HAUSTORIUM

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PRESIDENT'S MESSAGE

Dear IPPS members

The previous issue of Haustorium was distributed amidst Covid problems around the world. Fortunately, since then we have been slowly going back to normal, at least as far as Covid is concerned. Moreover, for the first time in 3 years we were able to have a World Congress on Parasitic Plants (WCPP) again, on location in Nairobi, Kenya. The meeting was wonderful, and it was so great to see many IPPS members and be able to discuss our work again in person. I want to thank Damaris Odeny and Steven Runo for the fantastic organization. For details on the meeting see the report by Lytton Musselman elsewhere in this issue. I am happy that I can also already announce the next WCPP, which will be held in Nara, Japan, in June or July 2024. Keep an eye on www.parasiticplants.org for details and more information on this meeting.

In addition to the WCPP meeting in Nairobi, in the past year the IPPS organized an on-line monthly seminar series (see report by Luiza Teixeira in this issue). This was a great success with often over 50 participants. The IPPS wants to continue to host these online seminars throughout 2022-2024 until the next World Congress on Parasitic Plants. If you or one of your students wants to contribute to these seminars, please drop a line to Jonne Rodenburg at j.rodenburg@greenwich.ac.uk .

To keep the IPPS website lively and up to date we have several dynamic features, such as a Scopus and Google Scholar feed reader showing publications on parasitic plants that are refreshed every couple of days, a Twitter feed showing IPPS as well as #Parasiticplants hashtagged tweets and the option for IPPS members to post news. Please check them out on www.parasiticplants.org! To post news yourself, login into the member area where you can post your most recent paper or project funding, as well as job vacancies. I would also greatly appreciate if you'd update your profile, with your picture and that of your institution and with a short description of your research area.

If you are reading Haustorium but are not an IPPS member yet, consider becoming a member, see www.parasiticplants.org for details and an online membership fee payment option. We use these fees to run the society and to support the organization of the WCPP and its attendance by young researchers from developing countries. Membership entitles you to a reduced fee for WCPP attendance and gives you access to the member area of the IPPS website. If you are a member but did not pay your membership fee, please do so here.

Finally, I am happy to see that this issue of Haustorium again has a great selection of parasitic plant related news. See for example the articles on 'Natural super glue from mistletoe berries' and the intriguing sounding 'Don't make mistakes about our misunderstood, mysterious mistletoes'.
Enjoy reading!
I wish you all a successful academic year 2022-2023.

Harro Bouwmeester
IPPS President

FROM YOUR EDITORS

Our apologies for the lateness of this issue, due to a variety of reasons. Future issues may also fail to follow a regular schedule and may take a modified format which will be apparent next time. But we shall endeavour to keep you informed and entertained on the latest happenings in the fascinating sphere of parasitic plants. Read on!

MEETING REPORTS

The 16th World Congress 16th World Congress on Parasitic Plants, Nairobi, Kenya 10-15 July, 2022.

Over one hundred participants from around the world attended (in person or online) the meeting held at the Eka Hotel in Nairobi, Kenya. Thirty-one years ago, the Fifth Symposium on Parasitic Plants was held in Nairobi and the progress in understanding these remarkable plants since that time is stunning.

The more than forty presentations (some presented virtually) and twenty-four posters covered several groups of parasites and a diversity of research approaches. As usual, the majority of the papers dealt with the parasitic weeds in the genera *Cuscuta*, *Orobanche,* and *Phelipanche*, and *Striga.* Emphasis on the latter was important because of the impact of witchweeds on cereal crops in Kenya and it was encouraging to see the coterie of young African scientists working on this problem.

Strigolactones received due coverage clearly indicating the remarkable importance of this recently discovered group of plant hormones which help us understand the mechanisms of communication between host and parasite.

Perhaps more than any of the many parasitic plant meetings I have participated in the last half-century, this congress included significant contributions to the understanding of the genus *Hydnora* (the 'insane asylum of plants') and other lesser studied parasites like *Cistanche* and *Cynomorium*. Mistletoes garnered two presentations. Thus, there was a good balance between agronomically important parasites and botanically fascinating parasites. There are other groups that need attention, and we can look forward to learning more about the Mitrastemonaceae, Balanophoraceae and more in the asylum at future meetings.

As a long-time student of haustoria, I was excited to hear talks on the role of primary and secondary haustoria, the transcriptome's role in development of the host-parasite xylem bridge, and more. Genomic studies and sophisticated microscopy are among the tools that elucidated these findings.

There were several genomic and phylogenetic studies on the importance of the evolution of parasites—and the evolution of parasitism—that can provide information identifying points of intervention for control.

Despite reams of elegant and sophisticated studies on witchweeds and broomrapes, it is generally agreed that little has been done to staunch the damage inflicted on the crops raised by small-holder farmers. But many of the studies reported at the meeting clearly indicate a resolve to develop impactful, sustainable control measures like the push-pull system and the toothpick and suicidal germination methods. In mechanized farms, herbicides are practical and there we heard reports on their efficacy and history of use.

A field trip took participants to Embu west of Nairobi to see *Alectra vogelii* in the field.

The discoveries and programs generated spirited discussion and palpable excitement. Having all the sessions plenary, generously punctuated with coffee breaks, lunch, and dinners facilitated this. We were treated to a banquet at the well-known Nairobi Carnivore Restaurant, an appropriate name for people working with parasites, where further discussions ensued over crocodile, ostrich, and other delicacies preceded by a review of the history of our society and symposia.

The full programme and abstracts are available at https://www.parasiticplants.org/wcpp-meeting/16th-world-congress-on-parasitic-plants-nairobi-kenya/

All of the meetings, socials, field trip, registration, lodging, travel and visa assistance were graciously proffered by our hosts, Damaris Odeny of the International Centre for Research in the Semi-Arid Tropics (ICRISAT) and Steven Runo of Kenyatta University, and the officers of IPPS.

Lytton John Musselman

IUFRO Division 7 (Forest health, Pathology, and Entomology).. Technical Session: Parasitic flowering plants in forests. Lisbon, Portugal. 2022 6-9 September 2022.
Organizers: David Shaw, David Watson, Tod Ramsfield and Luiza Teixeira.

The IUFRO Parasitic Flowering Plants in Forests working group, had an oral session at the Division 7 meeting of the International Union of Forest Research Organizations. The meeting was attended by from Australia, Belgium, Brazil, Chile, Germany, and USA.

Relevant papers presented:

Luiza Teixeira-Costa et al.: Leveraging parasitic flowering plant collections to understand and monitor impacts of global (see full paper at https://doi.org/10.1111/2041-210X.13866)

Francisco Fonturbel et al.: Geographic context outweighs habitat disturbance effects in explaining mistletoe population (see full paper at https://doi.org/10.1111/mec.16337)

David Shaw et al.: Transformation of western hemlock (*Tsuga heterophylla*) tree crowns by dwarf mistletoe (*Arceuthobium tsugense*, Viscaceae) (see full paper at https://doi.org/10.1111/efp.12664)

Max Mylo et al.: How the European mistletoe attaches to its host—Biomechanics and functional morphology of their persistent connection (see full paper at https://doi.org/10.1093/jxb/erab518)

Gregorio Ceccantini et al: Fruit and seed dispersal of *Phoradendron quadrangulare* (Santalaceae) by birds in urban areas of the city of São Paulo: a parasite may enhance the conservation of a threatened bird

David Watson et al.: Functional roles of mistletoe in a warming world (see full paper at https://doi.org/10.1146/annurev-ecolsys-102320-115331)

Abstracts for each talk and a complete list of authors can be found at https://iufro-lisbon2022.com/program/program. Also, a special issue of the journal Botany, on mistletoes, will include some of these, as well as several others, due in May 2023.

Luiza Teixeira-Costa.

Conference - Overcoming the barriers to adoption of microbial bioherbicides, Bari Italy, 26-28 September, 2022. Several papers related to parasitic weeds.A special issue of Pest Management Science is planned by the end of the year, containing peer reviewed articles prepared after the conference.

PROFILE

CASSYTHA SPECIES

(The following is an edited version of the Introduction to the paper by Zhang H., Florentine, S. and Tennakoon, Kushan, 2022. The angiosperm stem hemiparasitic genus *Cassytha* (Lauraceae) and its host interactions: a review, recently published in Frontiers in Plant Science 06 June. References are not included here but can be checked in the original article at https://doi.org/10.3389/fpls.2022.864110.)

Despite a large body of research on the biology of root hemiparasites regarding the Scrophulariaceae and Santalaceae species, plus, mistletoes of families Loranthaceae and Viscaceae, and the stem holoparasites *Cuscuta*, a notable exception is stem hemiparasitic genus *Cassytha*. Being stem-parasitic vines, *Cassytha* and *Cuscuta* behave similarly and are often referred to together or represented inadvertently as *Cuscuta*. However, *Cassytha* is a hemiparasite whilst *Cuscuta* is a holoparasite, and they actually differ in many aspects such as the action of the haustorium, their stem appearance, and life span. Study on *Cassytha* has been relatively neglected, leading to it being less well characterized compared to its companion *Cuscuta*. *Cassytha*, belongs to the sub-family Cassythoideae, the family Lauraceae and the magnoliid clade. *Cassytha filiformis* has been exploited for medicines, cosmetics, ropemaking, and cushioning in the Pacific Islands, and is treated as an important medicinal plant both in China and Nigeria. *C. filiformis* and *Cassytha glabella* have been treated as sources of bush tucker and medicines by the Australian Aboriginals, and *Cassytha pubescens* has the potential to be used as a biocontrol agent for alien invasive species in southern Australia. *Cassytha pondoensis* is recognized as a medicinal plant in Angola whilst *C. pubescens, Cassytha melantha, Cassytha racemosa, Cassytha pomiformis,* and *C. filiformis* contain alkaloids and *C. filiformis*, *C. pubescens,* and *Cassytha capillaris* contain essential oils. The *Cassytha* grouping contains 19 species according to The Plant List, 16 of which occur in Australia. There are 13 species endemic to Australia, one being pantropical (*C. filiformis*), one extending into Assam, Borneo, Lesser Sunda Islands, Malulu, New guinea, and Vietnam (*C. capillaris*), and one also being found in New Zealand (*C. pubescens*). The other three species are endemic to Africa (*Cassytha ciliolata* and *C. pondoensis*) or Thailand (*Cassytha larsenii*). It has been reported that *C. capillaris* also occurs in Indonesia and China, which has not been confirmed. *Cassytha pergracilis* was an endemic species found in Japan. However, it is not recorded in Global Biodiversity Information Facility and is recognized as a synonym of *C. glabella* in The Plant List. *Cassytha muelleri, Cassytha paniculata*, and *Cassytha phaeolasia* were recorded as species in the Flora of Australia that follows the Australian Plant Census, but they are treated as synonyms of *C. racemosa* and *C. pubescens*, respectively. As a widespread pan-tropical species, *C. filiformis* has been more extensively studied than other species of this genus. However, a group of scientists from South Australia has recently investigated the potential of using native *C. pubescens* to control the alien invasive shrubs *Ulex europaeus* and *Cytisus scoparius*. For other species in the *Cassytha* genus, there are relatively few taxonomic studies and field investigations concentrating on species in certain habitats, with few empirical studies. For example, the cuticular character of all the *Cassytha* species and the stem and systematic anatomy of *C. ciliolata, C. filiformis, C. glabella, C. melantha*, and *C. pubescens* has been studied. The chlorophyll content and photosynthetic characteristics of *C. ciliolata* and *C. filiformis* in South Africa and the seasonal fluctuations in pigment chemistry of *C. glabella* and *C. pubescens* in Australia have also been investigated. However, the *Cassytha*–host interactions of any of these species have not been reviewed. We suggest that a detailed interpretation of *Cassytha*–host interactions are important to allow an understanding of their complex interactive biology and to allow us to build up a relatively detailed picture of the co-physiological behavior of these parasite–host associations. Further, parasites have a great impact on plant communities even though they might contribute a minor component in the mix, and a single parasite may seriously influence a large portion of an ecosystem. Hence, the understanding of *Cassytha*–host interactions can also help to control the damage induced by these parasites in both agriculture and natural settings. In addition, it may be possible to utilize these stem parasites to control invasive weeds and use them separately for raw material and medicinal purposes. In this review, we summarize currently available information on *Cassytha*–host interactions focusing on its parasitic nature and worldwide distribution, identifying host range and preference, noting the impacts of *Cassytha* on host species and understanding the overall responses to the changes in climate, viable control strategies under heavy infestations and its sustainable utilization. We also identify gaps in current knowledge of this area and suggest future study directions deemed necessary for *Cassytha*–host interactions.

Kushan Tennakoon, Zhang H. & Florentine, S.
Federation University, Australia

PROJECTS

CRP Success Story: Mutation Breeding for Resistance to *Striga* Parasitic Weed in Cereals for Food Security (D25005)

A recently completed five-year IAEA Coordinated Research Project (CRP) (D25005) has helped experts from 12 countries to identify novel sources of resistance to the devastating parasitic weed *Striga* in cereals with efficient protocols, which help them to reduce production constraints and improve food security.

Host plant resistance is the most tangible control measure of *Striga*. This can be achieved through nuclear applications by inducing novel sources of genetic variation for the development of resistant varieties of vulnerable food crops. The CRP on Mutation Breeding for Resistance to *Striga* Parasitic Weed in Cereals for Food Security (D25005) targeted mutation breeding using physical mutagenesis for broadening resistance to *Striga* in sorghum, maize and upland rice. It focused on the development or adaptation of screening protocols for *Striga* resistance in the field, greenhouse and laboratories, and integration of efficiency enhancing technologies.

The CRP attracted experts from 12 research teams from cereal improvement programmes and *Striga* biologists from several countries. The overall objective of the CRP was to support generation of novel sources of variation, using mutation breeding, by developing efficient screening protocols for *Striga* resistance in cereals for improvement of food security in Member States. To achieve this goal, the following four specific research objectives were established:

Develop, optimize and validate technology packages for screening of mutant populations for resistance to *Striga* in major cereals.
Integrate efficiency enhancing techniques for rapid generation of genetic diversity in major cereals (doubled haploid, rapid cycling & genomics).
Generate genetic diversity to develop resistant varieties to *Striga* infestation.
Enhance capacity in efficient mutation breeding for resistance to *Striga* in Member States.

The CRP has achieved these planned targets as shown by the following examples:

Three field, four greenhouse and six laboratory protocols were developed, validated and used by participating Member States to induce and characterize novel variation in the targeted crops (sorghum, maize and upland rice). Efficiency enhancing technologies such as rapid generation cycling, doubled haploid, metabolomic and genomic are developed/adapted and used in the characterization of the identified mutants and acceleration of the breeding programme. Four to six generations of sorghum could be produced in one year, reducing the time to deliver advanced mutant lines in two years instead of five to seven years using the conventional approach. 64 induced mutants were identified with resistance/tolerance to *S. hermonthica* or *asiatic* in sorghum, maize and upland rice.

At least three of the verified mutants from each crop were advanced to field evaluation for possible release in three of the participating countries (Burkina Faso, Madagascar and Sudan) to ensure sustainable production under *Striga* prone fields.

Capacity building: In addition to targeted individual training within the context of the CRP for more than 20 individual fellows/interns at the Plant Breeding and Genetics Laboratory, six MSc and six PhD students conducted their studies in collaboration with participating Member States and the Plant Breeding and Genetics Laboratory.

The CRP was implemented by the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture using six research and two technical contracts, and four agreements. Five of the participating contract holders in the CRP were from Africa, three from Asia, two from Europe and two from USA. An additional indication of the CRP's success was that it generated 12 peer-reviewed publications and ten conference proceedings. Furthermore, additional papers are in the pipeline. A book compiling twelve chapters of the optimized protocols during the CRP is planned to be published under Springer Nature Open Access publications.

The CRP improved human capacity and the developed resistant mutant lines in the major cereals are expected to generate tangible impact on sustainable production and food security in *Striga*-prone areas in Africa and part of Asia. Experts involved in the project recommend the following for the best utilization of the results generated by the CRP:

Official release of resistant lines developed in sorghum, rice and maize through IAEA technical cooperation (TC) projects for wide use by farmers (BK5019, BKF2020005, MAD5025, MAD5026).

Support of a regional project (TC or specially funded) to test advanced resistant/tolerant lines in *Striga*-prone countries of Africa for their wide utilization.

Wide dissemination of technology packages for resistance screening developed by the CRP to affected Member States through TC projects to combat the devastating parasite.

Abdelbagi M.A. Ghanim, IAEA Department of Nuclear Sciences and Applications

Striga Solutions: Protecting the food security and livelihood of millions by combating the spread of _Striga_ in sub-Saharan Africa.

