter, Hisamuddin and Khan, T.A. 2020. *Orobanche crenata* destroying *Cajanus cajan*: a new report from India. Indian Phytopathology 73(4): 817-819. [Recording serious infestations of *O. crenata* on pigeon pea in Madhya Pradesh.]

*Guo, X., C. Liu, G. Zhang, W. Su, J. B. Landis, X. Zhang, H. Wang, and Y. Ji. 2020. The complete plastomes of five hemiparasitic plants (*Osyris wightiana, Pyrularia edulis, Santalum album, Viscum liquidambaricolum,* and *V. ovalifolium*): comparative and evolutionary analyses within Santalales. Frontiers in Genetics 11: doi: 10.3389/fgene.2020.00597 [Additional plastome sequencing in the sandalwood order confirms previous work showing the progressive reduction in size in the more derived clades.]

*Guo XiaoRong, Zhang GuangFei, Fan LinYuan, Liu ChangKun and Ji YunHeng. 2021. Highly degenerate plastomes in two hemiparasitic dwarf mistletoes: *Arceuthobium chinense* and *A. pini* (Viscaceae). Planta 253(6): (https://doi.org/10.1007/s00425-021-03643-y) [The plastid genomes of *A. chinense* and *A. pini* were shown to be much reduced and unexpectedly, several essential housekeeping genes (*rpoA*, *rpoB*, *rpoC1*, and *rpoC2*) and some core photosynthetic genes (*psbZ* and *petL*), as well as the *rpl33* gene, indispensable for plants under stress conditions, were deleted or pseudogenized.]

*Guzmán-Rodríguez, L.F., Cortés-Cruz, M.A., Rodríguez-Carpena, J.G., Coria-Ávalos, V.M. and Muñoz-Flores, H.G. 2020. Biochemical profile of avocado (*Persea americana* Mill) foliar tissue and its relationship with susceptibility to mistletoe (Family Loranthaceae). Revista Bio Ciencias 7: (https://doi.org/10.15741/revbio.07.e492) [Assessing the secondary metabolites in avocado 'drymifolia' which is sensitive to the attack of mistletoe (presumably *Psittacanthus calyculatus*) and in 'Hass' and 'Mendez' varieties which exhibit tolerance. A number of compounds were found in the latter varieties and not in 'drymifolia', presumably explaining the difference in susceptibility.]

*Gwatidzo, V.O., Rugare, J.T., Mabasa, S., Mandumbu, R., Chipomho, J. and Chikuta, S. 2020. In vitro and in vivo evaluation of sorghum (*Sorghum bicolor* L. Moench) genotypes for pre- and post-attachment resistance against witchweed (*Striga asiatica* L. kuntze). International Journal of Agronomy 2020:.9601901.

(https://www.hindawi.com/journals/ija/2020/9601901/) [Concluding that sorghum varieties 111 IN, and SV4 had low-stimulant resistance to *S. asiatica,* while SV4 had some tolerance.]

Hailu, G.., Ochatum, N., Nyeko, P. and Niassy, S. 2020. Farmer's knowledge of termite species and infestation in eastern Uganda. International Journal of Agricultural Extension 8(3): 149-162. [Noting that *Desmodium* spp. used in the push-pull technique to control *Striga* spp. can be seriously damaged by termites.]

*Halouzka, R., Zeljkovic, S.C., Klejdus, B. and Tarkowski, P. 2020. Analytical methods in strigolactone research. Plant Methods 16 (76): (https://doi.org/10.1186/s13007-020-00616-2) [Different protocols used for strigolactone analysis are discussed. Techniques suitable for SL analysis such as GC-MS and LC-MS/MS are also discussed, and newer ambient techniques such as HR-DART-MS and DESI-MS are highlighted as tools with considerable potential in SL research.]

Hamissou, A.M., Ibrahim, A.A. and Hamissou, Z. 2020. Effect of sesame (*Sesamum indicum* L.) on the development of *Striga hermonthica* (Del.) Benth. *a* (Del.) Benth. (in French) Journal of Applied Biosciences 152: 15720-15726. [In pot experiments, certain varieties of sesame (HC110 et ICN130), inter-planted with pearl millet reduce emergence of *S. hermonthica* on the cereal. Other varieties less effective.]

He XiaoFang, Wang SongWei, Körner, C. and Yang Yang. 2021. Water and nutrient relations of mistletoes at the drought limit of their hosting evergreen oaks in the semiarid upper Yangtze region, SW China. Trees: Structure and Function 35(2): 387-394. [Although *Quercus pannosa* is at its drought-driven limit and has to survive 9-10 months of the year without rain, infestation with *Loranthus delavayi* or *Taxillus thibetensis* does not appear to cause aggravated drought stress in the dry season.]

Hejduk, S., Bitomský, M., Pornaro, C. and Macolino, S. 2020. Establishment of a hemiparasite *Rhinanthus alectorolophus* and its density-dependent suppressing effect on a grass: a case study from golf roughs. Agronomy Journal 112(5): 3619-3628. [Experiments with *R. alectrolophus* and *Festuca arundinacea* suggested that at least 50 *Rhinanthus* plants/m^2 are needed to achieve desirable effects on biodiversity and that *Rhinanthus* performance will be better when nutrients are rather limiting.]

Hernández-Juárez, A.**,** Aguirre, L.A.**,** Jesús Guzmán-Uribe, E. de**,** Chacón-Hernández, J.C., Cepeda, M., Cerna, E. and Ordaz-Silva, S. 2020. Insecticidal activity of botanical powders targeting fall armyworm, *Spodoptera frugiperda*, under laboratory conditions. Southwestern Entomologist 45(4): 899-906. [A powder from *Phoradendron densum* prevented *S. frugiperda* from completing its lifecycle.]

Horbelt, N., Eder, M., Bertinetti,, L.,Fratzl, P., and Harrington, M.J.. 2019. Unraveling the rapid assembly process of stiff cellulosic fibers from mistletoe berries. Biomacromolecules 20: 3094-3103. doi: 10.1021/acs.biomac.9b00648 [This paper examines in detail the structure of *Viscum album* viscin fibers demonstrating their amazing physical properties]

Houngbedji, T., Dessaint, F., Nicolardot, B., Perronne, R. and Gibot-Leclerc, S. 2020. Abundance of *Rhamphicarpa fistulosa* in rainfed lowland rice fields in the savannah region of Togo: moderate influence of physico-chemical characteristics of soils. Weed Research (Oxford) 60(6): 385-391. [Finding that the increasing problem of *R. fistulosa* in northern Togo is associated with coarser soil texture, higher K and higher pH, and little by organic C or N. As these factors are difficult to change, early sowing and selection of variety are suggested.]

Hu Lei and Wu XinWei. 2020. The difference in pollen harvest between *Apis mellifera* and *Apis cerana* in a Tibetan alpine meadow. Journal of Mountain Science 16(7): 1598-1605. [The native *A. cerana* foraged more on *Pedicularis longiflora* than the exotic western honey bee.]

Irakiza, R., Makokha, D.W., Malombe, I. LeBourgeois, T., Chitiki, A.K. and Rodenburg, J. 2021. Composition of weed communities in seasonally flooded rice environments in East Africa is determined by altitude. South African Journal of Botany (140): 143-152. [With very brief reference to *Striga* and *Rhamphicarpa*.]

Iszkuło, G.,Armatys, L., Dering, M., Ksepko, M., Tomaszewski, D., W ażna, A. and Giertych, M.J. 2020. (Mistletoe as a threat to the health state of coniferous forest.) (in Polish) Sylwan 164(3): 226-236. [Noting an increase in *Viscum album* infection in European forests in recent years, the worst affected being Scots pine and *Abies alba*, and discussing control options.]