Pearl millet is a staple food for African smallholder farmers, ranked 6th as the world's most important cereal crop. Currently, uncontrolled *Striga hermonthica* infestation is causing significant losses in cereal production, affecting crop yields of cereals equating to at least $7 billion each year. *Striga* Solutions aims to significantly enhance pearl millet production for smallholder farmers, while supporting rural agriculture and economic development in sub-Saharan Africa. To meet this goal, we've developed efficient hormone-based methods that hold promise for a significant reduction of *Striga* seedbank and are working on identifying genetic targets for breeding and generating *Striga*-resistant pearl millet varieties.

Led by Professor Salim Al-Babili from King Abdullah University of Science and Technology (KAUST), the *Striga* Solutions team is comprised of experts from the Middle East, Europe, Africa, and Asia. These teams are studying plant hormones and their function in order to increase the yield of crops, plant performance, and food security worldwide. The aim of Professor Al-Babili's research is to generate crops with improved agricultural performance and enhanced nutritional value. Professor Al-Babili has long-standing experience in engineering biofortified crops, such as Golden Rice, and in elucidating metabolic pathways. His group is currently working on basic and translational aspects of plant metabolism and hormone research, with focus on developing hormone-based chemistries to combat the root parasitic plant *Striga*, identifying novel small molecules regulating crop resilience and performance, and on the metabolism and functions of the plant hormone strigolactone. In addition, he is establishing molecular toolkits required for genetic engineering and gene editing of pearl millet, towards improving the resistance and performance of this nutritious and highly important cereal for arid and hot regions.

Striga Solutions is looking for talented and experienced individuals who have a desire to make a positive impact in the world. If you're interested in joining our team, please email us to learn more about open positions.

Striga Solutions is a multidisciplinary project led by the BioActives Lab, Center for Desert Agriculture (KAUST) and funded by the Bill & Melinda Gates Foundation and King Abdullah University of Science and Technology (KAUST). As visionary donors, we thank them for their engagement to preserve life, and to eliminate poverty and food insecurity around the world.

ERC Proof of Concept grant to control witchweed infection in maize

Harro Bouwmeester received a Proof of Concept Grant funded by the European Research Council (ERC) for the project LGSMAIZE. With this grant we will test whether it is possible to genetically modify African maize genotypes so they become resistant to parasitic witchweeds. This can be an enormous asset in the fight against witchweed. The parasitic witchweeds pose an enormous threat for production of cereal crops, such as maize, especially in the African continent. Witchweed seeds can lay dormant in the soil until their germination is triggered by strigolactones that are exuded by the roots of maize. In our research, we found a North-American cultivar that is resistant to witchweed, but is not adapted to the African climate. It carries a mutation altering the composition of the strigolactones which results in less germination, and less witchweed infection. Together with researchers, Pooja Bhatnagar and Amos Alonya of the International Maize and Wheat Improvement Center (CIMMYT) we will test whether mutating this gene in African maize genotypes will result in the same result. This will also be tested in the field in Kenya to test this in a relevant agricultural setting. If this works, this will create a new opportunity to control witchweed infection in maize in Africa.
The ERC Proof of Concept competition is open only to ERC grantees. Worth €150.000 each, the grants will be used to explore the commercial or societal potential of the results of grantees research projects. This funding is part of the EU's research and innovation programme, Horizon Europe. Find an overview of the 55 recipients of this ERC Proof of Concept call here on the ERC website.

Harro Bouwmeester, September 19, 2022

CONGRATULATIONS

Dr. Jay Bolin has been named as Dean of Science and the Environment. He will oversee biology, environmental studies, chemistry, and the Center for the Environment. Jay earned his doctorate and master's degrees from Old Dominion University. Prior to coming to Catawba, Bolin taught at Trinity Washington University and the University of Namibia. He was also a Smithsonian Research Collaborator.

IPPS awards Honorary Fellowship to five members

At the occasion of the 16th World Congress on Parasitic Plants held 3-8 July 2022 in Nairobi, Kenya, the IPPS has awarded Honorary Fellowships Julie Scholes, Dan Nickrent, Abdelgabar Babiker (posthumous), Jonathan Gressel and Barach Rubin. They received this award for their service to the society and their important contributions to the parasitic plant science field.

SOME PARASITIC PLANTS OF RWANDA—DECORATION OR DAMAGE?

Parasitic plants have received little attention in Rwanda. Two species of *Striga* are known and cause considerable crop loss in some regions. *Striga hermonthica* occurs in the southern part of the country where it has been reported to damage grains. I have seen *S. asiatica* in the vicinity of the village of Mbyo where families told me they had to stop growing maize because of the damage. In one field the farmer grew legumes for twenty years and then planted sorghum which was severely damaged by the witchweed.

Broomrapes, species of *Orobanche*, have not been reported to be a serious problem, interesting because of the widespread cultivation of potatoes and cole crops, well known hosts for some broomrape species and a serious constraint to the growth of these crops especially in the Mediterranean region.

There are several species of dodders, *Cuscuta*, in the country but like broomrapes they appear to be of limited importance.

Cuscuta kilimanjari, is given its name because it was first described from Mount Kilimanjaro. It is widespread in East and Central Africa and is distinct with its rigorous growth and bright color. I have never seen Kilimanjaro dodder on a native host except in South Sudan.

Isambe parasitized by Kilimanjaro dodder, city of Munsanze.

The most common hosts are introduced ornamental shrubs, especially bougainvillea (*Bougainvillea spectabilis*) and *Duranta erecta* (golden dewdrop or pigeon berry). I was always amazed the way the parasite grew more or less evenly on the top of the trimmed shrubs. Turns out the dodder is planted on the top of the hedge! Just how and when this is done remains to be determined but to my knowledge it is the only example of a dodder grown as an ornamental. The burst of bright yellow strands is undeniably appealing.

But this beautiful parasite needs to be monitored. I found it on numerous shrubs of *Isambe*, a cultivar of cassava (*Manihot esculenta*) grown for its leaves which are used to prepare a popular food. It is apparently not grown commercially but rather as a home garden tree. Will it attack other cultivars of cassava? The proverbial further research is needed.

Should gorillas be concerned?

Orobanche minor, small broomrape, is found throughout much of East Africa and parasitizes a diversity of hosts. Of particular interest in Rwanda is its parasitism of *Peucedanum linderi*, wild celery, a main food of mountain gorillas.

Small broomrape parasitizing wild celery in a garden of plants favored by mountain gorillas. The broomrape is just above the yellow leaf, dying as a result of parasitism. Ellen DeGeneres Campus of the Dian Fossey Gorilla Fund, Northern Province.

In Search of the Furtive *Hydnora*

For many years I have been studying this genus including its ethnobotany, how it is used by local people. *Hydnora abyssinica* has been collected in Rwanda so I was interested to know it is used as a medicine as it in numerous other places in Africa. When I described the medicinal use of the plant for stomach upsets, she immediately responded that her mother had given some terrible tasting medicine when she was a child based on my description of the bitterness and color. While her response was visceral, she helped me search in several markets for the plant but to no avail.

Lyton J. Musselman

With thanks to Tom Allen and Rosine Ndayishimiye for encouragement, logistical support, and information.

IPPS ZOOMINARS

February 2, 2022

Dorota Kawa (UC Davis) -**Mechanisms of microbe-induced resistance to *Striga* in sorghum.**

Sorghum bicolor is one of the most important cereal crops in the world, predominantly grown in sub-Saharan Africa by smallholder farmers. Despite its outstanding resilience to the abiotic stresses, around 20% of sorghum yield is annually lost on the African continent due to the infestation with the parasitic weed *Striga*. Existing Striga management strategies often show low efficiency and are not easily integrated into current agricultural practices. Microbial-based solutions may prove an effective, low-cost mode for reducing *Striga* parasitism in sub-Saharan Africa. We identified a field soil whose microbiome component suppressed *Striga* infection. This soil microbiome promotes endodermal suberization as well as formation of aerenchyma, both coinciding with fewer *Striga* attachments to sorghum root. Moreover, in a presence of microbes we observed a depletion of haustorium inducing factors (compounds essential for Striga to establish the host-parasite association) and an increased level of the products of their degradation. With modeling approach, we predicted which microbial strains reduce *Striga* parasitism via identified mechanisms. Our results provide a framework for high-throughput screening of individual microbial isolates that can potentially elicit *Striga* resistance.

March 2, 2022.

Luiza Teixeira (Hanse-Wissenschaftskolleg, Germany) - **New perspectives in haustorium structure and evolution across parasitic flowering plants**

Parasitic flowering plants are characterized by the development of an organ known as haustorium, which has evolved in multiple independent angiosperms clades. The haustorium has also been deemed 'the most plastic of organs' due to its ability to accommodate physiological and anatomical differences between the parasite itself and its host plants. This is achieved through the development of vascular connections, which involve the differentiation of various specialized cell types by the parasite. The development, structure, and evolution of the haustorium and the connections it fosters are reviewed here considering all 12 parasitic plant lineages. A multi-level comparison between 'model' parasitic plants, such as Orobanchaceae and *Cuscuta* species, with members of often neglected groups, such as Lennoaceae, Mitrastemonaceae, and Santalales yields the idea of a shared general body plan of the mature haustorium. This proposed haustorium bauplan is composed of an upper part, including structures associated with mechanical attachment to the host body, and a lower part, including all parasitic tissues and cell types within the host body. The analysis of multi-level convergence is also applied here to the comparison between haustoria and other plant organs. Considering the structure, molecular development, and functionality of this organ under the framework of continuum and process plant morphology, I propose the interpretation of haustoria as morphological misfits.

Runxian Yu (CAS, Beijing) – **The minicircular and extremely heteroplasmic mitogenome of the holoparasitic plant *Rhopalocnemis phalloides***

The plastid and nuclear genomes of parasitic plants exhibit deeply altered architectures, whereas the few examined mitogenomes range from deeply altered to conventional. To provide further insight on mitogenome evolution in parasitic plants, we report the highly modified mitogenome of Rhopalocnemis phal loides, a holoparasite in Balanophoraceae. Its mitogenome is uniquely arranged in 21 minicircular chromosomes that vary in size from 4,949 to 7,861 bp, with a total length of only 130,713 bp. All chromosomes share an identical 896 bp conserved region, with a large stem-loop that acts as the origin of replication, flanked on each side by hypervariable and semi-conserved regions. Similar minicircular structures with shared and unique regions have been observed in parasitic animals and free-living protists, suggesting convergent structural evolution. Southern blots confirm both the minicircular structure and the replication origin of the mitochondrial chromosomes. PacBio reads provide evidence for chromosome recombination and rolling-cir cle replication for the R. phalloides mitogenome. Despite its small size, the mitogenome harbors a typical set of genes and introns within the unique regions of each chromosome, yet introns are the smallest among seed plants and ferns. The mitogenome also exhibits extreme heteroplasmy, predominantly involving short indels and more complex variants, many of which cause potential

loss-of-function mutations for some gene copies. All heteroplasmic variants are transcribed, and functional and nonfunctional protein-coding variants are spliced and RNA edited. Our findings offer a unique perspective into how mitogenomes of parasitic plants can be deeply altered and shed light on plant mitogenome replication.
April 6, 2022.

Satoshi Ogawa -Orobanchaceae parasitic plants use strigolactones as chemo- attractants for host tropism

A major characteristic shared by parasitic plants is the ability to connect to host plants and acquire nutrients and water from them. To this end, parasites can locate host plants and grow toward them prior to infection. However, the molecular mechanism of such host tropism remains largely elusive in Orobanchaceae parasitic plants such as *Striga* spp., which causes multibillion-dollar economic loss annually in agriculture. To study host tropism, I selected the model facultative root parasite *Phtheirospermum japonicum*, a member of the Orobanchaceae. I show that *P. japonicum* exhibits chemotropism to strigolactones (SLs). Chemotropism to SLs is also observed in *S. hermonthica* but not in non-parasitic plants, suggesting that chemotropism to SLs might be Orobanchaceae parasite-specific strategy for parasitism. Chemotropism to SLs in *P. japonicum* is repressed by ammonium in the medium, where the perception of SLs remains but the downstream asymmetrical accumulation of an auxin transporter PIN2 is lost. I also show that among the seven KAI2d homologs encoded in the genome of *P. japonicum*, at least two receptors are able to recognize exogenous SLs. Expression of a dominant-negative form of KAI2d suppresses chemotropism to SLs. This study provides a novel function of SLs as chemoattractants for Orobanchaceae parasitic plants.

May 4, 2022.

Michael Axtel (Pennsylvania State University) - **Molecular Evolution and Transcriptional Control of Trans-Species microRNAs from *Cuscuta campestris***

Plants can receive functional short interfering RNAs (siRNAs) and microRNAs (miRNAs) from pathogens, parasites, symbionts, and other plants. Little is known about the molecular evolution or transcriptional control of such 'trans-species' small RNAs in any system. The obligate parasitic plant *Cuscuta campestris* expresses over 100 distinct miRNAs that specifically accumulate at the interface between parasite and host. These miRNAs are detectable inside of host tissues suggesting they can move some distance in the recipient organism. Many of these *C. campestris* miRNAs have been shown to target host plant messenger RNAs (mRNAs) for silencing. Targeted host mRNAs often encode proteins that function in defense responses, hormone responses, and vascular system functions. *C. campestris* is a generalist that successfully parasitizes diverse host plants. Expression of *C. campestris* trans-species miRNAs are not host-specific; the same set of miRNAs are induced, with identical kinetics, regardless of host species. *C. campestris* trans-species miRNAs can also be induced in haustoria (the parasitic organ that attaches to hosts) from parasites grown in the absence of any host plant at all. *C. campestris* trans-species miRNAs preferentially target extremely conserved regions of host mRNAs. The miRNAs also often are expressed as a constellation of polymorphic sequence variants, with polymorphisms occurring to compensate for synonymous site variation in host mRNAs. This is strong evidence that *C. campestris* trans-species miRNAs have been selected to maintain targeting to certain host transcripts. The loci that encode the primary transcripts of *C. campestris* trans-species miRNAs all have a common ten base-pair promoter-proximal sequence motif. This upstream sequence motif (USE) is not found at canonical miRNA-encoding genes of *C. campestris* or in any other plants. The USE promotes trans-species miRNA accumulation, and thus is a positive cis-acting regulatory element specific for trans-species MIRNA genes. The USE and other sequence features of *C. campestris* trans-species MIRNA loci strongly suggest transcription by RNA polymerase III. This is previously unknown for plant MIRNA transcription; Pol II has been shown to transcribe canonical MIRNA loci in plants. Our working hypothesis is that coordinated, USE-dependent Pol III transcription distinguishes *C. campestris* trans-species miRNAs from canonical miRNAs. It may allow them to be specifically exported from the parasite, as opposed to being used within *C. campestris* tissues.

A Toothpick Revolution: Small scale farmers in Africa lead in a novel bioherbicide for *Striga.*

Claire Sands Baker & David Sands
Using biology to fight biology in one of the biggest battles against weeds globally, the Toothpick Project's bioherbicide innovation utilizes a local plant disease to effectively kill *Striga* (witchweed), Africa's worst pest threat to food security. Developed by Dr. David Sands, Montana State University, the novel technology brings together two concepts: amino acid inhibition and biocontrol with the host-specific plant pathogen, *Fusarium oxysporum*. After twelve years of research and development in Kenya, including five years of regulatory processes, the resulting bioherbicide product, Kichawi Kill, was approved for full commercial use in Kenya in November 2021. In 2018, the project selected and trained a team of scientists from a dozen other sub-Saharan countries - in anticipation of expansion beyond Kenya. The innovation is participating in the ICGEB effort to harmonize biocontrol regulation in the SADC. Based on the novel innovation, the potential for food security and economic development, and the new opportunity to challenge the dominant synthetic herbicide market, the company has received recent awards including: Milken-Motsepe AgriTech Prize Finalist; World Food Program Sprint 2022; UN Best Small Business Good Food for All Winner 2021; IFT Seeding Solutions Finalist 2021; UNDP Cultiv@te 2021; MacArthur Foundation Bold Solutions Network: Top 100 (2020); Gates Foundation Grand Challenges Exploration 2013. The mission of the Toothpick Project is to create and implement a biological solution for small scale farmers battling Striga (witchweed), the worst pest threat to food security in Africa. Globally, we envision a shift in pest management, mobilizing safer, more effective technology through biocontrol.

OBITUARIES

Siny ter borg

We are sad to report that that Dr Sina Jacoba (Siny) ter Borg passed away on 6 February 2022, in Wageningen, the Netherlands at the age of 85. Siny ter Borg was born in the Northern part of the Netherlands. She was very much encouraged and stimulated by her grandfather, a local alderman on education in her municipality, to take an academic education. Accordingly, after high school, she took on a study in Biology, specialization Plant Ecology, at the University of Groningen. She very much enjoyed her study, became student-assistant, and completed her study in a short period of time. After completion of her study, she was appointed at the same University, working in the field of plant ecology. In 1962, she visited the University of Bangor (Wales) for a couple of months. Back in Groningen, she followed the example of her father, who had obtained a doctor's degree, and started her doctoral study on '*Rhinanthus,* a hemi-parasitic plant species'. She completed and defended her dissertation in 1972.

In 1982, she was asked to join Wageningen University to strengthen the Plant Ecology Group. She accepted and worked at Wageningen University with huge pleasure. She had a great passion for her work, both research and education, and was very committed. She carried out her work with great diligence, also investing ample time in proper documentation of her findings. After her pension she kept visiting the University and made use of an office made available to her. Here she completed the organization of the huge amount of data collected throughout her career and completed some further papers based on those data
.

She used her expertise in plant ecology not only in her academic career, but also put it to the benefit of Society. In Groningen, the Province of her birth, she advised on how to successfully turn agricultural land back to nature.

Siny has always been a very active and respected member of the 'parasitic plant' community. She enjoyed travelling abroad and was a regular delegate at the meetings organized by IPPS and preceding organizations, and was a contributor at the very first founder meeting in Malta, 1973.. She put a lot of effort into supervision of students working on their MSc- and PhD-thesis and was especially committed to students from abroad. Through her membership of the church, she financially supported students from African countries to be able to follow their master and doctoral studies in the Social Sciences at Wageningen University. She also was an active member of organizations that stimulated the position of women in science and society.

We will miss a creative, warm and knowledgeable colleague, with an open eye for people who could use some additional support. May she rest in peace.

Aad van Ast, Lammert Bastiaans and Chris Parker

Dr Gospel Oluoch Omanya

Our colleague Gospel Omanya, who passed away on 16 June 2019 at age 51 after a short illness, was a plant geneticist and Africa's frontier seed systems expert with decades of combined work experience, mostly spent as a practitioner of technology deployment at AATF where he worked for 15 uninterrupted years, maintaining his exceptional focus and productivity up to the time of his death.

The diversity of responsibilities that Gospel took on at AATF and in his prior professional life was simply extraordinary, as were the intelligence, energy, enthusiasm, and collegiality he brought to all of them. Gospel smiled all the time, often joking that this was because his name literally translated to 'good news'. Uniquely multilingual, Gospel was fluent in English, French, German and Kiswahili, an attribute that enabled him make friends from all over the world, including those he worked so hard to support – farmers.

Hired by AATF in 2005 as Geneticist and Seed Systems Manager, Gospel would have a trailblazing career that saw him serve in the positions of Projects Manager, Seed Systems Manager, Seed Stewardship Manager rising to become Senior Manager for Deployment and later on as Technology Lead and Coordinator for the Technologies for African Agricultural Transformation (TAAT) Maize Compact.

A Kenyan who grew up in Nairobi, Gospel studied for his bachelors and master's degrees in plant Breeding at the University of Nairobi. He later earned a doctorate in Agricultural Sciences from the University of Hohenheim in Germany before debuting as research coordinator for millet and sorghum at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Niamey, Niger. His research speaks for itself as the list of his contributions, comprising publications, monographs and press articles and credentialed key note presentations, run into pages.

For us at AATF, his close colleagues, professional colleagues in the TAAT Program and across the world, what Gospel brought to our work was not only a first-class mind, a deeply informed focus on some of the most important issues at the intersection of technology and deployment nexus, an admirable commitment to seed delivery, a mind-boggling stamina for work, and his exceptional standing as a global leader in crop technology diffusion. He was also a wonderful colleague – warm, ever upbeat and enthusiastic, always ready to consider seriously the views of others, always looking for ways to contribute to a better world, a prosperous Africa. We shall surely miss him.
May the Almighty God rest his soul in eternal peace and grant his immediate family the fortitude to bear this great loss.

AATF, 2019.

Abdul Gabar Babiker 1949-2022

When I was asked to say a few words in memory of my friend and fellow strigologist, Abdul Gabbar Babiker, I did not expect all the accolades and affection that speakers at this meeting rightly gave him, even having a presentation dedicated to him. I spent a lot of time with him when I Iived in Sudan and he was an invaluable help to me in my research, so I was saddened to hear of his death on June 5th of this year at the age of 73. I knew Abdul Gabbar for many years, he was a guest in my home in Virginia and I enjoyed his hospitality at his house in Wad Medani, Sudan, a home, by the way, which is the only one I have visited with a tile floor ruptured by *Hydnora abyssinica* which he was proud to point out to me despite the damage.

He was an intrepid researcher, always developing new hypotheses, aggressively learning new techniques. While he spent most of his career at the Agricultural Research Center in Wad Medani, he also directed numerous theses and published about 120 papers of which sixty or so dealt with *Striga* and fifteen with *Orobanche.*

Abdul Gabbar started his international activity with doctoral studies in Scotland. He received his PhD at the University of Glasgow after which he spent considerable time in laboratories in the United States, Japan, and Germany.

Abdul Gabbar was a friend and encourager to all strigologists as is clearly evident from the many times his assistance has been mentioned by scientists from different nations at this congress. In his enthusiasm he was always eager to help a researcher. I well remember how he would greet me excited by some new finding or some new idea, 'Musselman [as he called me] I just found a new activity for ethylene'. Despite infrastructure challenges at that time, he kept up with current literature and was always eager to share this information with me and anyone else.

Once the eminent parasitic plant researcher, Johann Visser, was staying at my house and Abdul Gabbar came to stay at the same time. I told him that our small house with a family of six meant he would have to stay in the same room as Johann. 'Musselman', he exclaimed, 'I can't stay in the same room with a South African!' When I explained the alternatives, he grudgingly acceded and by morning was engaged in animated discussion with Johann, adding another collaborator to his expanding list of contacts.

While he researched a diversity of other plants, he was at heart a true strigologist to the end. His last publication I am aware of appeared in 2020.

Abdul Gabbar is survived by his wife, Selwa, two daughters and a son. In the traditional Sudanese expression of condolence, we can say '*Barakah fiki*.'

Lytton John Musselman.

PRESS REPORTS

CSIR-Crops Research Institute releases 5 new maize varieties

The Crops Research Institute, under the Council for Scientific and Industrial Research has received approval for the release of five new improved hybrids of maize for cultivation and consumption in Ghana. The new hybrids, fortified with Pro Vitamin A, would serve as an alternative source of the vitamin for consumers who are unable to patronize animal-sourced vitamins. The approved five maize hybrids are high yielding capacity, drought resistant, early maturing, and high Vitamin A content. This follows their approval from the National Varietal Release and Registration Committee under the Ministry of Food and Agriculture.
Consumption of low content nutrient cereals, root and tuber crops contributes partly to the high prevalence of Vitamin A deficiency in Ghana

With Vitamin A deficiency resulting in stunted growth and weakened immune system, maize, a major staple food in Ghana, has been found to be a feasible resort to address the situation.
Lead Researcher, Dr.
Mrs. Priscilla Francisco Ribeiro said the newly approved hybrids would help reduce malnutrition and improve the livelihood of farmers. 'One of the varieties is early maturing (110-120 days), has Pro

Vitamin A and is *Striga*-tolerant. Maize farms are usually attacked by the pest known as *Striga* which eventually causes the farmer to abandon its farm to rot. However, this new hybrid would reduce malnutrition in many homes as well as improve the farming activity of many farmers,' he said. The five new hybrids are enriched with various food nutrients and improves vision, good for poultry and livestock feed with averagely 5.5 to 8.1 tons of yields per hectare.

Chairman for the National Varietal Release and Registration Committee, Seth Osei-Akoto revealed that the hybrids after being subjected to careful and scientific scrutiny have been approved for commercial production and use. 'The Committee has eventually approved 5 out of the 8 seeds presented before it for the Seed Council to gazette for commercial use,' he said.

Emmanuel Bright Quaicoe
23 December 2021

African scientists lead the Continent's gene editing research. (abridged)

Research using gene editing technology is being undertaken on the continent largely by African scientists to provide solutions for Africa, according to a panel of scientists and regulatory experts. Their work is drawing upon the efficiency and precision of gene editing to restore staples that African farmers prefer, like banana and sorghum, they said. The goal is to support food security and better incomes for farmers, especially in the face of climate change challenges. The panel of scientists included Dr. Leena Tripathi, director of Eastern Africa for the International Institute for Tropical Agriculture; Prof. Steven Runo, associate professor at Kenyatta University in Nairobi, and Josphat Muchiri, deputy director technical services at Kenya National Biosafety Authority (NBA). They made their observations in a recent Alliance For Science Live webinar, in which they noted that gene editing can improve Kenya's food security. 'Gene editing is valuable in addressing problems associated with plant diseases and climate resiliency in Africa,' Tripathi said.

Runo, a botanist fascinated with plants, initially had no idea he would be conducting gene editing research or working on sorghum. However, his passion for solving Kenya's agricultural problems led him to obtain his PhD in plant genetics and molecular biology. He eventually moved into applying gene editing to combat the *Striga* weed in sorghum. Traditional control measures, such as crop rotation, intercropping and hand weeding, are ineffective over time. Runo's collaborative research focuses on conferring resistance to this parasitic weed by editing the low germination stimulant 1 (LGS1) gene in sorghum. (see below). This will potentially increase yield and nutrition for millions of people in Africa, he said.
When asked about the cost of the gene-edited sorghum products to farmers, the scientists affirmed that the improved products will be sold at the same price as conventional crops.

The technique is also being used to develop disease-resistant banana varieties, focusing on banana bacterial wilt, fusarium wilt and banana streak virus.

Muchiri, speaking on the regulatory status of gene-edited products, assured participants that these products are safe for humans and the environment. 'As the National Biosafety Authority, we have set up a regulatory framework to monitor this technology as it advances,' he explained. 'The Kenyan regulatory framework is transparent and offers the researchers an opportunity to engage with NBA, the early consultation process, where we determine whether the technology will be regulated or not based on presence of foreign DNA.' 'We are confident in the future of the technology and the opportunities it presents for increasing income for farmers and feeding millions of people,' Muchiri said.
This webinar was moderated by Doris Wangari, a biotechnology regulatory expert in Kenya.

Modesta Abugu and Doris Wasngari, Alliance for Science.

Scientists release new, weed-resistant sorghum variety (extract)

Prof Steven Runo, an associate professor at Kenyatta University, said the *Striga*-smart sorghum has been developed through the modern technology of gene editing.
Gene editing is the use of naturally occurring molecular scissors to improve crops and animals' interaction with the environment for better traits such as weed resistance.
Speaking during a virtual media science café on the deployment of *Striga* Smart Sorghum in Kenya, Runo said science and technology have the potential to increase food productivity in Africa. He said that Calestous Juma, the late

Kenyan scientist and scholar, once said that weeds have done more harm to Africa than colonialism. This is because weeds always come back immediately after they are uprooted. The variety was tested in Busia, Kisumu and Homa Bay Counties where the weed is common. ‘There is a lot of potential in agricultural technology and we need to harness it. African scientists must do this and must leverage partnerships with other countries to be able to use and harness technologies for crop improvement,’ said Runo.

Researchers gain insights into the genome of European mistletoe.

Researchers around the world are working on decoding the genomes of plants. Detailed knowledge on biochemical processes in plants can provide important contributions to agriculture, environmental protection and medicine. A team of researchers from Leibniz University Hannover (LUH) has now succeeded in gaining insights into the genome of European mistletoe, *Viscum album*. Mistletoe is a semi-parasitic evergreen flowering plant that grows on branches of various trees and is characterized by a very special life cycle. Moreover, mistletoe is known for its special secondary compounds, which are used in the treatment of numerous diseases. However, the genome of mistletoe could not be analyzed so far due to its exceptional size. With around 90 billion nucleotides—the basic building blocks of the genome—the mistletoe genome is approximately 30 times larger than the human genome.

In order to analyze the mistletoe genome, scientists around Lucie Schröder, Dr. Hans-Peter Braun and Dr. Helge Küster from the Institute of Plant Genetics at LUH used a trick: The genome, which consists of DNA, was not analyzed directly. Instead, transcripts of the genome (RNAs), which code for the mistletoe's proteins, were isolated and transcribed into DNA using enzymes. The resulting shorter DNA molecules could then be subjected to systematic sequence analysis. This way, the researchers were able to determine more than 39,000 mistletoe gene sequences and predict corresponding protein sequences. For the first time, they succeeded in making a systematic inventory of which proteins and thus enzymes occur in *V. album* and which metabolic pathways this plant can perform. Among them are numerous known enzymes that are generally important for life processes in plants, but also special mistletoe proteins, such as viscotoxins and viscolectins, which are considered to possess significant medicinal potential. Furthermore, the researchers were able to demonstrate that the DNA of the protein-coding sections of the mistletoe genome is characterized by a particularly high stability compared to the DNA of other flowering plants. This could contribute to the stress resistance properties of mistletoe.

‘We can learn a lot from studying parasites and semi-parasites since they do not have to carry out all life processes themselves,’ explains Dr. Hans-Peter Braun. ‘If certain structures are missing, it becomes clearer what they are good for and how exactly they function.’ Mistletoe, for example, has a special respiratory mechanism. Studying this mechanism could also contribute to a better understanding of malfunctions of the respiratory chain in humans and animals during diseases.

The results of the research project were recently published in the British scientific journal The Plant Journal (Schröder, L., *et al.* 2022. Plant Journal 109(1): 278-294.) The project can initially be seen as the beginning of a systematic molecular characterisation of mistletoe, since so far only a small part of the DNA sequences determined could be evaluated. In order to encourage further analyses, a public database has been set up in which more than 39,000 gene sequences can be accessed. The researchers anticipate that the use of this database will greatly promote future research activities relating to this extraordinary plant. The database is available at viscumalbum.pflanzenproteomik.de/

Leibniz Universität Hannover

Scientists uncover the distribution and physiological role of planteose

Planteose (a storage carbohydrate) metabolism is a possible target for root parasitic weed control. In a previous research Associate Professor Atsushi Okazawa and his collaborators revealed that planteose metabolism was activated after perception of strigolactones (a class of plant hormones that stimulate branching in plants and the growth of symbiotic arbuscular mycorrhizal fungi) in germinating seeds of *Orobanche minor*. Nojirimycin (a potent inhibitor of α-glycosidase) inhibited planteose metabolism and impeded seed germination of *O. minor*, indicating that planteose metabolism is a possible target for root parasitic weed control.

In a more recent study, this team of scientists based at Osaka Prefecture University, investigated α-galactosidases (AGALs) activities during seed germination of *O. minor*. They also studied planteose distribution in the dry seeds using matrix-assisted laser desorption/ionization-mass spectrometry imaging.

Planteose was found in tissues surrounding the embryo but not within it, indicating that it may have a role as a storage carbohydrate. Biochemical experiments and molecular characterization of a α-galactosidase family member, OmAGAL2, indicated the enzyme is involved in planteose hydrolysis in the apoplast around the embryo after the perception of strigolactones to provide the embryo with essential hexoses for germination. These results indicated that OmAGAL2 is a potential molecular target for root parasitic weed control.

Mass spectrometry images obtained for two fragment ions were almost identical, indicating that these fragment ions were all generated from a single source, planteose. The authors also provided visual aids demonstrating that planteose is distributed in the endosperm, perisperm and seed coat in the dry seeds of *O. minor*, which coincides with its role as a storage carbohydrate.

In summary, the discovery of this study elucidates that (i) planteose is distributed in *O. minor* dry seeds and its physiological role is elusive, (ii) during seed germination of root parasitic weeds, planteose is rapidly hydrolyzed after perception of strigolactones (SLs), which is indicative of its role as a storage carbohydrate (iii) tissues surrounding the embryo, namely the endosperm, perisperm, and seed coat, play roles in nutrient supply in root parasitic weeds. Moreover, the novelty of this study lies in the fact that; for the first time, the authors visualized the distribution of the storage carbohydrate (planteose) in seeds of a root parasitic weed.

Osaka Prefecture University

Rare native mistletoe found in eastern BOP

NZ's three beech mistletoe species are semi-parasitic plants which host on native beech trees or tawheowheo. They are best known for their brilliant displays of red flowers in summer. All are considered under threat largely a result of sustained browsing by possums and the loss of native bird species which pollinate them. Department of Conservation botanist Paul Cashmore said finding red mistletoe (*Pera*xill*a tetrapetala)* on the remote Motu Rd was a pleasant, if not totally unexpected, surprise when Rotorua Botanical Society members first discovered a plant in late 2019. There had been no recorded sightings of any of the parasitic beech mistletoes in areas adjoining Motu Rd until this one large red mistletoe plant was seen overhanging the road on the northern side of Pāpāmoa Hill. It was agreed that further survey should be undertaken along rest of the Motu Rd in December and January when plants were flowering but it took until 2022 for it to happen.

NZ native red mistletoe (*Pera*xill*a tetrapetala)* Photo: DOC

Paul says the first task was to relocate the initial plant found in 2019 and record its details including how healthy it was. After that, further plants were found either by looking for mature host tawheowheo trees and inspecting them with binoculars or by walking along the road looking for dropped red petals. If red mistletoe plants were spotted, the tawheowheo trees were marked and the mistletoe plants' health was assessed. Paul took two days to survey the entire length of Motu Rd from Meremere Hill Scenic Reserve to Motu township and found 25 red mistletoe plants, most of which were flowering, on 21 tawheowheo host trees.