Jamil, M, Kountche, B.A. and Al-Babili, S. 2021. Current progress in *Striga* management. Plant Physiology 185(4): 1339–1352. (https://academic.oup.com/plphys/article/185/4/1339/6129111) [An in-depth review of recent progress in research on *Striga* spp. and their control, covering host resistance, agronomic techniques, biocontrol and suicidal agents, High-lighting push-pull, toothpick and

herbicide seed-dressing, stimulants for suicidal germination and new progress in developing strigolactone antagonists.]

Jang SeJi and Kuk YongIn. 2020. Growth characteristics of *Cuscuta pentagona* under different environmental conditions and occurrence distribution in soybean (*Glycine max*) fields. Research on Crops 21(3): 480-486. [Recording an increase in *C. pentagona* (= *C. campestris*?) in southern S. Korea, and studying its optimum germination conditions.]

*JieChen, QuanhongXue, YongqingMa, LianfangChe and XinyuTan. 2020. *Streptomyces pactum* may control *Phelipanche aegyptiaca* in tomato. Applied Soil Ecology 146: (https://doi.org/10.1016/j.apsoil.2019.103369) [Of 88 actinobacterial strains assayed, *S. pactum* Act12 cell-free culture filtrate inhibited seed germination and germ tube elongation of *P. aegyptiaca* by ca. 95%. A field experiment confirmed over 30% control and 50% increase in tomato yield.]

Kabambe, V.H. and Bokosi, J.M. 2020. Role of variety and fertilizer practices on cowpeas (*Vigna unguiculata*) yield and field incidence of the parasitic weed *Alectra vogelii* (Benth) in central Malawi. Journal of Agricultural Science (Toronto) 12(11): 200-208. [Noting the immunity of cowpea variety Mkanakaufiti to *A. vogelii*, but its poor yield performance. Application of cattle manure to more susceptible varieties reduced emergence of *A. vogelii* but gave little benefit in crop yield.]

*Kabiri, S., Rodenburg, J., van Ast, A., Pflug, S., Kool, H. and Bastiaans, L. 2021. Impact of the facultative parasitic weed *Rhamphicarpa fistulosa* (Hochst.) Benth. on photosynthesis of its host *Oryza sativa* L. Journal of Plant Physiology 262:153438. (https://doi.org/10.1016/j.jplph.2021.153438) [Concluding that *R. fistulosa* affects host growth by first extracting assimilates and making considerable gains in growth, before impacting host photosynthesis and growth.]

Kang YunYao, Pang ZhiLi, Xu NiuNiu, Chen FangJie, Jin Zhong and Xu XiaoHua. 2020. Strigolactone analogues derived from dihydroflavonoids as potent seed germinators for the broomrapes. Journal of Agricultural and Food Chemistry.68(40): 11077-11087. [Describing the development of a novel class of strigolactone analogues derived from dihydroflavonoids as potent seed germinators of *Orobanche* spp. It was shown that one of them displayed a higher potential toward the seed germination of the broomrapes than the positive control GR24. Structure−activity relationship of these analogues was further validated on the basis of binding affinity]

Kapitonova, O.A. 2020. Additions to the vascular flora of the Tyumen region, Western Siberia. Acta Biologica Sibirica 6 : 339-355. [Including the 'protected' *Pedicularis dasystachys*.]

*Kim WookJin, Yang SungYu, Choi GoYa, Park InKyu, Noh Pureum, Lee, A.Y., Kim HyoSeon and Moon ByeongCheol. 2020. Establishment of conventional PCR and real-time PCR assays for accurate, rapid and quantitative authentication of four mistletoe species. Phytochemistry 176: (https://doi.org/10.1016/j.phytochem.2020.112400) [Describing assays to distinguish *Taxillus sutchuenensis* var. *duclouxii*, *Korthalsella japonica*, *Loranthus tanakae* from *V. coloratum*, in connection with the therapeutic use of the latter.]

*Kruh, L.I.**,** Bari, V.K.**,** Abu-Nassar, J.**,** Lidor, O. and Aly, R. 2020**.** Characterization of an endophytic bacterium (*Pseudomonas aeruginosa*), originating from tomato (*Solanum lycopersicum* L.), and its ability to inhabit the parasitic weed *Phelipanche aegyptiaca*. Plant Signaling and Behavior 15(7): (https://doi.org/10.1080/15592324.2020.1766292) [Confirming that the endophyte *Pseudomonas* sp. *PhelS10* strain could move from tomato into *P. aegyptiaca*. It reduces parasite parasitism and could be a biocontrol agent.]

Krasylenko, Y., J. Těšitel, G. Ceccantini, M. Oliveira-da-Silva, V. Dvořák, D. Steele, Y. Sosnovsky, R. Piwowarczyk, D. Watson, L. Teixeira-Costa. 2021. Parasites on parasites: hyper-, epi-, and autoparasitism among flowering plants. American Journal of Botany 108(1): 1–14. (doi:10.1002/ajb2.1590). [Review of plant hyperparasitism, including variations of self-parasitism, discussing the diversity and ecological importance of these interactions and suggesting possible evolutionary mechanisms.]

*Kubov, M. and 10 others. 2020. Drought or severe drought? Hemiparasitic yellow mistletoe (*Loranthus europaeus*) amplifies drought stress in sessile oak trees (*Quercus petraea*) by altering water status and physiological responses. Water 12(11): (https://www.mdpi.com/2073-4441/12/11/2985) [Detailed study concluding that *L.europaeus* can be a serious threat that jeopardizes the water status and growth of oak stands.]

Kurniawan, H. and Pamungkas, D. 2020. The limiting factors of land suitability for sandalwood (*Santalum album*) in Sumba Island, Indonesia. Biodiversitas: Journal of Biological Diversity 21(7): 3364-3372. [The result shows that P_2O_5 content was the most influential factor to