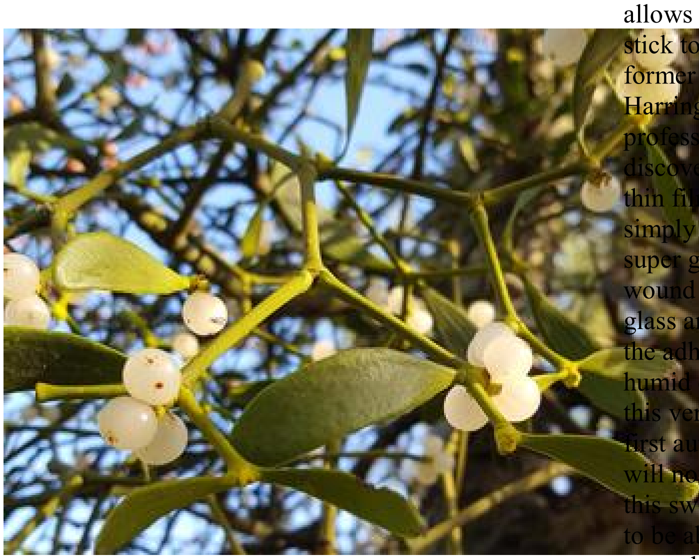
'Finding 25 red mistletoe plants on tawheowheo is a significant discovery as there are no known or historic red mistletoe records in the immediate area along Motu Rd**.** 'The nearest plants present would be those in Otamatuna to the west or Moanui and Matawai to the south.' 'Twenty-three out of 25 red mistletoe plants - that's 92% - showed evidence of dieback which generally recognises the past seasons' browsing intensity by possums. This shows that plants are under regular possum browsing pressure to some extent with only two plants free of dieback.'

Paul says the survey has demonstrated for the first time that not only is red mistletoe still present in and around the Motu-Urutawa forest, but that viable populations still exist in several places. 'It is important that these remnant populations are prevented from declining to extinction so, at very least, fur trapping needs to be encouraged in these areas. 'But ultimately this provides further justification for larger scale landscape pest control across this wider forest tract.' There is good evidence from elsewhere that large scale possum control operations will result in a relatively quick recovery of mistletoe health and recruitment if sufficient residual plants are still present in a block.

Control of predators also contributes to mistletoe recovery through protection of bellbirds and tui which are its main pollinators.

Beech mistletoe populations have drastically declined throughout NZ, especially in the North Island, with only remnant populations in isolated areas. In the Bay of Plenty significant populations are found in Whirinaki Te Pua-a-Tāne Conservation Park and parts of Te Urewera.

Natural super glue from mistletoe berries



pixabay.com
Close up of mistletoe berries containing sticky seeds

A team of researchers from the Max Planck Institute of Colloids and Interfaces (MPICI) and McGill University in Canada discovered strong adhesive properties of white-berry mistletoe. The mistletoe berry's flexible fibers adhere to both skin and cartilage as well as to various synthetic materials and could find application in many fields, such as wound sealant in biomedicine, through ease of processing.

For their research, the materials scientists led by Prof. Dr. Peter Fratzl picked the mistletoe berries from the trees themselves. From his office window, the director of the Department of Biomaterials can see the many green parasitic plants. 'Mistletoe grows in large numbers everywhere, including the Max Planck Campus, and is biodegradable and renewable,' says Peter Fratzl, adding, 'For the first time, we are now investigating how to harness its excellent adhesive properties for potentially medical or technical uses.'

Advantages of the biological glue: it adheres very well and is easy to remove under humid conditions.

To observe the adhesive properties, materials scientist and former carpenter Dr. Nils Horbelt wore the mistletoe glue on his fingers for three days in a self-experiment: 'Afterwards, I was able to remove the viscin by simply rubbing my fingers together.' Each mistletoe berry can produce a sticky thread up to two meters long called viscin - a natural cellulose adhesive. This allows the seeds of the semi-parasitic plant to stick to their host plants. The researchers in the former research group of Dr. Matthew Harrington, who has since moved on to a professorship at McGill University in Canada, discovered that viscin fibers can be stretched into thin films or assembled into 3D structures by simply processing them when wet. This natural super glue could potentially find application as a wound sealant, and it also adheres to metals, glass and plastics. Also exciting is the fact that the adhesive properties are fully reversible under humid conditions. 'Many questions remain about this very unusual material,' says Nils Horbelt, first author of the present study. The next step will now be to investigate the chemistry behind this swellable, extremely sticky material in order to be able to imitate the bonding process in a second step.

Original publication
Nils Horbelt, Peter Fratzl, Matthew J Harrington; Mistletoe viscin: a hygro- and mechano-responsive cellulose-based adhesive for diverse material applications; PNAS Nexus, Volume 1, Issue 1, March 2022.

Mistletoes, locust bean trees and birds work together in Nigeria's forest ecology.

In West Africa, mistletoes are found on many indigenous trees and several tree crops of economic importance. These hosts include shea, neem, sweet orange, cocoa, rubber and the African locust bean tree. The African locust bean (*Parkia biglobosa*) is regarded as an important tree crop, used for medicine and food. The trees also play a valuable role in nutrient cycling by fixing atmospheric nitrogen in soils. They are susceptible to mistletoe infection and agroforestry managers usually eradicate the parasitic plant. But if mistletoes provide food and shelter for species that are particularly important in an ecosystem, then removing them might not be a good strategy.

We therefore investigated an aspect of mistletoe's ecological benefits that was not well researched. We studied how birds use mistletoes that grow on *P. biglobosa* in Amurum Forest Reserve, Nigeria, across its mosaic of habitats. We recorded all visits by birds to trees with mistletoe: when they visited, how long they spent in the trees and how they behaved. As predicted, *Tapinanthus dodoneifolius* mistletoes on *P. biglobosa* were an important provider of food and shelter for birds. In addition, the ecological role of this mistletoe on *P. biglobosa* in times of food scarcity, especially in the dry season, appears important. This broader understanding of mistletoe significance and ecology could inform any action in the management of African locust bean forests, and in conservation.

We carried out our study in Amurum Forest Reserve in Jos, Plateau State, central Nigeria. The reserve has three major habitat types, differing in plant species. It has about 278 bird species, 31% of the total recorded in Nigeria. This makes it one of Nigeria's biodiversity hotspots. Some of the plant species, including *P. biglobosa*, in the reserve host mistletoes, attached to their stem as parasites. The locust bean trees in the study area are infected by three mistletoe species: *Tapinanthus dodoneifolius*, *T. bangwensis* and *T. sesselifolius*. Only *T. dodoneifolius* was fruiting during our study, so we only observed birds visiting this species.

The Amurum Forest Reserve had a relatively high density of mistletoe-infected *P. biglobosa* trees. Of 663 trees, 398 (60%) were parasitised with *T. dodoneifolius* mistletoes and 265 (40%) were not. Ninety-four (14.2%) of the total number of trees were recorded in the rocky habitat, with 49 infected and 45 non-infected. Seventy-one (10.7%) of the total were in the gallery forest, with 59 infected and 12 non-infected. We recorded 498 (75.1%) of the total in the savanna, with 290 infected and 208 non-infected. In 432 hours of observations, we recorded 725 individual birds, comprising 71 species, and belonging to 31 families and four orders, visiting both the locust bean trees and their associated *T. dodoneifolius* mistletoes. Fruit eaters, insect eaters, nectar feeders and omnivores all visited mistletoe flowers or fruits on the locust bean trees. A total of 352 individual bird visits (from 54 species) were recorded directly on the mistletoes.

The rate of mistletoe infection on the trees in our study did not differ significantly across habitat types. This suggests that the probability of infection does not depend on habitat type but might be related to host plant quality, host availability and bird behaviour. Our findings corroborate the host quality hypothesis: mistletoes favour nitrogen-fixing and leguminous plants as hosts.

Bird species in our study had similar chances of accessing all habitat types. Therefore, they could move seeds from one habitat to another to an available host. This supports larger numbers of birds and increases the chances that the mistletoe and the host plant's fruits will be dispersed. The number of mistletoes on the host plant also determines birds' preferences for particular trees (measured as time spent by birds on plants in a tree), as found in other studies. Birds were attracted to a dense build-up of berries of *T. dodoneifolius* mistletoes on the host and tended to spend a lot of time feeding on them, thereby enhancing dispersal. Mistletoes do not all produce fruit or ripen at the same time. Fruit dispersers therefore find their fruit reward available all year round in some species or at times of general food scarcity.

We observed that the height of the host tree and the number of mistletoes on it influenced the bird activity. Aside from eating fruit, we also saw birds perching, pecking, and foraging on insects, seeds, leaves, and nectar on both the mistletoe and host. This benefits the bird, mistletoe and host.

Our study supported the idea we started with – that *T. dodoneifolius* mistletoes on locust bean

trees are a keystone producer, based on the bird species use and visitation. Keystone producers are species that have a large impact or influence on the ecosystem. These mistletoes on the trees appear to have an important role in times of food scarcity, especially in the dry season. They are important resources for birds in the reserve. Understanding relationships like these can help identify critical resources and potential keystone species to inform conservation planning. Reforestation programmes should consider the parasitic relationship between mistletoes and their hosts and their ecological benefits for bird diversity, fruit dispersal and pollination, and ultimately ecosystem stability
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Islamiat Abidemi Raji, Adams Chaskda, Colleen T. Downs and Shiiwua Manu
March 9, 2022 1.26pm GMT

Don't make mistakes about our misunderstood, mysterious mistletoes

There are few plants so misunderstood as the wonderful mistletoes, which we know best as those great bunches of yellowish leaves growing among the foliage of eucalypts – although there are many kinds. They live by tapping into the sap system of their host and taking a modest amount of water and dissolved minerals for their own use. The first and greatest misconception is that as parasites they must be 'bad' and should be eliminated.
I have even known of park care groups in Canberra (in the past, fortunately) who carefully cut vast amounts of mistletoe from the local reserve in the misguided belief that they were 'helping'. In a moment I will explain just why this was so wrong.

An associated piece of mistletoe fake news is that they are not even Australian, so their removal is even more justified. This is perhaps partly associated with tales of northern mistletoes – related to Australian ones, though not closely – which have strong folklore associations in many cultures, including Christmas connections in recent times. However the mistruth has also been spread by people (including in the Canberra area) who sought to make money by persuading landowners that they needed to get rid of their mistletoes, 'and we're here to help!'.

Enough of the myths; how about some truths about mistletoes, which are far more interesting?

Box Mistletoe (*Amyema miquelii*) growing on a Red Box in Canberra; the yellowish clumps of the mistletoe leaves stand out. Photo: Ian Fraser.

Dr David Watson, an ecologist working at Charles Sturt University, has done a lot of work on the role of mistletoes and has concluded they are a 'keystone resource'. By this he means mistletoes contribute essential food and shelter to a wide range of other species, far more than we might expect from the relatively small number of species and individual plants. The dense clumps provide necessary nesting shelter for many birds and the moist fleshy leaves are an important food for other animals, including several butterfly species. Both birds and insects avidly seek the abundant flowers. Mistletoe fruit is also an important food source in many Australian habitats; many animals eat them and some – such as the Mistletoebird and the endangered Painted Honeyeater – rely on them.

The mistletoe attaches to its host by a thick base called a haustorium, which is easily seen from the ground, the seed having been deposited on the branch by a bird, most likely a Mistletoebird. While the tree overall is unaffected by the extra demands of the mistletoe, the tree branch beyond the mistletoe sometimes dies. Furthermore many mistletoes don't survive – for one thing the growing tree fatally shades many of them out – and when they or the dead tree branch falls this too is essential ground habitat. For instance David Watson showed that ground-feeding threatened Brown Treecreepers disappear from woodland without mistletoes.

A male Mistletoebird with mistletoe berries. Photo: Ian Fraser.

The Mistletoebird is a delightful red, white and glossy blue-black little bird that follows the mistletoe fruiting around the land and is almost exclusively responsible for spreading the mistletoe. Indeed, apart from insects and spiders, growing chicks only eat mistletoe berries. The seed passes through very quickly with some sticky flesh still attached and to remove this annoyance from its feathers the bird wipes its backside on a convenient branch. The mistletoe seed germinates within this sticky dropping and roots itself in the branch.

Sheoak Mistletoe (*Amyema cambagei*), growing on River Oak (a casuarina) by the Murrumbidgee. The leaves of this species are needle-shaped to match the host tree's foliage. Photo: Ian Fraser.

One of the aspects of mistletoes that has always intrigued me is how the leaves of a species seem to mimic those of its host tree, be it the long narrow leaves of eucalypts, the round leaves of the Kurrajong or the needles of the Sheoak. Some say it's to hide the leaves from browsing possums, but I'm not convinced; I think a possum's nose would be more useful to it at night than its eyes. No, I think it's down to the Mistletoebird again. It's just found a very yummy snack among leaves that look like eucalypt leaves, so where to look for another one? Yep, among leaves that look the same – and most of these are actually going to *be* eucalypt leaves. The plant effectively sends the bird to find another host tree for its seeds.

Far from being a problem, mistletoes greatly enhance a natural landscape – and they have great stories to tell. What's not to love?

Ian Fraser 24 April 2022 1

***Striga* in Northern Europe! – Global warming? - not yet .**

Striga, a bitcoin and cryptocurrency banking infrastructure provider, became the first virtual asset service provider (VASP) to gain regulatory approval in Estonia following the country's revamping of its digital asset legal framework, per an announcement from the Financial Intelligence Unit.

BITCOIN Magazine
September 2022.

BOOK REVIEW

Die Mistel in der Tumortherapie 5 Aktueller Stand der Forschung und klinische Anwendung. 2020. Scheer, R., *et al.* (Eds.) ISBN 978-3-96562-030-8: 607 pp. KVC Verlag – Natur und Medizin e. V., Essen. 29,90 € (www.kvc-verlag.de)

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 (*Viscum album*) 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 volume in this series contains 49 contributions in English or German) 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 focused 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.

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PUBLICATION NEWS

Plant, people and Planet Special Issue –Call for papers.
https://www.newphytologist.org/news/view/309

Chemical, Biological, and Biotechnological Control of Parasitic Weeds – a new section under Frontiers in Plant Science
https://www.frontiersin.org/research-topics/37883/chemical-biological-and-biotechnological-control-of-parasitic-weeds

FORTHCOMING MEETINGS

8th International Weed Science Congress, 'Weed Science in a Climate of Change, 4-9 December 2022. Bangkok, Thailand. Including a session' Invasive and Parasitic Weeds'
https://www.iwsc2020.com

17th World Congress on Parasitic Plants, July 2024, Nara, Japan, 2-8 July, 2023.

GENERAL WEB SITES

For individual web-site papers and reports see LITERATURE
some 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/ (may be temporarily unavailable)

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 *Striga* Solutions, led by Prof. Salim Al-Babili, KAUST, Saudi Arabia: https://strigasolutions.com

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 *Viscum album* Genespace Database see: viscumalbum.pflanzenproteomik.de/

For an excellent publication by the Universidade Federal do Rio Grande do 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 a participatory website cataloguing tools for the identification and localization of fauna and flora, including parasitic plants see: https://nadaba.net/fr

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Agarwal, P., Mukhopadhyay, A., Gupta, V. .Pradhan, A.K. and Penaal, D. 2022. Glyphosate-resistant *Brassica juncea* (oilseed mustard) transgenics for possible control of root parasite *Orobanche aegyptiaca* and conservation agriculture. Journal of Plant Biochemistry. Biotechnol. 31: 648–656. . (https://doi.org/10.1007/s13562-021-00758-x [Transgenic lines in *B. juncea* variety Varuna using the gene - *cp4 epsps*, which encodes for a protein that is insensitive to glyphosate, combined with a double mutant *als* gene increased the tolerance of *B. juncea*, allowing selective control of *Phelipanche aegyptiaca.*]

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Camaño Portela, J.L., Pino Pérez, J.J., Silva-Pando, F. J. and Pino Pérez, R. 2021. (On the presence of *Orobanche hederae* Vaucher ex Duby in the Maritime-Terrestrial National Park of the Atlantic Islands (Galicia, Spain).)

(in Spanish) Acta Botanica Malacitana 46: (https://doi.org/10.24310/abm.v46i.10642)

Cárdenas, D.M., Bajsa-Hirschel, J., Cantrell, C.L., Rial, C., Varela, R.M., Molinillo, J.M.G. and Macías, F.A. 2022. Evaluation of the phytotoxic and antifungal activity of C_{17}-sesquiterpenoids as potential biopesticides. Pest Management Science (https://doi.org/10.1002/ps.7042) [Showing that C_{17}-sesquiterpenoids stimulated germination of *Phelipanche ramosa*. Also showing that the presence of the α-methylene-γ-butyrolactone system is not essential for the bioactivities of sesquiterpene lactones and may thus function through a different mechanism of action not related to the widely assumed Michael addition.]

Cartry, D., Steinberg, C. and Gibot-Leclerc, S. 2021. Main drivers of broomrape regulation. A review. Agronomy for Sustainable Development 4(2): (https://doi.org/10.1007/s13593-021-00669-0) [Reviewing the interactions of *Orobanche* and *Phelipanche* spp. with surrounding organisms and concluding that (1) they co-evolve with their host through tight interactions ranging from the molecular to the tissue level, (2) they have to face host plant defences, allelopathic interferences, and pest attacks from both the rhizosphere and phyllosphere; (3) alternative methods combining these natural mechanisms especially biocontrol with existing conventional methods should be used to control broomrape.]

Ceriotti, L F., Gatica-Soria, L. and Sanchez-Puerta, M.V. 2022. Cytonuclear coevolution in a holoparasitic plant with highly disparate organellar genomes. Plant Molecular Biology 109(6): 673-688. [Results suggest that a structurally-mediated compensatory factor may be driving plastid-nuclear coevolution in *Lophophytum* spp. (Balanophoraceae) and that mito-nuclear coevolution was not altered by horizontal gene transfer.]

Chedadi, T., Idrissi, O., Elkhabli, A., Khachtib, Y., Haddioui, A. **and** El-Hansali, M. **2021.** First report of branched broomrape (*Orobanche ramosa*) on turnip (*Brassica rapa*) in Morocco. Plant Health Progress 22(2): (https://doi.org/10.1094/PHP-10-20-0090-SC)

Chen, B.J.W., Xu Jing and Wang XinYu. 2021. Trophic transfer without biomagnification of cadmium in a soybean-dodder parasitic system. Plants 10(12): (2690; https://doi.org/10.3390/plants10122690) [The results suggested no evidence of Cd biomagnification in dodders parasitizing Cd-contaminated hosts, and implied that the Cd transfer from hosts to dodders may be a selective process.]

Chen YuChao, Kuang Yi, Shi LiYang, Wang Xing, Fu HaoYu, Yang ShengXiang, Sampietro, D.A., Huang LuQi and Yuan Yuan. 2021. Synthesis and evaluation of new halogenated GR24 analogs as germination promotors for *Orobanche cumana*. Frontiers in Plant Science 12(September) (https://doi.org/10.3389/fpls.2021.725949) [Describing two new halogenated (+)-GR24 analogs, 7-bromo-GR24 and 7-fluoro-GR24, synthesized using commercially available materials following simple steps. Both compounds strongly promoted seed germination of *O. cumana*.]

Cheruiyot, D., Chidawanyika, F., Midega, C.A.O., Pittchar, J.O., Pickett, J.A. **and** Khan, Z.R. **2021.** Field evaluation of a new third generation push-pull technology for control of striga weed, stemborers, and fall armyworm in western Kenya. Experimental Agriculture.57(5/6): 301-315. [The new third generation push-pull technology involved *Brachiaria brizantha* cv Xaraes in place of *B. brizantha* cv Mulato II. This was equally effective against *Striga hermonthica*, and superior in yield of the forage crop, more drought-resisatnt and more effectiver against fall army worm.]

Choudhary, D. and Singh, K.V. 2021. The efficacy of *Ximenia americana* plant mediated silver nanoparticles against dengue vector mosquito larvae [*Aedes* (*Stegomyia*) *aegypti* (Linnaeus, 1762) (Diptera: Culicidae)]. International Journal of Mosquito Research 8(5)Part A: 48-56.

Cirocco, R.M., Facelli, E., Delean, S. and Facelli, J.M. 2021. Does phosphorus influence performance of a native hemiparasite and its impact on a native legume? Physiologia Plantarum 173(4): 1889-1900. [Results showed that growth of *Cassytha pubescns* and its negative impact on *Acacia paradoxa* was unaffected by P supply.]

Clapco, S. 2021. Virulence and aggressiveness of some sunflower broomrape populations belonging to different countries. Scientific Papers - Series A, Agronomy 64(4): 266-272. [Finding evidence for variation in aggressiveness within 27 populations of *O. cumana* from 8 countries, independently of the their race.]

Córdoba, E.M., Fernández-Aparicio, M., González-Verdejo, C.I., López-Grau, C., del alle Muñoz-Muñoz, M. and Nadal, S. 2021. Search for resistant genotypes to *Cuscuta campestris* infection in two legume species, *Vicia sativa* and *Vicia ervilia*. Plants10(4): (https://doi.org/10.3390/plants10040738) [Screening over 100 genotypes each of *V. sativa* and *ervilea* yielded only one line Vs.1, of *V. sativa* with high resistance, showing hypersensitive response and less growth inhibition.]

Cuccurullo, A., Nicolia, A. and Cardi, T. 2022. Resistance against broomrapes (*Orobanche* and *Phelipanche* spp.) in vegetables: a comprehensive view on classical and innovative breeding efforts. Euphytica 218: (https://doi.org/10.1007/s10681-022-03035-7) [A general review commending the integration of different genetic resistance mechanisms with innovative agronomical management practices.]

Dakskobler, I., Strgar, P., Strgar, P., Zupan, B., Anderle, B., Bačič, T. and Krajšek, S.S.. 2021. *Pedicularis* × *mayeri* Daksk. & Vreš (*Pedicularis julica* E. Mayer × *Pedicularis rostratocapitata* Crantz): new localities of the southeastern-alpine endemic. Hladnikia 48: 22-29. [In Slovenia.]

Dakskobler, I., Vreš, B., Seliškar, A.,, Rudolf, A., Poljšak, F., Anderle, B. Dolinar, B. and Kocjan, J.M. 2021. *Corallorhiza trifida*: new localities in the sub-Mediterranean phytogeographical region of Slovenia, novelty for the flora of the Slavnik mountains and Čičarija. Hladnikia 48: 29-37.

Debabrata Maity. 2021. Rediscovery of *Pedicularis globifera* (*Orobanchaceae*) in India after 110 years. Journal of Japanese Botany 96(5): 304-307. [Known from only 2 collections from Sikim, *P. globifera* refound in the Lhonak Valley and in the Gurudongmar Valley, the Sikkim Himalaya.]

Degife Zebire, Menkir, A., Adetimirin, V., Mengesha, W., Meseka, S. and Gedil, M. 202 Efficacy of maize inbred testers with varying levels of resistance to *Striga* for classifying *Striga*-resistant yellow-maize lines into heterotic groups. Journal of Crop Improvement 36(4): 473-493.

Dettke, G.A.and Caires, C.S. 2021. Synopsis of *Dendrophthora* and *Phoradendron* (Santalaceae) in Brazil.: Rodriguésia 72: (https://doi.org/10.1590/2175-7860202172132) [Clarifying the difference between these two genera, i.e. one anther locule in *Dendrophthoe,* and two in *Phoradendron*. And providing a key to the three species of *Dendrophthora* and 41 of *Phoradendron* occurring in Brazil.]

Dieringer, G. and Cabrera, L.R. 2022. Stamen dimorphism, bee visitation, and pollen removal in three species of *Agalinis* (Orobanchaceae). Botany 100(4): 377-386. [‘The flower form of *Agalinis* appears to encourage inverted foraging, which has not led to a division of labour for the dimorphic stamens typical of heterantherous species. The annual habit and short-lived flowers in these species likely select for rapid pollen loss.’]

Dimitrakopoulos, P.G., Aloupi, M., Tetradis, G. and Adamidis, G.C. 2021. Broomrape species parasitizing *Odontarrhena lesbiaca* (Brassicaceae) individuals act as nickel hyperaccumulators. Plants 10(4): (https://doi.org/10.3390/plants10040816)

Diniz, U.M., Fischer, N.L.S. and Aguiar, L.M.S. 2022. Changing the main course: strong bat visitation to the ornithophilous mistletoe *Psittacanthus robustus* (Loranthaceae) in a Neotropical savanna. Biotropica 54(2): 478-489. [Although usually pollinated by birds, *robustus* is an important resource for bats in the Brazilian savanna, potentially representing a mixed or early transitional state toward bat pollination.]

Dobson, A. 2021. Plant ecology: macroparasitism in plant communities. Current Biology31(6): R287-R289. (https://doi.org/10.1016/j.cub.2021.01.044) [Illustrating elegant ways to quantify cost to the host and how this impacts competition between mistletoe species (not specified in the abstract). And offering a fuller consideration of plant parasites as macroparasites.]

Domina, G., Uhlich, H. and Barone, G. 2022. *Orobanche australis* moris ex bertol. the correct name for O. *thapsoides* Lojac. (Orobanchaceae). Phytotaxa 531(2): 91-96. [*O. australis*, related to *O. amethystea,* occurring in the Mediterranean.]

Dor, E and Goldwasser, Y. 2022. Parasitic weeds: biology and control’ Special Issue Editors Summary. Plants (Basel). 11(14):1891. (https://doi.org/10.3390/plants11141891) [Reviewing the special issue which comnprises 11 papers, 5 original research papers, two focused on crop resistance to parasitic plants, 3 providing new insights on plant-parasite interaction and one 'Opinion Paper' by yours truly (CP)]

Dor, E and Goldwasser, Y. 2022. Parasitic weeds: biology and control' Special Issue Editors Summary. Plants (Basel). 11(14):1891. (https://doi.org/10.3390/plants11141891) [Reviewing the special issue which comnprises 11 papers, 5 original research papers, two focused on crop resistance to parasitic plants, 3 providing new insights on plant-parasite interaction and one 'Opinion Paper' by yours truly (CP)]

Duca, M., Clapco, S. and Joita-Pacureanu, M. 2022. Racial status of *Orobanche cumana* Wallr. in some countries other the world. Helia 45(76): 1-22. [A useful survey of the distribution of *O. cumana* across Asia and Europe. Races G and H occur in most countries, other than Serbia. The most virulent race H is predominant in Romania, Ukraine and Turkey.]

Duca, M., Mutu, A. and; Clapco, S. 2021. Efficiency of microsatellite markers in genotyping of *Orobanche cumana* populations. Lucrari Stiintifice, Universitatea de Stiinte Agricole Si Medicina Veterinara 'Ion Ionescu de la Brad' Iasi, Seria Agronomie 64(1): 25-30. [A total of 279 *O. cumana* plants from a wide range of sources from Europe to China, were genotyped and 110 alleles identified. Seven SSR markers were selected as the most informative and efficient markers for measuring genetic diversity in *O. cumana*.]

Ebrahimi, E., Darbandi, E.I., Mohassel, M.H.R. and Afshari, R.T. 2022. Seed germination and seedling emergence in two populations of eastern dodder (*Cuscuta monogyna* Vahl.): evaluation of environmental factors and burial depth. Acta Physiologiae Plantarum 44(2): (https://doi.org/10.1007/s11738-021-03354-7) [Results of a study on *C. momogyna* in Iran.]

Ebrahimi, E., Darbandi, E.I., Mohassel, M.H.R. and Tavakolafshari, R. 2021. Effect of temperature and salinity on two eastern dodder (*Cuscuta monogyna* vahl) ecotypes seed germination characteristics. Journal of Plant Protection (Mashhad) 35(3): fa347-en356. [Germination of *C. monogyna* was reduced 50% at salinity levels of -0.68-0.90, and inhibited at -1.2 Mpa, though recovery was possible on leaching.]

El-Dabaa, M.A.T., Abo-Elwafa, G.A. and Abd-El-Khair, H. 2022. Safe methods as alternative approaches to chemical herbicides for controlling parasitic weeds associated with nutritional crops: a review. Egyptian Journal of Chemistry 65(4): 53-65. [A general review.]

El-Mehy, A.A., El-Gendy H.M., Aioub, A., Mahmoud, A., Abdel-Gawad, S. and Ellesawy A.E. 2022. Response of faba bean to intercropping, biological and chemical control against broomrape and root rot diseases. Saudi Journal of Biological Sciences 29(2): (https://doi.org/10.1016/j.sjbs.2022.02.032) [Finding that a faba bean–garlic intercrop along with arbuscular mycorrhiza inoculation can reduce root rot disease, damping off and *Orobanche crenata*, as well as enhancing the profitability for the Egyptian farmer.]

En-Nahli, Y. and 9 others. 2021. Resistance to *Orobanche crenata* Forsk. in lentil (*Lens culinaris* Medik.): exploring some potential altered physiological and biochemical defense mechanisms. Journal of Plant Interactions 16: 321-331. (https://doi.org/10.1080/17429145.2021.1949498) [Accumulation of α-linolenic acid and arachidic acid was more pronounced in the resistant genotypes ILL6415, ILL7723 which could be associated with resistance pathways involved in the resistance to *O. crenata*.]

Espinoza, D.M.M.C., Olivas, Á.R., Astorga, G.I.A., García, G.A.L., Meza, A.O. and Olvera, A.P. 2022. (Evaluation of the southern cosahui (*Krameria erecta* Willd) in wild conditions.) (in Spanish) IDESIA.40(1): 67-76. [A general survey of distribution, density and associated insects. No discussion of hosts.]

Faradonbeh, N.H., Darbandi, E.I., Karimmojeni, H. and Nezami, A. 2021. The morphological and physiological traits of *Cucumis sativus-Phelipanche aegyptiaca* association affected by arbuscular mycorrhizal fungi symbiosis. Journal of Crop Protection 10(4): 669-684. [An arbuscular mycorrhizal fungus partially reduced *P. aegyptiaca* on cucumber, but failed to provide complete protection.]

Fatino, M.J. and Hanson, B.D. 2022. Evaluating branched broomrape (*Phelipanche ramosa*) management strategies in California processing tomato (*Solanum lycopersicum*). Plants 11(3): (https://doi.org/10.3390/plants11030438) [Treatments with sulfosulfuron and imazapic had reasonable crop safety on tomato but rotational crops would need to be resistant to sulfosulfuron. Sulfosulfuron and imidazolinone treatments reduced *P. ramosa* shoots per plot but none were fully effective and tomato yields were not significantly improved.]

Fauzan, M. and 13 others., 2021. Managing and protecting of endangered *Rafflesia* species in Kelantan, Peninsular Malaysia. Conference paper : IOP Conference Series : Earth and Environmental Science 3rd International Conference on Tropical Resources and Sustainable Sciences, Kelantan, Malaysia, 2021. 842. [Describing the efforts of the Kelantan State Forestry Department in preserving *Rafflesia* spcies, including the creation of several protected areas.]

Fernández-Aparicio, M., Masi, M., Cimmino, A. and Evidente, A. 2021. Effects of benzoquinones on radicles of *Orobanche* and *Phelipanche* species. Plants 10(4): (https://doi.org/10.3390/plants10040746) [Noting the haustorium-inducing effects of p-benzoquinone and 2,6-dimethoxy-p-benzoquinone on the radicles of *O. minor* and *P. ramosa*.]

Ferreira, P.P.A., Dettke, G.A., Simão-Bianchini, R. and Miotto, S.T.S. 2021. (*Cuscuta* L. (Convolvulaceae) in Southern Brazil.) (in Portuguese) Hoehnea48: (https://doi.org/10.1590/2236-8906-98/2020) [Providing a key, descriptions, illustrations and distribution of 15 *Cuscuta* spp. in S. Brazil, including a new species, *C. taimensis*.]

Ferreira, V.C.M., Neves, F.S. and Guerra, T.J. 2021. Direct and indirect effects of ant-trophobiont interactions on the reproduction of a hummingbird-pollinated mistletoe. Plant Ecology 223(3): 285-296. [The ant *Camponotus rufipes* did not affect pollination of *Psittacanthus robustus* by the hummingbird *Eupetomena macroura* but seed size was somewhat reduced.]

Fischer, K., Lachner, L.A.M., Olsen, S., Mulisch, M. and Krause, K. 2021. The enigma of interspecific plasmodesmata: insight from parasitic plants. Frontiers in Plant Science 12: (https://doi.org/10.3389/fpls.2021.641924) [Summarizing what is known about interspecific plasmodesmata between parasitic plants and their hosts and discussing the potential of the intriguing parasite/host system for deepening our insight into plasmodesmatal structure, function, and development.]

Fornier, S.D. and 9 others. 2022. Noncanonical strigolactone analogues highlight selectivity for stimulating germination in two *Phelipanche ramosa* populations. Journal of Natural Products 85(8): 1976-1992. [*P. ramosa* on rape, hemp, and tobacco in France. *P. ramosa* 2a preferentially attacks hemp, while *P. ramosa* 1 attacks rapeseed. The recently isolated cannalactone from hemp root exudates has been characterized as a non-canonical strigolactone that selectively stimulates the germination of *P. ramosa* 2a seeds in comparison with *P. ramosa* 1.]