determine the land suitability class for sandalwood in Sumba Island.]
*Kuruma, M., Suzuki, T. and Seto, Y. 2021. Tryptophan derivatives regulate the seed germination and radicle growth of a root parasitic plant, *Orobanche minor*. Bioorganic & Medicinal Chemistry Letters 43: (https://doi.org/10.1016/j.bmcl.2021.128085) [Finding that l-tryptophan stimulated germination of *O. minor.* The related auxin, IAA, was also stimulatory. A hybrid strigolactone/IAA and modifications of N-acetyl tryptophan stimulated germination of *O.minor* and also inhibited radicle growth, potentially providing new types of germination regulator for control of root parasites.]
*Lachner, L.A.M., Galstyan, L. and Krause, K. 2020. A highly efficient protocol for transforming *Cuscuta reflexa* based on artificially induced infection sites. Plant Direct 4(8): (https://onlinelibrary.wiley.com/doi/10.1002/pld3.254) [A novel and highly efficient transformation protocol for *Cuscuta reflexa* cells using *Agrobacterium*-mediated transformation of different plant parts.]
Lemma Diriba Firew Mekbib and Mussa Jarso. 2020. Performance of faba bean (*Vicia faba* L.) varieties grown under broomrape (*Orobanche* spp.) infestation in South Tigray, Ethiopia. African Journal of Agricultural Research 16(8): 1101-1115. [Noting the increasing severity of the *O. crenata* problem in Tigre. Comparing 20 varieties of faba bean for their performance under *O. crenata* infestation and finding Ashenge partially resistant and highest yielding, while Dedia and Obse also performed well.]
Lerner, F., Pfenning, M., Picard, L., Lerchl, J. and Hollenbach, E. 2020. Prohexadione calcium is herbicidal to the sunflower root parasite *Orobanche cumana*. Pest Management Science 77(4): 1893-1902. [Showing that prohexadione is an inhibitor of *O. cumana* germination and that it is found in sunflower roots shortly after application and is apparently excreted in sufficient amounts to have a direct impact on *O. cumana* germination.]
Li JuanJuan and 9 0thers. 2021. Genome-wide investigation and expression analysis of membrane-bound fatty acid desaturase genes under different biotic and abiotic stresses in sunflower (*Helianthus annuus* L.). International Journal of Biological Macromolecules 175: 188-198. [Identifying 40 putative *FAD* genes in sunflower and noting significant changes in their expression in response to stresses including *Orobanche cumana.* Up-regulated genes such as *HaFAD3.2*, *HaADS8*, *HaFAD2.1*, and *HaADS9* would be the potential candidate genes for the sunflower tolerance breeding programme.]
Liu Cheng, Ya JiDong, Guo YongJie, Cai Jie and Zhang Ting. 2020. (Newly recorded species of seed plants from Xizang, China.) (in Chinese) Biodiversity Science 28 (1): 1238-1245. [Recording *Alectra arvensis.*]
Liu ShengLi, Wang Peng, Liu YanTao AND Wang PeiZheng. 2020. Identification of candidate gene for resistance to broomrape (*Orobanche cumana*) in sunflower by BSA-seq. Oil Crop Science 5(2): 80-84. [Mapping of resistance gene for *O. cumana* races was performed in a recombinant inbred line population revealing six genes for potential resistance.]
*Liu Ye, Liu LiNa, Zhao WenQian, Guan ZhiYong, Jiang JiaFu, Fang WeiMin and Chen FaDi. 2021. A transcriptional response atlas of *Chrysanthemum morifolium* to dodder invasion. Environmental and Experimental Botany 181: (https://doi.org/10.1016/j.envexpbot.2020.104272) [Finding that over 20,000 genes were differentially expressed in *C. morifolium,* infected by unspecified *Cuscuta* sp. Resulting in stimulation of reactive oxygen species, calcium, and MAPK-related pathways. A series of defence genes were also up-regulated.]
Lombard, N., le Roux, M.M. and van Wyk, B.E. 2021. Economic revision of the *Thesium scirpioides* species complex (subgenus *Frisea*, Santalaceae) near endemic to South Africa. South African Journal of Botany 138: 193-208. [Nine morphologically similar taxa from subgenus *Frisea* are revised and one new species described - *T. atratum* N. Lombard & M.M.le Roux. An identification key includes seven species, and two varieties are newly synonymised. Distribution maps and conservation notes included.]
Lombard, N., le Roux, M.M. and van Wyk, B.E. 2021. Electronic identification keys for species with cryptic morphological characters: a feasibility study using some *Thesium* species. PhytoKeys 172: 97-119. [Discussing the problems of creating electronic keys, especially for groups with minor morphological differences such as *Thesium* spp.]
Luo Hang, Xu Jie, Jiao SiQian, Zhang RenGang and Mao JianFeng. 2020. The complete mitochondrial genome of an endangered tree: *Malania oleifera* (Olacaceae). Mitochondrial DNA Part B 5(4): 3829-3830.
***Luyang Hu, Jiansu Wang, Chong Yang, Faisal Islam, Bouwmeester, H.J., Muños, S. and Weijun Zhou. 2020. The effect of virulence and resistance mechanisms on the interactions**

between parasitic plants and their hosts. International Journal of Molecular Sciences 21(23): (https://www.mdpi.com/1422-0067/21/23/9013) [Reviewing the virulence mechanisms of *Orobanche* and *Striga.* and the resistance mechanisms in their hosts. Speculating what drives the evolution of virulence effectors in parasitic plants by considering concepts from similar studies of plant–microbe interaction, and discussing CRISPR/Cas9-mediated genome editing and RNAi silencing that could contribute to the development of novel strategies for control.]

*Makani, K.W., Joyful, R.T., Mabasa, S., Edmore, G., Makasa, W., Gwatyidzo, O.V., Moyo, R. and Mandumba, R. 2021. Screening finger millet (*Eleusine coracana* L. Gaertn) genotypes for pre and post- attachment resistance to witchweed (*Striga asiatica* L. Kuntze) infection under controlled environments. African Journal of Rural Development 5(2): 125-139. (http://www.afjrd.org/jos/index.php/afjrd/article/view/2213) [Assessing three genotypes of finger millet for resistance to *S. asiatica* in Zimbabwe and finding good, though incomplete, resistance in SDMF1702.]

Mallu, T.S., Mutinda, S., Githiri, S.M., Odeny, D.A and; Runo, S. 2021. New pre-attachment *Striga* resistant sorghum adapted to African agro-ecologies. Pest Management Science 77(6): 2894-2902. [The *low germination stimulant 1* (*lgs1*) gene identified in 38 of 177 accessions of sorghum causing germination of *S. hermonthica* comparable with SRN-39 and IS9830. Some also cause reduced radicle length.]

*Martínez, G., Brea, M., Martínez, G.A. and Zucol, A. F. 2021. First anthrachological studies at the eastern pampa-Patagonia transition (Argentina). hunter-gatherers management of woody material and initial late Holocene vegetal communities inferred from the Zoko Andi 1 archaeological site. Journal of Arid Environments 187: (https://www.sciencedirect.com/science/article/abs/pii/S0140196320303049?via%3Dihub) [Charcoal from Late Holocene (ca. 1500-400 ^{14}C years BP) found to include *Jodinia rhombifolia* (Santalaceae),]

Masanga, J. and 10 others. 2021. Physiological and ecological warnings that dodders pose an exigent threat to farmlands in Eastern Africa. Plant Physiology 185(4): 1457–1467. [A critical assessment of the current presence and future risks from *Cuscuta* spp. in E. Africa. *C. campestris* and *C. kilimanjari* are widespread; also *C. reflexa* which now presents a significant threat to tea and coffee. Mango shows some resistance.]

Masumoto, N. and 12 others. 2021. Three-dimensional reconstruction of haustoria in two parasitic plant species in the Orobanchaceae. Plant Physiology 185: 1429-1442. [see Literature Highlight above.]

Mohammed, A.B., Daniya, E. and Kolo, M.G.M. 2020.Enhancing maize production in a *Striga* infested environment through weed management practices, sowing date and improved crop varieties. African Journal of Agricultural Research 16(9): 1270-1277. [Results suggest that maize varieties SAMMAZ 15 and 40 in combination with pre-emergence atrazine at 2.4 kg a.i ha^{-1} and post-emergence nicosulfuron at 0.06 kg a.i ha^{-1} and sowing in May effectively reduced *Striga* infestation. SAMMAZ 17 in combination with atrazine at 2.4 kg a.i ha^{-1} and nicosulfuron at 0.06 kg a.i ha^{-1} and sowing in June increased maize grain yield.]

*Mohammed, S.B., Dzidzienyo, D.K., Umar, M.L., Ishiyaku, M.F., Tongoona, P.B. and Gracen, V. 2021. Appraisal of cowpea cropping systems and farmers' perceptions of production constraints and preferences in the dry savannah areas of Nigeria. AgriRxiv 2021: 31pp. (https://www.cabdirect.org/cabdirect/FullTextPDF/2021/20210152201.pdf) [Survey results showed insect pests, *Striga gesnerioides*, drought and poor access to fertilizers as major constraints to increased production. Recommendations include encouraging farmers to grow cowpeas in sole cropping.]

*Monteiro, G.F., Novais, S., Barbosa, M., Antonini, Y., Passos, M.F.deO. and Fernandes, G.W. 2020. The. mistletoe *Struthanthus flexicaulis* reduces dominance and increases diversity of plants in campo rupestre. Flora (Jena) 271 October 2020, 151690. (https://doi.org/10.1016/j.flora.2020.151690) [Showing that parasitism by *S. flexicaulis* had an important role in reducing the vigour of susceptible species and thus changing the structure of the plant community in the *campo rupestre* ecosystem in Brazil.]

Moore, G.M. and Lefoe, G. 2020. The effect of a heat wave on urban tree pests in Melbourne, Australia: examples that may inform climate change tree management. Arboriculture & Urban Forestry 46(2): 135-147. [Following temperatures exceeding 45°C, mistletoes *Amyema miquelii* and *A. pendula* growing on *Eucalyptus camaldulensis* died, and populations remained low 5 years later.]