Fu JiNe and 10 others. 2022. Chromosome-level genome assembly of the hemiparasitic Taxillus chinensis (DC.) Danser. Genome Biology and Evolution 14(5): (https://doi.org/10.1093/gbe/evac060) [A genetic study providing a valuable genomic resource for elucidating the genetic basis underlying the recalcitrant characteristics of *T. chinensis* seeds and the evolution of photosynthesis loss in parasitic plants.]

Furuta, K.M., Xiang Lei, Cui SongKui and Yoshida, S. 2021. Molecular dissection of haustorium development in Orobanchaceae parasitic plants. Plant Physiology 186(3): 1424-1434. [A detailed review of all aspects of haustorial initiation and development in Orobanchaceae.]

Gaier, L., Graiss, W., Klingler, A., Schaumberger, A. and Krautzer, B. 2022. Measures to control yellow rattle in extensive grassland. Proceedings of the 29th General Meeting of the European Grassland Federation, Caen, France, 26-30 June 2022: 94-396. [On a two-cut grassland that had been unfertilized for ten years, a single early first cut resulted, a yeat later, in a decrease of *Rhinanthus minor* compared with the usual cutting time.]

Galili, S., Hershenhorn, J., Smirnov, E., Yoneyama, K., Xie XiaoNan, Amir-Segev, O., Bellalou, A. and Dor, E. 2021. Characterization of a chickpea mutant resistant to *Phelipanche aegyptiaca* Pers. and *Orobanche crenata* Forsk. Plants 10(12): (https://doi.org/10.3390/plants10122552) [An ethyl methanesulfonate mutant population of F01 variety (Kabuli type) yielded the line CCD7M14, highly resistant to both *P. aegyptiaca* and *O. crenata* thanks to zero exudation of orobanchol and related strigolactones; and identifying the point mutation in the Carotenoid Cleavage Dioxygenase 7 (CCD7) gene.]

Galvan-González, L.G., Cerros-Tlatil(pa, R., Flores-Morales, A., Caspeta-Mandujano, J.M. and Flores-Castorena, Á. 2022. Diversity and richness of parasitic plants in Morelos State, Mexico.) (in Spanish) Botanical Sciences

100(3): 729-747. [Search of herbaria revealed 411 species in 14 families, including 14 species of holoparasites, 10 species of epiparasitic mistletoe and 24 species endemic to Mexico. Beautifully illustrated.]

García Murillo, P., Boniquito, J.M., Gutierrez González, D., Castilleja López, F.J. and de García Lomas, J. 2021. (*Eichhornia crassipes* (Mart.) Solms, new from Seville (Andalusia, Spain).) (in Spanish) Acta Botanica Malacitana 46: 119-121. (https://doi.org/10.24310/abm.v46i.12150) [Including mention of *Orobanche amethystea.*]

Gasura, E., Nyandoro, B., Mabasa, S., Setimela, P S., Kyalo, M. and Yao, N. 2021. Breeding strategy for resistance to *Striga asiatica* (L.) kuntze based on genetic diversity and population structure of tropical maize (*Zea mays* L.) lines. Genetic Resources and Crop Evolution 69(3): 987-996. [A study of 222 inbred lines revealed that molecular variance was larger (91%) within individuals than within populations (9%), providing the basis for a breeding strategy for resistance to *S. asiatica*]

Gateva, S.P. and 9 others. 2022. Effect of UV radiation and other abiotic stress factors on DNA of different wild plant species grown in three successive seasons in alpine and subalpine regions. Phyton (Buenos Aires) 91(23): 293-313. [Including results on *Pedicularis orthantha* in Bulgaria.]

Gebremedhin Woldemariam, Zenebe Getachew, Alemayehu Damot and Dereje Ayalew Zewdie. 2021.Nitrogen fertilizer and cattle manure for *Striga (Striga hermonthica)* management and enhancement of sorghum productivity in northwest Ethiopia. Journal of Plant Nutrition 45 (2021): 232 - 245. [Testing combinations of 46 or 92 kg/ha with 10 or 20 t/ha cattle manure and showing lowest *Striga* count and highest economic return from 92 kg/ha N and 20 t/ha manure.]

Getahun Mitiku, Rybka, D., Klein-Gunnewiek, P., Taye Tessema, Raaijmakers, J.M. and Etalo, D.W. 2022. **M**olecular detection and quantification of the *Striga* seedbank in agricultural soils. Weed Research 62(3):181-191. [Technique developed capable of detecting one seed of *S. heronthica* in 150 g soil. Sampling across Ethiopia found *Striga* seeds in 75% of samples, with a maximum of 86 per 150 g soil.]

Gibot-Leclerc S. and 8 others. 2022. Screening for potential mycoherbicides within the endophyte community of *Phelipanche ramosa* parasitizing tobacco. FEMS Microbiological Ecology. 98(3): (doi: 10.1093/femsec/fiac024) [Finding 374 endophyte isolates in *P. ramosa* infesting tobacco, mostly *Fusarium* spp. including *F. venenatum* which inhibited germination and caused necrosis of the parasite.]

Giesemann, P. and Gebauer, G. 2021.Distinguishing carbon gains from photosynthesis and heterotrophy in C_3-hemiparasite-C_3-host pairs. Annals of Botany 129(6): 647-656. [Studies with *Lathraea squamaria* parasitizing the same carbon nutrient source (xylem-transported organic carbon compounds) as potentially *Pedicularis*, *Rhinanthus*, *Bartsia*, *Melampyrum* and *Euphrasia* spp. concluded tha progressive 2H-enrichment can be used as a proxy to evaluate carbon gains from hosts.]

González, F., Suaza-Gaviria, V. and Pabón-Mora, N. 2021. Floral development and morphology of the mistletoe *Antidaphne viscoidea*: a case of extreme flower reduction in the sandalwood family (Santalaceae). Australian Journal of Botany 69(3): 152-161. [Data support the current phylogenetic relationship between *Antidaphne* and the neotropical genera *Eubrachion* and *Lepidoceras*, all having unisexual flowers, lacking trichomes between the petals and stamens, sessile stigmas, and baccate fruits.]

González Martínez, X.I., Boullón Agrelo, C., Calvo Vázquez, J. and Rodríguez Leal, S. 2021. (New contributions on Galician vascular flora (Spain).) (in Spanish) Acta Botanica Malacitana 46: 135-141. [Listing *Orobanche amethystea*.]

Goremykina, Ye.V., Azaryan, A.D., Akime, E.L. and Leshchina, K.Ye. 2021. The features of xylem tracheary elements in some herbaceous members of the family Convolvulaceae Horan. Turczaninowia 24(3): 129-137. [Showing that the xylem of autotrophic *Convolvulus arvensis* and *Calystegia sepium* has some wide elements and many narrow, typical of climbing plants, while *Cuscuta* spp have only narrow elements and many fewer.]

Guerra, P.C., Escobedo, V.M., Gutiérrez, G.O. and Gianoli, E. 2021. Mistletoe infection changes arthropod community on its cactus host through indirect effects. Insect Conservation and Diversity 15(2): 288-298. [Infection by *Tristerix aphyllus* results in a more diverse arthropod community on its cactus host, *Echinopsis chiloensis* in the

Chilean coastal desert through induced susceptibility to stem-borers whose brood chambers are colonised by arthropods.]

Gujral, A.K., Misiewicz, T.M., Hauser, C. and Carter, B.E. 2022. Natural history and demography of the imperiled redwood forest specialist *Pedicularis dudleyi* (Dudley's Lousewort, Orobanchaceae). Madroño 69(1): 6-15. [Studying the rare *P. dudleyi* and concluding that its decline is due to very poor establishment from seed.]

Guo ChengLin, Qin LiuYan, Ma YongLing and Qin JianLin. 2022. Integrated metabolomic and transcriptomic analyses of the parasitic plant *Cuscuta japonica* Choisy on host and non-host plants. BMC Plant Biology 22(393) (https://doi.org/10.1186/s12870-022-03773-9) [Studying the different metabolomics involved when *C. japonica* infected susceptible *Ficus microcarpa* and non-host mango.]

Gutierrez, N. and Torres, A.M. 2021. QTL dissection and mining of candidate genes for *Ascochyta fabae* and *Orobanche crenata* resistance in faba bean (*Vicia faba* L.). BMC Plant Biology 21(551) (https://doi.org/10.1186/s12870-021-03335-5) [A fine-mapping approach proposes increases in genetic resolution of relevant QTL regions, paving the way for efficient deployment of alleles for faba bean ascochyta and broomrape resistance.]

Hahn, M.H., Gelain, J., Pereira, W.V., Martinha, D.D., May-de-Mio, L.L. and Duarte, H.S.S. 2021. First report of *Orobanche laxissima* parasitizing pomegranate (*Punica granatum*) in Georgia. Plant Disease 105(5): 1572-1572.

Haynes, A.F. 2021. Presence of N-fixing neighbors increases leaf N and $\delta^{13}C$ in *Castilleja applegatei*, a root hemiparasite. Plant Ecology 223(2):213-228. [*C. applegatei* grown in association with the N-fixing host *Ceanothus prostratus* accumulated more N than when grown on non-N-fixing hosts.]

Hilpman, E.T. and Busch, J.W. 2021. Floral traits differentiate pollination syndromes and species but fail to predict the identity of floral visitors to *Castilleja*. American Journal of Botany 108(11): 2150-2161. [Floral trait differentiation among 5 *Castilleja* species reflects both taxonomy and pollination syndromes. Differentiation was generally more evident in morphological traits compared to VOCs. Furthermore, ideas of pollination syndromes in this system are overly simplistic and fail to predict which animals most frequently visit *Castilleja* in natural populations.]

Holmes, M.A. 2022. Host quality, mediated by land-use history and landscape position, shapes distributions of parasitic plants in postagricultural forests. International Journal of Plant Sciences 183(5): 348-356. [Studying the abundance of *Conopholis americana* and *Epifagus virginiana*, in forests in Ohio 40-60, 61-80, 81-100, and >130 yr since canopy closure. The presence of both species and the abundance of *C. americana* were linked to large individual host trees. *C. americana* was associated with uplands and older forests, and *E. virginiana* was limited to stands of more than 80 yr old.]

Horbelt, N., Fratzl, P., Harrington M.J. and Mistletoe. 2022. Mistletoe viscin: a hygro and mechano-responsive cellulose-based adhesive for diverse material applications, PNAS Nexus 1(1): (https://doi.org/10.1093/pnasnexus/pgac026) [See Press Report above.]

Hosseini, A. and Soleimani, R 2022. *Loranthus europaeus* Jacq. infection alters leaves morphology and physiology of Persian oak *(Quercus brantii* Lindl.).

BioResources 17(2): 2896-2905. [Detrimental effects of *L. europaeus* on Quercus brantii included reduced area and weight of leaves and the amount of leaf K, P, and Ca. Leaf N, Mg, Mn, Zn, and Fe contents were not significantly affects.]

Hu JieDong, Li KaiHui, Deng ChengJun, Gong YanMing, Liu YanYan0 and Wang Lei. 2022. Seed germination ecology of semiparasitic weed *Pedicularis kansuensis* in alpine grasslands. Plants 11(13): (https://doi.org/10.3390/plants11131777) [Seed germination was improved by GA_3, GR24, and aqueous extracts of *Festuca ovina., Stipa purpurea,* and *Leymus secalinus* and by two to eight weeks of cold stratification but not by temperature, light or drought.]

Ibiapino, A., Báez, M., Pedrosa-Harand, A., García, M.A., Costea, M. and Stefanovic, S. 2022. Karyotype asymmetry in *Cuscuta* L. subgenus *Pachystigma* reflects its repeat DNA composition. Chromosome Research 30(1): 91-107. [Investigated the origin of bimodal karyotypes in *Cuscuta*, subgenus *Pachystigma*, showing accumulation of repetitive DNA, which is directly linked to karyotype evolution in the genus.]

Ito, S. and 23 others (including Al-Babili, S. 2022. Canonical strigolactones are not the tillering-inhibitory hormone but rhizospheric signals in rice. bioRxiv (https://doi.org/10.1101/2022.04.05.487102) [Confirming that
4-deoxyorobanchol (4DO) and orobanchol, do not have major role in determining rice shoot architecture, and any procedure to reduce their exudation could confer resistance to *Striga* spp. without affecting rice root structure.]

Ivanovic, Ž., Marisavljevic, D., Marinkovic, R., Mitrovic, P., Blagojevic, J., Nikolic, I. and Pavlovic, D. 2021. Genetic diversity of *Orobanche cumana* populations in Serbia. Plant Pathology Journal 37(6): 512-520. [Molecular analyses of RAPD-PCR analysis revealed high genetic diversity of *O. cumana* populations which indicated high adaptive potential of this parasitic weed in Serbia.]

Jayanta Ghosh, Mrinmoy Midday and Debabrata Maity. 2021. The genus *Thesium* L. (Santalaceae) in India: addition of *Thesium jarmilae* Hendrych to the flora of India. Feddes Repertorium 133(1): 18-23. [Recording *T. jarmilae* from Sikkim Himalaya. The species can readily be distinguished by its suprabasal bracts and fruits with conspicuous longitudinal veins.]

Jhu MinYao and 10 others. 2022. Heinz-resistant tomato cultivars exhibit a lignin-based resistance to field dodder (*Cuscuta campestris*) parasitism. Plant Physiology 189(1): 129-151. [Finding that the stem cortex in Heinz tomato hybrids responds with local lignification upon *C. campestris* attachment, preventing parasite entry into the host. *Lignin Induction Factor 1* (*LIF1*, an *AP2*-like transcription factor), *SlMYB55*, and *Cuscuta R-gene for Lignin-based Resistance 1*, a *CC-NBS-LRR* (*CuRLR1*) are identified as factors that confer host resistance.]

Jia Yan**,** Fu PeiLong**,** Li Qian**,** Li WenXiang**,** Zhang TianYao**,** Huang MeiJuan **and** Huang HaiQuan**. 2021.** Diversity of culturable endophytic bacteria from *Viscum liquidambaricolum* and its survival promotion. (in Chinese) Journal of Southern Agriculture 52(12): 3415-3424. [Concluding that *V. liquidambaricolum* is rich in microbial resources and life-promoting strains, among which *Pseudomonas* strain SWFU34 had the ability to produce siderophore and dissolving phosphorus and potassiumwhich has the potential of agricultural application.]

Jiang Lei Wang Ying, He LiAng, Sun ZiYong, Liu YunDe and Bu JianWei. 2021. Ecological benefit analysis of restoration of degraded environment by Artificial Tamarix-Cistanche. Environmental Technology & Innovation 23: (https://doi.org/10.1016/j.eti.2021.101792) [The establishment of the combination *Cistnache* (unspecified in abstract) on tamarisk in an arid area of Xinjiang, China improved the income of local farmers, improved soil and local microclimate, and restored biodiversity.]

Jost, M., Naumann, J., Bolin, J.F., Martel, C., Rocamundi, N., Cocucci, A A., Lupton, D., Neinhuis, C. and Wanke, S. 2022. Structural plastome evolution in holoparasitic Hydnoraceae with special focus on inverted and direct repeats. Genome Biology and Evolution 14(6): (https://doi.org/10.1093/gbe/evac077) [A study of 8 *Hydnora* and 3 *Prosopanche* spp. suggested three possible, distinct models to explain the Hydnoraceae plastome states.]

Kawa, D., Taylor, T., Thiombiano, B., Musa, Z., Vahldick, H.E., Walmsley, A., Bucksch, A.. Bouwmeester, H. and Brady, S.M. 2021. Characterization of growth and development of sorghum genotypes with differential susceptibility to *Striga hermonthica*. Journal of Experimental Botany 72(22): 7970-7983. [Comparing sorghum varieties Shanqui Red (exuding 5-deoxystrigol, susceptible to *S. hermonthica*) and the resistant SRN39 (exuding orobanchol) and finding unrelated differences in growth rate, and enhanced lateral root growth in SRN39.]

Kawada, K., Koyama, T., Takahashi, I., Nakamura, H. and Asam, T. 2022. Emerging technologies for the chemical control of root parasitic weeds. Pesticide Science 47(3): 101–110. [A comprehensive review covering strigolactone biosynthesis suppressors in host plants, suicidal germination induction, receptor inhibition in parasitic plants and haustorial formation. It does not address the application of herbicides.]

Khaffagy, A.E., Soliman, I.E. and Elborhamy, A.L. 2022. Effectiveness of sowing methods and certain herbicides against dodder and annual weeds associated with flax. Egyptian Journal of Agricultural Sciences 73: 1-18. [Best results against *Cuscuta epilinum* in flax obtained with clethodim.]

Kokla, A. and 8 others. 2022. Nitrogen represses haustoria formation through abscisic acid in the parasitic plant *Phtheirospermum*

japonicum. Nature Communications 13(5): (https://doi.org/10.1038/s41467-022-30550-x)
Kopper, R.W. and Ruelle, M. L. 2022. Is push-pull climate- and gender-smart for Ethiopia? *a review*. Agroecology and Sustainable Food Systems 46(1): 23-55. [Finding strong evidence that intercropping with drought-tolerant *Desmodium* effectively reduces *Striga* abundance and enhances grain yield, but emphasising the need for more research on the efficacy of 'push-pull' under different climate conditions, the optimal timing of planting push and pull species, evaluation of fodder outputs, water requirements associated with establishment, and implications for gender burden across cultural contexts.]
Krasylenko, Y., Kinge, T.J., Sosnovsky, Y., Atamas, N., Tofel, K.H. Horielov, O. and Rambold, G. 2022. Consuming and consumed: Biotic interactions of African mistletoes across different trophic levels. Biotropica (https://doi.org/10.1111/btp.13130) [Reviewing the taxonomic and functional diversity of symbionts associated with mistletoes in Africa and adjacent islands that contribute to the major biological functions of mistletoes, such as establishment and growth, nutrition and fitness, resistance to external stresses, as well as pollination and dispersal.]
Kuang JingGe, Wang YuFei, Mao KangShan, Milne, R., Wang MingCheng and Miao Ning. 2022. Transcriptome profiling of a common mistletoe species parasitizing four typical host species in urban Southwest China. Genes 13(7): (https://doi.org/10.3390/genes13071173) [Studying *Taxillus nigrans* on *Broussonetia papyrifera*, *Cryptomeria fortunei*, *Cinnamomum septentrionale* and *Ginkgo biloba*.]
Kuramana, S., Gandipilli, G., Gera, V.K. and Kumar, P.K.R. 2022. Haustorial development of *Dendrophthoe falcata* (L.f.) Ettingsh. - an overview. International Journal of Scientific Research & Growth 10:2455-6211. [Morphological and physiological features of *D. falcata,* a parasite of mango in India, were systematically studied to understand the dynamics of host-parasite interaction and haustorial development.]
Latorre-Farfán, J P and; Swamy, V. 2021. *Acanthosyris annonagustata* C. Ulloa & P. Jørg. (Santalaceae), newly recorded for the flora of Peru. Check List 17 (3): 853-858.
Lee, C.T. and 9 others. 2021. Microsatellite analysis of *Rafflesia cantleyi* from the *Rafflesia* Conservation and Interpretive Centre, Bersia Timur and Gerik forest reserve, Perak, Malaysia. Conference paper: IOP Conference Series: Earth and Environmental Science 736 International Conference on Biodiversity, Malaysia, 2021. (https://iopscience.iop.org/article/10.1088/1755-1315/736/1/012033)
Lei Di, Thorogood, C.J., Tu PengFei, Song YueLin, Huang LinFang, Aldughayman, M., Leon, C.J. and Hawkins, J.A. 2021. *Cistanche deserticola*: Orobanchaceae. Curtis's Botanical Magazine 38(4): 472-486. [Lavishly illustrated, detailed, account of *C. deserticola*, noting its variations, its possible confusion with *C. salsa*, its distribution in eastern Asia, its therapeutic uses, its cultivation in China, and its potential for retarding desert encroachment.]
Lemma Degebasa, Taye Tessema, Zelalem Bekeko and Ketema Belete. 2022. Prevalence and socioeconomic impact of Striga (*Striga hermonthica*) in sorghum producing areas of East and West Hararghe zones, Oromia, Ethiopia. International Journal of Agronomy 2022: 8402280 (https://doi.org/10.1155/2022/8402280) [A survey in the Hararghe district of Oromia in Ethiopia found that there was at least 23% occurrence of *S. hermonthica* in all fields and over 70% in much of the area, causing 20-70% yield loss. Current control methods rarely go beyond hand-weeding.]
Leon, J.M., Yabar, H., Medina, E.L., Estraver, W.Z., Castillo, J.delaC. and Rivero, A.E.G. 2021. Identification, mapping and ethnobotany of plant species in the Peruvian high Andean wetlands: stimulating biodiversity conservation efforts towards sustainability. Journal of Sustainable Development 14(2): 66-81. [Noting the presence of *Castilleja arvensis Bartsia tomentosa* and *Bartsia bartsioides.*]
Li Li, Teng JianBei, Zhu YiLin, Xie FengFeng, Hou Jing, Ling Yuan and Zhu Hua. 2021. Metabolomics study of flavonoids of *Taxillus chinensis* on different hosts using UPLC-ESI-MS/MS. Molecules 26(24): (https://doi.org/10.3390/molecules26247681) [The total flavonoids in *Taxillus chinensis* from growth on *Morus alba*. was significantly higher than that Journal of Plant Ecology 15(2): 294-309. [Contrary to expectation, the number of host species did not significantly

change the asynchrony of reproductive phenology of *Dendrophthoe falcata*.]

Li ManRu, Chen Jin and Zhang Ling. 2021. Host-mediated effects on the reproductive phenological asynchrony of a generalist mistletoe in China. Journal of Plant Ecology 15(2): 294-309. [Finding that both flowering and fruiting in *Dendrophthoe pentandra* in S. China exhibited unimodal peaks in successive years; the first flowering date was significantly influenced by crown area of the mistletoe and light, such that clumps with larger crown and more light exposure had an earlier FFD and longer flowering and fruiting durations; and different host species had a significant impact on the phenology of mistletoes. The number of host species did not significantly change the asynchrony.]

Liu Rong, Wang Hong, Yang JunBo, Corlett, R.T., Randle, C.P, Li DeZhu and Yu WenBin. 2022. Cryptic species diversification of the *Pedicularis siphonantha* complex (Orobanchaceae) in the mountains of southwest China since the pliocene. Frontiers in Plant Science 13(March) (https://doi.org/10.3389/fpls.2022.811206) [A detailed study of the *Pedicularis siphonantha.*]

Liu TaiLong**,** Ji YaLi**,** Liu YiXuan**,** Wu XuanFeng**,** Chen FeiFei **and** Liu Xing**. 2021.** Study on the adaptive mechanisms of five plants to high-altitude light based on transcriptome sequencing in Maidica wetland of Tibet. Plant Science Journal 39(6): 632-642 [*Pediculris kansuensis* among species showing enrichment of genes related to photosynthesis, porphyrin and chlorophyll metabolism, apparently helping to protect against high light levels.]

Lu Zhang, Xiaolei Cao, Zhaoqun Yao, Xue Dong, Meixiu Chen, Lifeng Xiao and Sifeng Zhao. 2022. Identification of risk areas for *Orobanche cumana* and *Phelipanche aegyptiaca* in China, based on the major host plant and CMIP6 climate scenarios. Ecology and Evolution 12(4): [Concluding that very large areas, notably in Xinjiang and Inner Mongolia were at high risk of spread of *O. cumana* and *P. aegyptiaca*. Elevation and topsoil pH were the decisive factors for *O. cumana* distribution, while rainfall was the main factor limiting the spread of *P. aegyptiaca*. Climate change woud shift the risk zones further north.]

Lucena, D.daS., Gomes-Silva, F. and Alves, M. 2021. *Cathedra* (Olacaceae s. L.): a new species and morphological, nomenclatural, and distributional updates. Systematic Botany 46(3) 700-710. [Reviewing the the 5 species of *Cathedra* occurring in South Americas, including a new species, *C. rupestris*, differing in reticulate bark, length of pedicel in flower (1.5-2.2 mm), length of petals (3-3.5 mm), as well as by the proportion of the hypogynous disk in relation to the fruit.]

Maazou, A.R.S., Gedil, M., Adetimirin, V.O., Mengesha, W., Meseka, S., Ilesanmi, O., Agre, P.A. and Menkir, A. 202. Optimizing use of U.S. Ex-PVP inbred lines for enhancing agronomic performance of tropical *Striga* resistant maize inbred lines. BMC Plant Biology 22(286): (https://doi.org/10.1186/s12870-022-03662-1) [Six Ex-Plant Variety Act inbred lines identified with positive GCA effects for grain yield under *S. hermonthicaa*-infested and non-infested conditions and across multiple test locations. Inbred lines HB8229-1 and WIL900-1 also displayed negative GCA effects for emerged *Striga* count and *Striga* damage rating.]

Mallu, T.S., Irafasha, G., Mutinda, S., Owuor, E., Githiri, S.M., Odeny, D.A. and Runo, S. 2022. Mechanisms of pre-attachment *Striga* resistance in sorghum through genome-wide association studies. Molecular Genetics and Genomics 297(3): 751-762. [Revealing that *Striga* germination is associated with genes encoding hormone signalling functions, and that ABA-conditioned seeds have above 20-fold reduction in germination.]

Manole, D., Giumba, A.M., Jinga, V., Radu, I. and Gurau, L.R. 2021. The improvement of sunflower crop technology in Dobrogea under climate changes. Annals – Series on Agriculture, Silviculture and Veterinary Medicine 10(1): 43-49. [Assessing the response of 35 sunflower varieties to sowing date, pesticides and pathogens, including *Orobanche cumana*.]

Mansour, T.G.I., and Al-Rewany, M.A.M. 2022. Faba bean farmer's implementation of *Orobanche* integrated control techniques in the old lands at El Beheira Governorate. Egyptian Journal of Agricultural Research 100(1):.en137-fa152. [A survey of farmers' knowledge of control methods for control for *O. crenata* concluding that there is a need for extension programs aimed to teaching farmers about integrated control methods and implementing extension activities based on practical advice.]

Mar Iman, A.H., Nor Hizami Hassin, Muhamad Azahar Abas and Zulhazman Hamzah. 2021. Modelling *in-situ* factors affecting bud's growth of *Rafflesia kerrii* Meijer in Lojing Highlands, Kelantan, Peninsular Malaysia. Pertanika Journal of Science & Technology 29(2): 1243-1266. [The most influential of 8 ecological factors assessed for infuence on bud growth in *R.kerrii*, were its ecological ability, level of temperature, light shading, soil acidity, and interaction between plant survival condition and growth stage.]

Marrero, Á. 2021. (Flora and spontaneous native vegetation of the Canary Botanical Garden Viera and Clavijo.) (in Spanish) Botanica Macaronesica 31:.67-108. [Including a record of *Phelipanche schultzii.*)

Martín Gil, T. 2021. *Viscum album* L. subsp. *album*, new taxon for the flora of Segovia (Spain). Flora Montiberica 80: 29-35. [*V. album* recorded on *Frangula alnus* and *Salix atrocinerea.*]

Masanga, J., Oduor, R., Alakonya, A., Ngugi, M., Ojola, P., Bellis, E.S.and Runo, S. 2022. Comparative phylogeographic analysis of *Cuscuta campestris* and *Cuscuta reflexa* in Kenya: implications for management of highly invasive vines. Plants, People, Planet 4(2)) 182-193. [A very detailed analysis of the distribution of, and genetic variation within *C. campestris* and *C. reflexa* across Kenya and finding two main populations of each, in Eastern, and western Kenya, posing serious threats to agricultural crops, and needing urgent monitoring and control.]

Matthies, D. 2021. Closely related parasitic plants have similar host requirements and related effects on hosts. Ecology and Evolution 11(17): 12011-12024. [Studies with *Rhinanthus minor, R. alectrolophrus, Odontites vulgaris* and *Melapytum arvense* show that closely related parasites have similar host requirements and correlated negative effects on individual hosts, but that there are also specific interactions between pairs of parasitic plants and their hosts.]

Mazo, K.R., Nickrent, D.L. and Pelser, P.B. 2022. *Macrosolen zamboangensis* (Loranthaceae), a new mistletoe species from Zamboanga Peninsula, Philippines. Webbia 77(1): 127-134. [Describing *M. zamboangensis*, a member of the *M. melintangensis* species complex, but differing in having a conspicuously papillose corolla head, a combination of papillose pedicels, calycula and fruits, at least 3-4 inflorescence axes grouped at a node, and relatively small flowers that are clustered at the apex of a raceme.]

Miller, S.L. and Gans, M.R. 2021. Largely invariant communities of bacterial endophytes in the nonphotosynthetic mycoheterotrophic plant *Pterospora andromedea*. American Journal of Botany 108(11): 2208-2219. [Results suggest a largely invariant community of endophytic bacteria in *P. andromedea* whose role is uncertain predictive metagenomic profiling suggests a possible function in N-metabolism or N-fixation.]

MinYao Jhu and Sinha, N.R. 2022. Parasitic Plants: an overview of mechanisms by which plants perceive and respond to parasites Annual Review of Plant Biology 73(1): 433-455. [A comprehensive review of the current understanding of host perception of parasitic plants and the pre-attachment and post-attachment defence responses mounted by the host, suggesting that understanding non-conventional haustorial connections on other host organs, for example, when stem parasitic plants form haustoria on their host roots could provide the potential for developing a universal resistance mechanism.]

Mishev, K., Dobrev, P.I., Lacek, J., Filepová, R., Yuperlieva-Mateeva, B., Kostadinova, A. and Hristeva, T. 2021. Hormonomic changes driving the negative impact of broomrape on plant host interactions with arbuscular mycorrhizal fungi. International Journal of Molecular Sciences 22(24): (https://doi.org/10.3390/ijms222413677) [Co-cultivation of tobacco with broomrape (*Phelipanche ramosa* and *P. mutelii*) and AM fung,i alone or in combination led to characteristic changes in the levels of endogenous and exuded abscisic acid, indole-3-acetic acid, cytokinins, salicylic acid, and orobanchol-type strigolactones. Also, a significant reduction in AM colonization of infested tobacco plants, pointing to a dominant role of the holoparasite within the tripartite system.]

Miura, H., Ochi, R., Nishiwaki, H., Yamauchi, S., Xie XiaoNan, Nakamura, H., Yoneyama, K. and Yoneyama, K. 2022. Germination stimulant activity of isothiocyanates on *Phelipanche* spp. Plants 11(5): (https://doi.org/10.3390/plants11050606) [21 commercially-available isothiocyanates and several further analogues synthesised were assessed for germination of *P. ramosa.* Several found to have high activity, also on *P.*

aegyptiaca, but not *Orobanche minor* or *Striga hermonthica*.]

Molina, J. and 14 others. 2021. Living with a giant, flowering parasite: metabolic differences between *Tetrastigma loheri* gagnep. (Vitaceae) shoots uninfected and infected with *Rafflesia* (Rafflesiaceae) and potential applications for propagation. Planta 255(1): (https://doi.org/10.1007/s00425-021-03787-x) [Showing that benzylisoquinoline alkaloids were naturally more abundant in non-infected shoots, perhaps proving some defence against infection. Oxygenated fatty acids, or oxylipins, and a flavonoid, previously shown involved in plant immune response, were significantly elevated in infected hosts.]

Muhammad Jamil and 12 others. 2022. A new formulation for strigolactone suicidal germination agents, towards successful *Striga* management. Plants 11(6): (https://doi.org/10.3390/plants11060808) [A welcome paper exploring the use of strigolactones for practical use in the field to induce suicidal germination. Emulsifiable concentrates of both methyl phenlactonoate 3 (MP3) and Nijmegen were more stable than the previously available 'AG' formulations and gave excellent results against *S. hermonthica* in lab and pot tests. Field results were not quite so promising but the authors conclude - 'The development of proposed EC formulated simple SL analogs is the first step towards the large-scale synthesis of suicidal agents for field application and we believe this product will bring a breakthrough in suicidal technology to combat *Striga* in Africa.']

Muhammad Jamil, Wang, J.Y., Yonli, D., Ota, T., Berqdar, L., Traore, H., Marguerite, O., Zwanenburg, B., Asami, T. and Al-Babili, S. 2022. *Striga hermonthica* suicidal germination activity of potent strigolactone analogs: evaluation from laboratory bioassays to field trials. Plants 11:, 1045. (https://doi.org/10.3390/plants11081045) [Analogue MP16 caused the maximum reduction of *S. hermonthica* emergence (97%) in the greenhouse experiment, while Nijmegen-1 w the most promising under field conditions, with a 43% and 60% reduction of *Striga* emergence in pearl millet and sorghum fields, respectively.]

Murata, J. and Kato, N. 2022. Typification of *Balanophora japonica* and *B. nipponica* (*Balanophoraceae*).: Journal of Japanese Botany 97(2): 118-121. [Lectotypes are designated.]

Mursidawati, S.**,** Wicaksono, A. **and da** Silva, J.A.T. **2021.** *Tetrastigma leucostaphylum* (dennst.) alston ex mabb. partial wedge sampling, a new, less-invasive solution for stem-borne *versus* root-borne *Rafflesia* identification. Philippine Journal of Science 150(5): 1141-1152. [Using a minimally destructive method to determine *Rafflesia* spp. attachment to stem rather than root of *T. leucostaphylum*.]

Mutsvanga, S., Gasura, E., Setimela, P.S., Nyakurwa, C.S. and Mabasa, S. 2022. Nutritional management and maize variety combination effectively control *Striga asiatica* in southern Africa. CABI Agriculture and Bioscience 3(47): (https://doi.org/10.1186/s43170-022-00108-4) [Application of 40kg/ha P reduced *S. asiatia* in all maize varieties. Variety CV4 highest yielding under *Striga* infection.]