Mudereri, B.T., Abdel-Rahman, E. M.; Dube, T., Landmann, T., Khan, Z., Kimathi, E., Owino, R. and Niassy, S. 2020. Multi-source spatial data-based invasion risk modeling of Striga (*Striga asiatica*) in Zimbabwe. GIScience and Remote Sensing 57(4): 553-571. [Six machine learning modeling techniques and the ensemble model were evaluated for their suitability to predict current and future *S. asiatica* abundance. Results showed that the ensemble model had the strongest predictive power. Temperature seasonality, the maximum temperature of the warmest month and precipitation seasonality were determined to be the most dominant bioclimatic variables influencing *Striga* occurrence.]

*Mudereri, B.T., Abdel-Rahman, E. M., Dube, T., Niassy, S., Khan, Z., Tonnang, H.E.Z. and Landmann, T. 2021. A two-step approach for detecting *Striga* in a complex agroecological system using Sentinel-2 data. Science of the Total Environment 762: (https://www.sciencedirect.com/science/article/abs/pii/S004896972036681X?via%3Dihub) [To detect *S. hermonthica* in croplands in Rongo, Kenya, firstly, Sentinel-2 data (2017 to 2018) were utilized to map cropland and non-cropland areas using the Google Earth Engine. The cropland area was then used in a multiple end-member spectral mixture analysis (MESMA) to detect *Striga* occurrence and infestation using end-members obtained from the in-situ hyperspectral data.]

***Mwangangi, I.M., Büchi, L., Haefele, S.M., Bastiaans, L., Runo, S. and Rodenburg, J. 2021. Combining host plant defence with targeted nutrition: key to durable control of hemiparasitic *Striga* in cereals in sub-Saharan Africa? New Phytologist 230(6): 2164-2178. (https://nph.onlinelibrary.wiley.com/doi/10.1111/nph.17271) [A review exploring opportunities and knowledge gaps and to develop the way forward regarding research and development of combining genetics and plant nutrition for the durable control of *Striga*.]**

Nabity, P.D., Barron-Gafford, G.A. and Whiteman, N.K. 2021. Intraspecific competition for host resources in a parasite. Current Biology 31(6): 1344-1350. [Experimental manipulation of resource demand in *Phoradendron californicum* shows evidence for intraspecific competition. Location in the host, *Prosopis velutina,* determines both the strength of competition and virulence].

Nagassa Dechassa and Bayissa Regassa. 2021. Current status, economic importance and management of dodders (*Cuscuta* spp) of important crops. Advances in Life Science and Technology 87: 16-21. [Reviewing the major *Cuscuta* spp. and the available control methods.]

*Ndayisaba, P.C., Kuyah, S., Midega, C.A.O., Mwangi, P.N. and Khan, Z.R. 2021. Intercropping desmodium and maize improves nitrogen and phosphorus availability and performance of maize in Kenya. Field Crops Research 263: (https://doi.org/10.1016/j.fcr.2021.108067) [Comparing the effects of various intercrops grown with maize over 15 years, only *Desmodium intortum* increased yield of *Striga hermonthica*-infested maize in the final 3 years. Levels of both N and P in the soil were also increased.]

Neumann, P. and 9 others. 2021. Impact of parasitic lifestyle and different types of centromere organization on chromosome and genome evolution in the plant genus *Cuscuta*. New Phytologist.229(4): 2365-2377. [A remarkable 102-fold variation in genome sizes (342-34 734 Mbp/1C) was detected for monocentric *Cuscuta* species, while genomes of holocentric species were of moderate sizes (533-1545 Mbp/1C). The genome size variation was primarily driven by the differential accumulation of LTR-retrotransposons and satellite DNA. Demonstrating that the transition to holocentricity in *Cuscuta* was accompanied by significant changes in epigenetic marks, chromosome number and the repetitive DNA sequence composition.]

Ni Yang Jiang Mei, Chen HaiMei, Huang LinFang, Chen PingHua and Liu Chang. 2021. Adaptation of a parasitic lifestyle by *Cuscuta gronovii* Willd. ex Roem. & Schult.: large scale gene deletion, conserved gene orders, and low intraspecific divergence. Mitochondrial DNA Part B 6(4): 1475-1482.

Nikièma, M.P. and 11 others 2020. Induced resistance to *Striga hermonthica* in sorghum by gamma irradiation. American Journal of Plant Sciences 11(10): 1545-1561. [Dry seeds of three sorghum varieties; Grinkan, ICV1049 and Sariaso14 subjected to gamma-irradiation up to 500 Gy yielded 7 mutant families showed no emergence of *S. hermonthica* from Burkina Faso, and 2 of these, SA38M5 and IC47M5 showed resistance also to a Sudanese ecotype.]

Nobis, M. and 23 others. 2020. Contribution to the flora of Asian and European countries: new national and regional vascular plant records, 9. Turkish Journal of Botany.44(4): 455-480. [The paper presents new records for *Orobanche serbica* and *Viscum album* subsp. *austriacum* from Italy, and *Phelipanche lavandulacea* from Russia.]

Noshad, Q., Ajaib, M. and Kiran, A. 2020. Comparative investigation of palynological characters of *Cuscuta reflexa* and few members of

Convolvulaceae. JAPS, Journal of Animal and Plant Sciences 30(5): 1215-1223. [Detailed study of pollen morphology concludes that pollen of *C. reflexa* is 'exactly similar' to that of *Ipomoea arachnosperma*.]

Nosratti, I., Mobli, A., Mohammadi, G., Yousefi, A.R., Sabeti, P. and Chauhan, B.S. 2020. The problem of *Orobanche* spp. and *Phelipanche* spp. and their management in Iran. Weed Science 68(6): 555-564. [A review, recording *Orobanche cumana, Phelipanche aegyptiaca*, *P. ramosa* and *P. nana* as the major problem species in Iran, and tomato the worst affected crop. Chickpea and rapeseed also high-lighted.]

Ogawa, S. and 10 others. 2021. Subtilase activity in intrusive cells mediates haustorium maturation in parasitic plants. Plant Physiology 185(4):1381-1394. [Using promoter analyses to identify genes that are specifically induced in intrusive cells, and promoter fusions with genes encoding fluorescent proteins to develop intrusive cell-specific markers. Four of the identified intrusive cell-specific genes encode subtilisin-like serine proteases, suggesting that subtilasde activity plays an important role in haustorium development in *Phtheirospermum japonicum*.]

*Okazawa, A. and 8 others. 2021. Localization of planteose hydrolysis during seed germination of *Orobanche minor.* BioRxiv June 2021. (https://doi.org/10.1101/2021.06.16.448768) [Proteose acts as a storage carbohydrate in seeds of *O. minor* and its hydrolysis (releasing hexoses for embryo growth) is activated by α-galactosidase family member, OmAGAL2. This enzyme could thus be a target for control.]

*Okazawa , A, Samejima, H., Kitani, S., Sugimoto, Y and Ohta, D. 2021. Germination stimulatory activity of bacterial butenolide hormones from *Streptomyces albus* J1074 on seeds of the root parasitic weed *Orobanche minor.* Journal of Pesticide Science (https://doi.org/10.1584/jpestics.D21-014) [Noting that butenolide hormones regulate metabolism in actinomycete bacteria, and showing that they also stimulate germination of *O. minor.*]

Okazawa Atsushi, Wakabayashi Takatoshi, Muranaka Toshiya, Sugimoto Yukihiro and Ohta Daisaku. 2020. The effect of nojirimycin on the transcriptome of germinating *Orobanche minor* seeds. Journal of Pesticide Science 45(4): 230-237. [Differential gene expression analysis results suggest that nojirimycin alters sugar metabolism and/or signaling, which is required to promote seed germination.]

Ortega-González, P.F., Rios-Carrasco, S., González-Martínez, C.A., Bonilla-Cruz, N. and Vázquez-Santana, S. 2020. *Pilostyles maya*, a novel species from Mexico and the first cleistogamous species in Apodanthaceae (Cucurbitales). Phytotaxa 440(4): 255-267. [*P. maya* is sister to *P. mexicana*, distinguished by having cleistogamous, hermaphroditic flowers, tepals with ciliate margins and specificity on a *Bauhinia* host. It is listed as Critically Endangered due to its small known area of distribution and threats from deforestation.]

Orumwense, K.O., Koriecha, J.N., Ehis-Iyoha, E.,Adindu, G.A. and Omozusi, J.E. 2020. Nigerian Agricultural Journal 51(2): 195-198. [Four clones of rubber compared for their resistance to unspecified mistletoe spp. (perhaps *Phragmanthera capitata* and/or *Agelanthus brunneus*) and finding the two indigenous clones to be twice as susceptible as the exotic clones.]

*Oula, D.A., Nyongesah, J.M., Odhiambo, G. and Wagai,. S. 2020. The effectiveness of local strains of *Fusarium oxysporum* f. sp. *strigae* to control *Striga hermonthica* on local maize in western Kenya. Food Science and Nutrition 8(8): 4352-4360. (https://onlinelibrary.wiley.com/doi/epdf/10.1002/fsn3.1732) [Among 5 isolates of *F. oxysporum* tested at 3 sites, FK1 and 2 had least virulence on *S. hermonthica* and FK5 the greatest, and gave the highest improvement in maize yield, but there was some evidence that the ideal isolate might differ from site to site.]

Oveisi, M., Ojaghi, A., Mashhadi, H.R., Muller-Scharer, H., Yazdi, K.R., Kaleibar, B.P. and Soltani, E. 2021. Potential for endozoochorous seed dispersal by sheep and goats: risk of weed seed transport via animal faeces. Weed Research (Oxford) 61(1): 1-12. [*Cuscuta campestris* was the most persistent survivor of passage through sheep. Recommending that sheep be kept corralled for 96 hours to minimize dispersal of viable seeds.]

Oyekale, S.A., Badu-Apraku, B. and Adetimirin, V.O. 2020. Combining ability of extra-early biofortified maize inbreds under *Striga* infestation and low soil nitrogen. Crop Science 60(4): 1925-1945. [Studying 150 hybrids and concluding that additive and non-additive genetic effects controlled the inheritance of traits under *Striga* and high N, whereas additive genetic effects governed the inheritance of the traits under low N. Hybrids TZEEIORQ 55 × TZEEIORQ 26, TZEEIORQ 49 × TZEEIORQ 75, and TZEEIORQ 52 × TZEEIORQ 43 were high yielding and stable across environments and have potential for improving nutrition and maize yields.]

Özen, H.Ç., Savaşçi, S., Surmuş Asan, H. and Kizmaz, V. 2020. The effect of *Cuscuta babylonica* Aucher on chemical compounds of lice tomato. KSÜ Tarim ve Doga Dergisi 23(6): 1483-1488. [The study revealed that the amount of fatty acids,Ca2+, and phenolic compounds chlorogenic acid, hyperoside, rutin, quercetin and salicylic acid increased in tomato leaves that were infected by *C. babylonica* suggesting the variety grown in the Lice district of Turkey has developed some resistance.]

Pan LiMei and 9 others. 2021. Comparative proteomic analysis of parasitic loranthus seeds exposed to dehydration stress. Plant Biotechnology Reports 15(1): 95-108. [The results suggest that the efficient removal of excessive reactive oxygen species may be crucial for the germination of *Taxillus chinensis*.]

Pang ZhiLi, Zhang Xu, Ma FuLei, Liu JunLiang, Zhang Hang, Wang Jing, Wen Xin and Xi Zhen. 2020. Comparative studies of potential binding pocket residues reveal the molecular basis of ShHTL receptors in the perception of GR24 in *Striga*. Journal of Agricultural and Food Chemistry 68(45): 12729-12737.

Paporisch, A., Laor, Y., Rubin, B. and Eizenberg, H. 2020. Simulating sulfosulfuron fate in soil under different weather scenarios to support weed management decisions. Pest Management Science 77(1): 253-263. [Showing that 10-20 mm rain in 2 weeks after application may reduce the performance of sulfosulfuron on *Phelipanche aegyptiaca* in tomato.]

Piwowarczyk, R., Gmiter, D., Durlik, K., Ruraż, K. and Kaca, W. 2020. First report of *Orobanche laxissima* parasitizing Pallis' ash (*Fraxinus pallisiae*) in Georgia. Plant Disease 104(6): 1878-1878.

*Pointurier, O., Moreau, D., PagéL. Caneill, J and Colbach, N. 2021. Individual-based 3D modelling of root systems in heterogeneous plant canopies at the multiannual scale. Case study with a weed dynamics model. Ecological Modelling 44: (https://doi.org/10.1016/j.ecolmodel.2020.109376) [Devising a model that simulates crop-weed canopies from cropping system and pedoclimate to help design cropping systems in the absence of herbicide use, including those beneficial in the presence of parasitic species.]

*Pointurier, O., Gibot-Leclerc, S., Moreau, D., Reibel, C., Vieren, E. and Colbach,. N. 2021. Designing a model to investigate cropping systems aiming to control both parasitic plants and weeds. European Journal of Agronomy 129: 126318. (https://doi.org/10.1016/j.eja.2021.126318) [Describing PHERASYS which combines 1) a demographic submodel to predict *Phelipanche ramosa* seed bank dynamics, 2) a trophic-relationships submodel to predict the effect of parasitism on crops and weeds, and 3) a submodel of weed dynamics in agroecosystems to predict the growth of crops and weeds from cropping techniques and pedoclimate, a tool to test management strategies including crop mixtures and relying on biological regulations by weeds.]

Pratap, A and Gupta, S. (eds.) 2021. The Beans and the Peas: from Orphan to Mainstream Crops. Elsevier 362 pp. [Containing 12 chapters on different pea and bean crops, including faba bean (including reference to *Orobanche crenata*) and cowpea (with reference to *Striga gesnerioides* and *Alectra vogelii)*.]

Qu XiaoJian, Liu LiKang, Zhang LuoYan, Zhang XueJie and Fan ShouJin. 2020. First report of dodder (*Cuscuta japonica*) parasitizing Japanese red pine (*Pinus densiflora*) in China. Plant Disease 104(6): 1877-1878. [Reporting *C. japonica* on *P. densiflora*, perhaps the first report of a *Cuscuta* sp. on a gymnosperm? Also on *Ulmus pumila* in Shandong province, China.]

Quaglia, E., Enri, S.R., Perotti, E., Probo, M., Lombardi, G. and Lonati, M. 2020. Alpine tundra species phenology is mostly driven by climate-related variables rather than by photoperiod. Journal of Mountain Science 17(9): 2081-2096. [Including observations on *Pedicularis minima* in NW Italy.]

*Ramanan S.S., George, A.K., Chavan, S.B., Kumar, S. and Jayasubha, S. 2020. Progress and future research trends on *Santalum album*: a bibliometric and science mapping approach. Industrial Crops and Products 158: (https://www.sciencedirect.com/science/article/abs/pii/S092666902030889X?via%3Dihub)

*Ratnadass, A. and 16 others. 2021. Synergies and tradeoffs in natural regulation of crop pests and diseases under plant species diversification. Crop Protection 146: (https://doi.org/10.1016/j.cropro.2021.105658) [Describing a series of studies, one involving *Striga* – no detail in abstract.]

Rentsch, J.D., Hardee, L.J.,Shelley, C.E.Williams, M.T. 2020. The complete plastid genome of *Neottia bifolia* (Raf.) Baumbach (Orchidaceae): insights into chlorophyllous and achlorophyllous plastid genomes. Castanea 85(2): 285-295.

*Rial, C., Varela, R.M., Molinillo, J.M.G., Peralta, S. and Macías, F.A. 2021. Sunflower metabolites involved in resistance mechanisms against broomrape. Agronomy 11(3):

(https://www.mdpi.com/2073-4395/11/3/501) [Determining that resistance of sunflower varieties BR4, P96, BR3, K96, and R96 was not a result of low exudation of dehydrocostuslactone and orobanchyl acetate, but was associated with exudation of the haustorial elongation inhibitor scopoletin.]

Roulet, M.E., Garcia, L.E., Gandini, C.L., Sato, H., Ponce, G. and Sanchez-Puerta, M.V. 2020. Multichromosomal structure and foreign tracts in the *Ombrophytum subterraneum* (Balanophoraceae) mitochondrial genome. Plant Molecular Biology 103(6): 623-638. [Like *Lophophytum mirabile*, the *O. subterraneum* mitochondrial (mt) genome contains 54 circular chromosomes, but only 20% of that DNA is shared. *Ombrophytum* has 43% native, 15% Fabaceae, 14% Asteraceae and 27% DNA of unknown origin. The authors favour a hypothesis where the common ancestor of the two parasites experienced mt to mt horizontal gene transfer from a legume host. The Asteraceae (and other angiosperm families) DNA in *Ombrophytum* was acquired after it split from *Lophophytum*.]

*Rubiales, D., Barilli, E. and Flores, F. 2020. Broomrape as a major constraint for grass pea (*Lathyrus sativus*) production in Mediterranean rain-fed environments. Agronomy 10(12): (https://doi.org/10.3390/agronomy10121931) [Exploring a range of lines with varying resistance to *O. crenata* under different soil and climatic conditions: concluding that short season varieties were preferable where the parasite was most abundant and long season varieties yielded best where broomrape was less abundant.]

*Rubiales, D., Emeran, A.A. and Flores, F. 2020. Adaptation of grass pea (*Lathyrus sativus*) to Mediterranean environments. Agronomy.10(9):1295 (https://doi.org/10.3390/agronomy10091295) [*Orobanche crenata* reported to be the main limiting factor for the grass pea in both Spain and Egypt. Varieties Ls10, Ls11 and Ls18 proved to have the most favorable combination of yield and broomrape resistance.]

*Rubiales, D., Fondevilla, S. and Fernández-Aparicio, M. 2021. Development of pea breeding lines with resistance to *Orobanche crenata* derived from pea landraces and wild *Pisum* spp. Agronomy 11(1): (https://www.mdpi.com/2073-4395/11/1/36) [Describing the development of advanced pea breeding lines with resistance to *O. crenata* derived from wide crosses with resistant P. *fulvum, P. sativum* ssp. *elatius, P. sativum* ssp. *syriacum*, and with pea landraces, and confirming their useful performance in field trials.]

*Rubio, J. and Rubiales, D. 2021. Resistance to rusts and broomrape in one-flowered vetch (*Vicia articulata)*. Euphytica 217(1): (https://link.springer.com/article/10.1007/s10681-020-02741-4) [Study of the neglected legume *V. articulata* showed some susceptibility to *Orobanche crenata* but substantially less than in related legumes.]

*Sakadzo, N., Kugedera, A.T. and Mandumba, R. 2021. Correlation between *Striga* spp and soil fertility prominence. International Journal of Agricultural Sciences and Veterinary Medicine 9(1): (https://www.researchgate.net/publication/348919790_Correlation_between_Striga_spp_and_soil_fertility_prominence) [A wide-ranging review confirming the value of nitrogen, whether from fertilizer, manures or crop rotation.]

Salazar-Rivera, G.I.**,** Dáttilo, W.**,** Castillo-Campos, G.**,** Flores-Estévez, N., García, B.R. and Inzunza, E.R. 2020. The frugivory network properties of a simplified ecosystem: birds and plants in a Neotropical periurban park. Ecology and Evolution 10(16): 8579-8591. [Studying the frugivory network composed of 29 species of birds and 23 of plants. The main roles in this network are played by four species of generalist birds and three species of plants including *Phoradendron* sp.]

*Sanjust, E. and Rinaldi, A.C. 2021. *Cytinus* under the microscope: disclosing the secrets of a parasitic plant. Plants 10(1): (https://doi.org/10.3390/plants10010146) [A comprehensive review of all aspects of *Cytinus* spp., a 'paradigmatic' group with a wide range of adaptations to lure animal pollinators, and potential uses as nutraceuticals and antimicrobials.]

*Sarić-Krsmanović, M., Dragumilo, A., Umiljendić, J.G., Radivojević, L., Šantrić, L. and Đurović-Pejčev, R. 2020. Infestation of field dodder (*Cuscuta campestris* Yunck.) promotes changes in host dry weight and essential oil production in two aromatic plants, peppermint and chamomile. Plants 9(10): (https://www.mdpi.com/2223-7747/9/10/1286) [*C. campestris* reduced dry matter of peppermint and chamomile plants by 25% and 63%, respectively. Essential oil content was slightly increased in peppermint but decreased by 60% in chamomile. There were also changes in the oil profiles.]

Sawadogo, P. and 9 others. 2021. Differential and comparative screening of cowpea varieties to *Striga gesnerioides* (Willd.) Vatke for race specific identification in Burkina Faso. African Crop Science Journal 29(1): 101-118. [Cowpea varieties

B301, IT93K-693-2 and IT82D-849 were immune to all ecotypes of *S. gesnerioides* from across Burkina Faso. Varieties Tiligré, 524B, local Gorom and Niizwè, varied in response, indicating the presence of 5 biotypes, SG1, SG5 and SG Kp and 2 further unidentified biotypes.]

Sawadogo, P.**,** Sawadogo, N.**,** Ouedraogo, T.J.**,** Dieni, Z.**,** Batieno, T.B.J., Zongo, H., Poda, L., de las Salle Tignegre, J.B. and Sawadogo, M. 2021. Indigenous knowledge of *Striga gesnerioides* (Willd.) Vatke, in Burkina Faso. African Journal of Agricultural Research 17(1): 57-65. [Finding that farmers have a good knowledge of *S. gesnerioides* and estimated that it caused 20-100% yield loss in cowpea. Control is mainly by hand-pulling.]

Scheer, R. and 10 others (eds.) Mistel in der Tumortherapie 5: Aktueller Stand der Forschung und klinische Anwendung. 2020. KVC Verlag – NATUR UND MEDIZIN e. V.,Essen.www.kvc-verlag. 607 pp. [see Review above.]

Scott., D., Scholes, J.D., Randrianjafizanaka, M.T., Randriamampianina, J.A., Autfray, P and Freckleton, R.P. 2021. Mapping the drivers of parasitic weed abundance at a national scale: a new approach applied to *Striga asiatica* in the mid-west of Madagascar. Weed Research 60(5): 3234-333. [Demonstrating that one can capture distribution and management data for *Striga* density at a landscape scale and use this to understand the ecological and agronomic drivers of abundance. The importance of crop varieties and cropping patterns is significant, and has the potential to be promoted as readily available control options, rather than novel technologies requiring introduction.]

Serino, N.**,** Boari, A.**,** Santagata, G.**,** Masi, M.**,** Malinconico, M.**,** Evidente, A. and Vurro, M. 2020**.** Biodegradable polymers as carriers for tuning the release and improve the herbicidal effectiveness of *Dittrichia viscosa* plant organic extracts. Pest Management Science 77(2): 646-658. [Optimising the activity of extracts of *D. viscosa* (Asteraceae) against *Phelipanche ramosa.*]

*Shaibu, A.S., Badu-Apraku, B. and Ayo-Vaughan, M.A. 2021. Enhancing drought tolerance and *Striga hermonthica* resistance in maize using newly derived inbred lines from the wild maize relative, *Zea diploperennis*. Agronomy 11(1): (https://www.mdpi.com/2073-4395/11/1/177) [Determining the combining ability of 12 extra-early yellow maize inbreds derived from *Zea diploperennis* and tropical maize germplasm and examining hybrid performance under *Striga*-infested and rainfed environments in Nigeria.]

*Shi BiXian and Zhao Jun. 2020. Recent progress on sunflower broomrape research in China. OCL - Oilseeds and Fats, Crops and Lipids 27(30) 9 pp. (https://doi.org/10.1051/ocl/2020023) [A review of the literature on the problem of *Orobanche cumana* in China and latest research.]

*Silberg, T.R., Renner, K., Olabisi, L.S., Richardson, R.B., Chimonyo, V.G.P., Uriona-Maldonado, M., Basso, B.B. and Mwale, C. 2021. Modeling smallholder agricultural systems to manage Striga in the semi-arid tropics. Agricultural Systems 187: (https://www.sciencedirect.com/science/article/abs/pii/S0308521X20308696?via%3Dihub) [Model simulations in Malawi indicate that while a combination *S. asiatica* control practices are necessary to manage the weed, future research should focus on developing smallholder-adapted practices that address the attachment stage of the weed's lifecycle (e.g., timely manure application) rather than its germination, emergence or flowering stages.]

Silva, M.C., Guimarães, A.F., Teodoro, G.S., Bastos, S.S., de Castro, E.M. and van den Berg, E. 2021. The enemy within: the effects of mistletoe parasitism on infected and uninfected host branches. Plant Ecology 222(5): 639-645. [Finding that the damaging effects of *Phoradendron crassifolium* on *Eremanthus erythropappus* and of *Psittacanthus robustus* on *Vochysia thyrsoidea* in the Brazilian savannah are not confined to the infected branches, but also affect neighbouring branches.]

Şin, B., Öztürk, L., Sivri, N., Avcı, G.G. and Kadıoğlu, İ. 2020. Weed hosts of field dodder (*Cuscuta campestris* Yunck.) in northwestern Marmara Region of Turkey. Anadolu 30(1): 80-86. [Infection intensity was highest in *Lactuca serriola* , *Convolvulus arvensis*, *Portulaca oleracea*, *Tribulus terrestris*, *Ecballium elaterium*, *Rumex crispus* and *Polygonum aviculare*.]

Singh, L. J., Ranjan, V., Rasingam, L. and Swamy, l.. 2020. A new species of genus *Dendrophthoe* Mart. (Lorantheae-Loranthaceae) from the Peninsular India. Journal of Asia-Pacific Biodiversity: (https://doi.org/10.1016/j.japb.2020.03.017) [Describing *D. gamblei,* a new species from the Eastern Ghats that is similar to *D. memecylifolia*.]

Siti-Munirah, M.Y., Suhaimi-Miloko, Z. and Ahmad, M.I.Z. 2021. *Thismia belumensis* (Thismiaceae), a remarkable new species from the Royal Belum State Park, Gerik, Perak, Peninsular Malaysia. PhytoKeys 172: 121-134. [Describing *T. belumensis* Siti-Munirah & Suhaimi-Miloko, differing in its unique annulus, modified into a cucullate (hood-like) structure covering the apical floral tube conferring a zygomorphic symmetry to the flower, as in *T. labiata.*]

*Skay, R., Windmuller-Campione, M.A., Russell, M.B. and Reuling, L.F. 2021. Influence of eastern spruce dwarf mistletoe on stand structure and composition in northern Minnesota. Forest Ecology and Management 481: (https://doi.org/10.1016/j.foreco.2020.118712) [Noting that infestation by *Arceuthobium pusillum* was most severe in black spruce (*Picea mariana*) and was likely to kill the host trees within 17 years.]

*Soma Mondal, Ramachandran Sundararaj and Rao, H.C.Y. 2020. A critical appraisal on the recurrence of sandalwood spike disease and its management practices. Forest Pathology 50:6 (https://doi.org/10.1111/efp.12648) [Refining the identification of the causal phytoplasma. Using tissue culture to create disease-free clones, but suggesting that breeding resistant varieties may be the more realistic solution.]

*Stanley, A., Menkir, A.,. Paterne, A., Ifie, B., Tongoona, P., Unachukwu, N., Meseka, S., Mengesha, W. and Gedil, M. 2020. [Genetic diversity and population structure of maize inbred lines with varying levels of resistance to *Striga hermonthica* using agronomic trait-based and SNP markers. Plants 9(9): (https://www.mdpi.com/2223-7747/9/9/1223) [Results indicate wide genetic variability among 150 inbred lines, and the joint diversity analysis can be utilized to reliably assign the inbred lines into heterotic groups and also to enhance the level of resistance to *Striga* in new maize varieties.]

*Suetsugu, K. 2020. A specialized avian seed dispersal system in a dry-fruited nonphotosynthetic plant, *Balanophora yakushimensis*. Ecology 101(11): (https://doi.org/10.1002/ecy.3129) [Camera traps were used to record visitors to *Balanophora* infructescences. Pale thrush and Red-flanked bluetail birds were seen feeding on the fruits, likely attracted to the bright red claviform bodies. Fecal pellets from the birds contained *Balanophora* seeds that had the same viability as those directly from the plant. The migratory nature of these birds could explain the widespread and scattered populations of the parasite.]

*Takahashi, I, Fukui, K. and Asami, T. 2020. On improving strigolactone mimics for induction of suicidal germination of the root parasitic plant *Striga hermonthica.* aBIOTECH 2(6): (https://link.springer.com/article/10.1007%2Fs42994-020-00031-0) [Nitrile and methyl derivatives of debranones (phenoxyfuranone-type SL mimics) stimulated the germination of *S. hermonthica* seeds better than halogenated derivatives. Activity was approximately 1/10th that of GR24.]

*Tandang, D.N., Galindon, J.M.M., Lagunday, N.E., Coritico, F.P., Amoroso, V.B. and Robinson, A.S. 2021. *Amylotheca cleofei sp. nov.* (Loranthaceae), a new species and genus record for the Philippines. Phytotaxa 507(1): (https://doi.org/10.11646/phytotaxa.507.1.7) [see Press Notice above.]

Teixeira-Costa, L. 2021. A living bridge between two enemies: haustorium structure and evolution across parasitic flowering plants. Brazilian Journal of Botany volume 44: 165–178 (https://doi.org/10.1007/s40415-021-00704-0). [Multi-level comparison of haustorium structure including all 12 parasitic lineages, yielding the idea of a shared general body plan. Considering the structure, molecular development, and functionality of the haustorium under the framework of continuum and process morphology, an interpretation of haustoria as morphological misfits is also proposed.]

Teixeira-Costa L, Davis C., Ceccantini G. 2021. Striking developmental convergence in angiosperm endoparasites. American Journal of Botany 108(5): 1–13 (doi:10.1002/ajb2.1658) [Comparison of developmental trajectories among different endoparasites, showing remarkable convergence among species of Apodanthaceae, Cytinaceae, Mitrastemonaceae, and Rafflesiaceae].

Těšitel, J., AiRong Li, Knotková, K, McLellan, R., Bandaranayake, P.C.G. and Watson, D.M. 2020. The bright side of parasitic plants: What are they good for? Plant Physiology 185(4): 1309-1324. [Reviewing the positive effects of parasitic plants as keystone species in certain ecosystems, increasing biodiversity, contributing to herbivores and pollinators, in forestry, in traditional medicine and as edible crops.]

Těšitel, J., Cirocco, R.M., Facelli, J.M. and Watling, J. R. 2020. Native parasitic plants: biological control for plant invasions? Applied Vegetation Science 23(3): 464-469. [Referring to examples of the use of parasitic plants to suppress invasive species. In Europe, *Rinanthus alectrolophus* is being used in the Czech Republic to control the invasive grass *Calamagrostis epigeos,* while in Australia *Cassytha pubescens* can control *Ulex europaeus* and *Cytisus scoparius* and in China, *Cuscuta australis* suppresses *Mikania micrantha.*]

Thorogood, C. and Rumsey, F., 2021. Broomrapes of Britain & Ireland. BSBI Handbook 22.

Botanical Society of Britain & Ireland. 150 pp. [see Book Review above.]

*Tikkanen, O.P. and 11 others. 2021. Freezing tolerance of seeds can explain differences in the distribution of two widespread mistletoe subspecies in Europe. Forest Ecology and Management 482: (https://www.sciencedirect.com/science/article/abs/pii/S0378112720315759?via%3Dihub) [Seeds of *Viscum album* ssp. *album* collected in Sweden, Poland and Switzerland proved more tolerant of temperatures below -15°C than *V. album* ssp. *austriacum*. A warming climate is likely to see spread of both species to higher altitudes and latitudes.]

*Unachukwu, N.N., Menkir, A., Stanley, A., Farombi, E.O. and Gedil, M. 2020. Contrasting response mechanisms of maize lines to *Striga hermonthica*. Agriculture 10(10): (https://doi.org/10.3390/agriculture10100485) [The resistance of line TZISTR1108 to *S. hermonthica* is shown to be due to a combination of much lower stimulation of germination, and also slower development of those that do attach.]

Ustuner, T., Girgel, U. and Cokkizgin, A. 2020. Phenological and physiological effects of different broomrape (*Orobanche* spp.) on chickpea cultivars (*Cicer arietinum* L.) in vitro and in vivo conditions. Fresenius Environmental Bulletin 29(8): 6597-6601. [Comparing 5 varieties of chickpea for their response to *O. crenata* and/or *Phelipanche ramosa* in Turkey, but results not clearly presented.]

Vukojičić, S., Đurović, S.Z., Lakušić, D., Kabaš, E., Lazarević, P. and Clementi, M. 2021. Nomenclatural notes and typification of the names of plant taxa described by Josif Pančić from Montenegro. Phytotaxa 490(1): 1-17. [Nomenclatural notes and lectotypes proposed for 10 species including *Orobanche cruenta* var. *adusta*.]

Wang Ao and 10 others. 2020. Effects of soil moisture, needle age and leaf morphology on carbon and oxygen uptake, incorporation and allocation: a dual labeling approach with $^{13}CO_2$ and $H_2{}^{18}O$ in foliage of a coniferous forest. Tree Physiology 41(1): 50-62. [Dual-isotope labeling experiments at different levels of humidity showed incorporation of ^{18}O was not influenced by soil moisture, while ^{13}C incorporation was significantly higher under irrigation compared with control dry conditions.]

*Wang WeiBin, Gao FanFan, Shao MeiNi, Liu MingChao, Zhai HongFeng, Qu Bo and Feng YuLong. 2020. First record of field dodder (*Cuscuta campestris*) parasitizing invasive buffalobur (*Solanum rostratum*). Journal of Plant Pathology 102(3): 703-707. [Recording *C. campestris* seriously damaging the invasive *S. rostratum* in Liaoning Province, China.]

*Wang YaXin**,** Murdock, M.**,** Lai, S.W.T.**,** Steele, D.B. and Yoder, J.I. 2020. Kin recognition in the parasitic plant *Triphysaria versicolor* is mediated through root exudates. Frontiers in Plant Science 11: (https://doi.org/10.3389) [Results indicate that kin recognition in *Triphysaria* is associated with the lack of active haustorium-inducing factor in their root exudates.]

*Watson, D.M. 2020. Did mammals bring the first mistletoes into the treetops? The American Naturalist 196(6): 769-774. (https://www.journals.uchicago.edu/doi/abs/10.1086/711396?af=R&) [Noting that the evolution of mistletoes predated that of mistletoe-feeding birds, establishing that they could have been dispersed by Cretaceous primates (e.g., *Purgatorius*) and, in the Eocene, by ancestors of today's mistletoe-dispersing marsupials, *Dromiciops*.]

***Watson, D.M., Cook, M.E. and Fadini, R. 2020. Towards best-practice management of mistletoes in horticulture. Botany 98(9): 489-498. (https://cdnsciencepub.com/doi/10.1139/cjb-2019-0205) [A comprehensive review of mistletoe incidence in fruit, nut and other food products, listing 18 crops and at least 15 genera of mistletoe parasites. And considering the available control methods, including ethephon, mechanical control by pruning, and the potential for biological control, resistance and orchard management.]**

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*Yuan YongGe, Kleunen, M. van and Li JunMin. 2021. A parasite indirectly affects nutrient distribution by common mycorrhizal networks between host and neighboring plants. Ecology 102 No. (https://doi.org/10.1002/ecy.3339) [Results indicate that when *Trifolium pratense* was parasitized by *Cuscuta australis*, common mycorrhizal networks preferentially distributed more mineral nutrients to the nonparasitized neighboring *T. pratense* plant, and that this had a negative feedback on the growth of the parasite.]

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Yupei Wang, Ruifeng Yao, Xiaoxi Du, Lvjun Guo, Li Chen, Daoxin Xie and Smith, S.M. 2021. Molecular basis for high ligand sensitivity and selectivity of strigolactone receptors in *Striga.* Plant Physiology 185(4): 1411-1428. [Findings highlight the key role of SL-induced MAX2–ShHTL7–SMAX1 complex formation in determining the sensitivity of *Striga* to strigolactones.]

*Zagorchev, L., Pachedjieva, K., Tosheva, A., Li JunMin, Teofanova, D. and Atanasova, A. 2021. Salinity effect on germination and further development of parasitic *Cuscuta* spp. and related non-parasitic vines. Plants 10(3): (https://doi.org/10.3390/plants10030438) [Showing that *Cuscuta* spp. are highly sensitive to NaCl concentration within the range of 200 mM. Germination was delayed and reduced by nearly 70%, accompanied by decrease in further seedling growth, ability to infect host plants, and growth rate of established parasites.]

Zamora, R.**,** Lázaro-González, A. and Hódar, J.A. 2020**.** Secondary foundation species foster novel plant-animal interactions in the forest canopy: evidence from mistletoe. Insect Conservation and Diversity 13(5): 470-479. [Concluding that 'mistletoe' (presumably *Viscum album*) creates conditions that support the co-occurrence of functionally distinct organisms in the canopies, fostering pine forest biodiversity and complexity of ecological interactions.]

*Zebire, D., Menkir, A., Adetimirin, V., Mengesha, W., Meseka, S. and Gedil, M. 2020. Effectiveness of yellow maize testers with varying resistance reactions to *Striga hermonthica* for evaluating the combining ability of maize inbred lines. Agronomy 10 (9): (https://doi.org/10.3390/agronomy10091276) [Concluding that testers with a high frequency of desirable alleles were superior to the tester with a low frequency of favorable alleles in hybrid breeding programs for resistance to *S. hermonthica*.]

*Zhang RuiTing, Xu Bei, Li JianFang, Zhao Zhe, Han Jie, Lei YunJing, Yang Qian, Peng FangFang and Liu ZhanLin. 2020. Transit from autotrophism to heterotrophism: sequence variation and evolution of chloroplast genomes in Orobanchaceae species. Frontiers in Genetics 11: (https://doi.org/10.3389/fgene.2020.542017) [Comparison among 50 complete chloroplast genomes from Orobanchaceae species of different feeding types reveals important differences in gene content and structural variation. Codon usage patterns are discussed to be shaped by selective pressures and mutational biases.]

HAUSTORIUM 80
has been edited by Chris Parker, 6 Royal York Crescent, Bristol BS8 4JZ, UK (Email chrisparker5@compuserve.com), Lytton Musselman, Parasitic Plant Laboratory, Department of Biological Sciences, Old Dominion University, Norfolk Virginia 23529-0266, USA (fax 757 683 5283; Email lmusselm@odu.edu) and Luiza Teixeira-Costa, Department of Organismic & Evolutionary Biology, Harvard University Herbaria, USA. (luiza.teixeirac@gmail.com). It has been produced and distributed by Chris Parker and published by IPPS (ISSN 1944-6969).

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