Muttaqin, Z., Sri, W.B., Basuki, W., Siregar, I.Z. and Corryanti. 2021.The pattern of germination of teak mistletoe seeds in relation with parasitism. Conference paper: Earth and Environmental Science. International Symposium on Arboriculture in the Tropics: Trees and Human Health, Bogor, Indonesia, 2021 Vol.918. [Studying the viability and germination of *Dendrophthoe pentandra* and *Macrosolen tetragonus*. The former was faster to establish and was the more predominant on teak trees.

Mylo, M.D.**,** Hofmann, M.**,** Delp, A.**,** Scholz, R., Walther, F., Speck, T. and Speck, O. 2021. Advances on the visualization of the internal structures of the European mistletoe: 3D reconstruction using microtomography. Frontiers in Plant Science 12(September) (https://doi.org/10.3389/fpls.2021.715711) [Recording the morphology of the endophytic systems of various ages of *Viscum album* parasitizing *Aesculus flava* using X-ray microtomography scans and corresponding stereomicroscopic images. In older mistletoes, one main sinker was predominant and occupied an increasingly large proportion of the stem cross-section. Bands of vessels ran along the axis of the wedge-shaped haustoria and sinkers and bent sideways toward the mistletoe-host interface.]

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.

[Manipulating the population of *Phoradendron californicum* on the host *Prosopis velutina* and finding that intraspecific competition exists for xylem resources between mistletoe individuals, including host carbon and there were significant.]

Naoura, G., Amos, D.N., Reoungal, D. and Alfred, D. 2021. Assessment of traditional methods of controlling *Striga* on cultivated crops in Sudanian agricultural zone of Chad. International Journal of Applied Sciences and Biotechnology 9(4): 242-249. [Local control methods for *S. hermonthica* include organic and or mineral fertilization, associated crops, crop rotation and the use of false hosts and trap crops. Some farmers cultivate resistant varieties and early maturing varieties, others use shea flour and herbicide treatment.]

Ndifon, E.M., Lum, A.F., Ndoh, D. and Educk-Mbe, E.P. 2022. Host-parasite relationship between *Meloidogyne javanica* and plantain (*Musa paradisiaca*), and nematicidal activity of Lantana (*Lantana camara* L.) and mistletoe (*Viscum album* L.). Nigerian Agricultural Journal 53(1): 229-233. [Application of 16 g/plant of ground-up foliage of *V. album* per banana plant reduced nematode populations and prevented gall formation on plant roots. The result was equivalent to the use of the nematicide Ethoprofos.]

Ngugi, G. Kirika, P.M. and Mwachala, G. 2022. *Harveya kiangombensis* (Orobanchaceae), a new parasitic species from Kenya, East Africa. Phytotaxa 559 (3): 293-297. [Describing *H. kiangombensis,* easily distinguished from the closely related *H. liebuschiana* by its glandular pubescent pedicels, flowers occurring singly in the leaf axils, and its acute calyx lobes.]

Nepomuceno, S.C. and Buril, M.T. 2021. Disentangling *Cuscuta* identification in Brazil: a first taxonomic contribution to the northeast region species. Rodriguésia 72: (https://doi.org/10.1590/2175-7860202172058) [A detailed clarification of 8 *Cuscuta* spp. occurring in NE Brazil.]

Nickrent, D.L. and Vartak, A. 2021. Parasitic flowering plants on postal stamps: vehicles for learning. Current Science 121 (12): 1538-1548. [At least 95 different stamps show parasitic angiosperms representing 52 species in 29 genera. Indonesia has the highest number of parasitic plant stamps (7) followed by Malaysia (6). These two countries achieved high numbers because *Rafflesia* is a popular plant to be represented on stamps (18 times), closely followed by *Viscum album*. (15). The examples are fully listed and many colourfully illustrated.]

Nur-Atiqah Mohd-Elias and 11 others. 2021.Transcriptome analysis of *Rafflesia cantleyi* flower stages reveals insights into the regulation of senescence. Scientific Reports 11(12): (https://doi.org/10.1038/s41598-021-03028-x) [Results provide a model of the molecular mechanism underlying *R. cantleyi* flower senescence.]

Ogawa S, Cui S, White ARF, Nelson DC, Yoshida S, Shirasu K. 2022. Strigolactones are chemo-attractants for host tropism in Orobanchaceae parasitic plants. Nature Communications. 13(1):4653. [Showing that the strigolactones strigol, orobanchol, (+)-5-deoxystrigol and GR24 effected chemotropism in the seedlings of *Phtheirospermum japonica* – a welcome confirmation of this widely ignored phase in the parasitic process. It does not occur in non-parasitic plants.]

Ogawa, S. and Shirasu, K. 2022. Strigol induces germination of the facultative parasitic plant *Phtheirospermum japonicum* in the absence of nitrate ions.

Plant Signaling and Behavior 17(2114647): (https://doi.org/10.1080/15592324.2022.2114647) [Showing that, although *P. japonicum* germinates readily in an N-rich soil, germination is enhanced in the absence of N, by host exudates and by strigol.]

Okazawa, A., Baba, A., Okano, H., Tokunaga, T., Nakaue, T., Ogawa, T., Shimma, S., Sugimoto, Y. and Ohta, D. 2021. Involvement of α-galactosidase OmAGAL2 in planteose hydrolysis during seed germination of *Orobanche minor*. Journal of Experimental Botany 73(7): 1992-2004. [Detecting planteose in tissues surrounding-but not within-the embryo, supporting its suggested role as a storage carbohydrate. And identifying the α-galactosidase enzyme, OmAGAL2, involved in planteose hydrolysis in the apoplast around the embryo after the perception of strigolactones, to provide the embryo with essential hexoses for germination, suggesting that the enzyme OmAGAL2, which is involved in the hydrolysis of planteose, is a promising molecular target for root parasitic weed control. See also Press Report above.]

Oluwaseun, O., Badu-Apraku, B., Adebayo, M. and Abubakar, A.M. 2022. Combining ability and performance of extra-early maturing provitamin A maize inbreds and derived hybrids in multiple environments. Plants 11(7): (https://doi.org/10.3390/plants11070964) [Identifying hybrid TZEEI 79 × TZEEIOR 30 as the most outstanding in terms of grain yield and stability across environments, including *Striga*-infested, drought and optimal growing environments in Nigeria.]

Ossa, C.G., Aros-Mualin, D., Mujica, M.I. and Pérez, F. 2021. The physiological effect of a holoparasite over a cactus along an environmental gradient. Frontiers in Plant Science 12(November): (https://doi.org/10.3389/fpls.2021.763446) [The mistletoe *Tristerix aphyllus* had its most serious effect on *Echinops chiloensis* under drought conditions towards the north of Chile when it reduced host photosynthesis more than in the south, where moisture and nitrogen were more favourable for the host.]

Oulehla, J., Jiroušek, M., Šťastná, M. and Barroso, P. M. 2021. Rapid decreasing of a selected plant species distribution within recent decades as an illustration of gradual local extinction of low-productive wet meadow species in central Europe. Journal of Landscape Ecology 14(1): 92-105. [Noting the steep decline in *Pedicularis sylvatica.*]

Özdikmen, H. and00 Laz, B. 2022. Updated feeding preferences of *Leiopus* Audinet-Serville species in Turkey with new host plants for endemic longicorn beetle *Leiopus syriacus abieticola* Sama & Rapuzzi (Coleoptera: Cerambycidae: Lamiinae). Munis Entomology & Zoology 17(1): 301-315. [Finding that *Viscum album abietis* and *Viscum album* austriacumL are hosts for *L. syriacus abieticola*.]

Parise, A.G., Reissig, G.N., Basso, L.F., Senko, L.G.S., Oliveira, T.F.deC., Toledo, G.R.A.de, Ferreira, A.S. and Souza, G.M. 2021. Detection of different hosts from a distance alters the behaviour and bioelectrical activity of *Cuscuta racemosa*. Frontiers in Plant Science 12: (https://doi.org/10.3389/fpls.2021.594195) [The Brazilian *C. racemosa* develops greater chlorophyll content in the absence of a host plant. Also claiming that electrical signalling in the parasite differs according to the presence of different host pants nearby.]

Park SoYon, Shimizu, K., Brown, J., Aoki, K. and Westwood, J.H. 2021. Mobile host mRNAs are translated to protein in the associated parasitic plant *Cuscuta campestris*. Plants 11(1): (https://doi.org/10.3390/plants11010093) [Showing that host-derived GUS mRNAs are translated in *C. campestris* and that fusion of (tRNA)-like structures enhances RNA mobility in the host-parasite interaction.]

Pellissari, L.C.O., Teixeira-Costa, L., Ceccantini, G., Tamaio, N., Cardoso, L.J.T., Braga, J.M.A. and Barros, C.F. 2021. Parasitic plant, from inside out: endophytic development in *Lathrophytum peckoltii* (Balanophoraceae) in host liana roots from tribe Paullineae (Sapindaceae). Annals of Botany 129(3): 331-342. [A detailed study of the effects of *L. peckoltii* on the anatomy of hosts *Paullinia uloptera* and *Serjania clematidifolia*.]

Pendall, E. and 10 others. 2022. Remarkable resilience of forest structure and biodiversity following fire in the peri-urban bushland of Sydney, Australia. Climate 10(6): (https://www.mdpi.com/2225-1154/10/6/86) [Tree (*Eucalyptus* spp.) and unspecified mistletoe cover increased following fir in ironbark forest.]

Pinto-Carrasco, D., Delgado, L., Sánchez Agudo, J.A., Rico, E. and Martínez-Ortega, M.M. 2021. Phylogeography and ecological differentiation of strictly Mediterranean taxa: the case of the Iberian endemic *Odontites recordonii*. American Journal of Botany 109(1): 166-183. [Three species from the *O. vernus* group were recovered as distinct species, and three genetic groups were found within *O. recordoni*, which could have been restricted to narrow refugia during the Quaternary.]

Piwowarczyk, R., Pedraja, Ó.S., Fateryga, A.V. and Sviri, S.A. 2022. *Orobanche ingens* (Orobanchaceae) - a poorly known species of the Greater Caucasus: taxonomic problems, distribution, hosts and habitats. PhytoKeys 193: 55-66. [Clarifying the typification and taxonomy of *O. ingens*. Also describing its distribution, habit, host range (mainly *Heracleum* spp.) and distinguishing morphological features.]

Punia, S.S., Paras Kamboj, Yadav, D.B., Vinay Sindhu and Sushil Kumar. 2021. Herbicides' efficacy on Egyptian broomrape (*Orobanche aegyptiaca* Pers.) in tomato and brinjal in South-West Haryana, India. Indian Journal of Weed Science 53(4): 392-397. [Sulfosulfuron and ethoxysulfuron applied at 50 g/ha 30, 60, and 90 days after planting were more on tomato providing 90% control of *O. aegyptiaca*, and a yield increase of 50% over untreated check. Both herbicides were damaging to brinjal. Neem cake or metalaxyl were not effective.]

Qu XiaoJian and Fan ShouJin. 2021. First report of the parasitic invasive weed field dodder (*Cuscuta campestris*) parasitizing the confamilial invasive weed common morning-glory (*Ipomoea purpurea*) in Shandong, China. Plant Disease 105(4): 1230-1230.

Qasem, J.R. 202. Parasitic Weeds of Jordan. Species, hosts, distribution and management. Bentham Science Publications. 365 pp. [See Book Review above.]

Qianshi Lin, Banerjee, A. and Stefanović, S. 2022. Mitochondrial phylogenomics of *Cuscuta* (Convolvulaceae) reveals potentially functional horizontal gene transfer from the host. Genome Biology and Evolution 14(6): (https://doi.org/10.1093/gbe/evac091) [Mitochondrial *atp1* genes of South African subgenus *Pachystigma* were inferred to be transferred from Lamiales, with high support. Moreover, the horizontally transferred *atp1* gene has functionally replaced the native, vertically transmitted copy, has an intact open reading frame, and is under strong purifying selection, all of which suggests that this xenolog remains functional.]

Qin RuiMin and 11 others. 2022. Effects of *Pedicularis kansuensis* expansion on plant community characteristics and soil nutrients in an alpine grassland. Plants 11(13): (https://doi.org/10.3390/plants11131673) [*P. kansuensis* increased the community richness index, and the soil pH which had a significant negative effect on the soil AOC, NO_3^-.N, and available P, and finally caused the decline of soil quality.

Qumqum Noshad Muhammad Ajaib, Aysha Kiran., Muhammad Ishtiaq, Tanveer Bashir and Muhammad Faheem Siddiqui. 20211. A study on genetic diversity of *Cuscuta reflexa* roxb. and few members of Convolvulaceae on the basis of RAPD and SDS-page. Pakistan Journal of Botany 53(3): 959-965. [Results suggest a relatively close relationship between *C. reflexa* and *Ipomoea pes-tigridis*.]

Rodríguez-Rodríguez, P., Castro, A.G.F.,de; de Paz, P.L.P., Curbelo, L., Palomares, Á., Mesa, R., Acevedo, A. and Sosa, P.A. 2022. Evolution and conservation genetics of an insular hemiparasitic plant lineage at the limit of survival: the case of *Thesium* sect. *Kunkeliella* in the Canary Islands. American Journal of Botany 109(3): 419-436. [A detailed analysis of the *Thesium* species and their distribution across the Canary Islands, describing the 3 known species and defining a new species *T. palmense* from the island of La Palma.]

Roozkhosh, M., Azami-Sardooei, Z., Fekrat, F., Khalil-Tahmasebi, B., Rastgoo, M. and Jahanbakhshi, A. 2022. Tolerance to dodder (*Cuscuta campestris* L.) in citrus species of south of Kerman province - Iran. Journal of the Saudi Society of Agricultural Sciences 21(5): 331-338. [Valencia oranges and Bitter orange proved tolerant to *Cuscuta campestris* but lemon and tangerines (local and Kara) showed high sensitivity.]

Rubiales, D., Moral, A. and Flores, F. 2022. Agronomic performance of broomrape resistant and susceptible faba bean accession. Agronomy 12(6): (https://doi.org/10.3390/agronomy12061421) [Assessing 3 *Orobanche crenata*-susceptible, and 8 resistant lines of faba bean across 2 sites in southern Spain, over 3 seasons. Finding varieties Quijote, Navio6, Baraca and FaraonSC to be most suitable for their response to *O. crenata* and local weather conditions.]

Sadda, A.S., Issa, O.M., Jangorzo, N.S., Saïdou, A.A., Issoufou, H.B.A. and Diouf, A. 2021. *Striga gesnerioides* (Willd.) Vatke infestation and distribution as affected by soil properties and varieties at the plot and landscape scales in cowpea-based cropping systems. Weed Research (Oxford) 61(6): 519-531. [In screening 27 cowpea lines over 14 sites in Niger, varieties C5030 and C5095 were consistently resistant to *S. gesnerioides*, and occurrence of the parasite was negatively correlated with P and N and moisture levels.]

Sadda, A.S., d'Eeckenbrugge, G.C., Saïdou, A.A., Diouf, A., Jangorzo, N.S., Issoufou, H.B.A. and Issa, O.M., 2021. The witchweed *Striga gesnerioides* and the cultivated cowpea: a geographical and historical analysis of their West African distribution points to the prevalence of agro-ecological factors and the parasite's multilocal evolution potential. PLOS ONE August 4, 2021 (https://doi.org/10.1371/journal.pone.0254803) [Commenting on 'the increasing severity of *Striga gesnerioides* attacks on cowpea across West Africa' and attributing it to 'the increasing importance and intensification of the crop, and the consequent loss of biodiversity'. Also noting 'Senegalese strains of *S. gesnerioides* from the wild developing virulence on cowpea'.

Saharan, G.S., Mehta, N.K. and Meena, P.D. 2021. Principles of host resistance. In:

Genomics of Crucifer's Host-Resistance. Springer, Singapore: 1-64. (https://doi.org/10.1007/978-981-16-0862-9_1) [Apparently including reference to parasitic weeds e.g *Phelipanche ramosa,* but no detail in abstract.]

Sajedi, S., Minbashi, M. and Abadi, M.Y. 2021. (Report of several broomrape (*Orobanche*) species as new parasitic weeds of rapeseed fields of Golestan and Ilam provinces in Iran.) (in Persian) Iranian Journal of Weed Science 17(1):.fa135-fa139. [Reporting *O. nana, O. oxyloba*, and *O. mutelii* from Golestan Province, and *O. aegyptiaca* and *O. hirtiflora* from Ialm Province.]

Sakina Banoo, Ganie, A.H. and Khuroo, A.A. 2022. *Pedicularis gracilis* var. *brunoniana* (wall. ex pennell) t. husain & arti garg: first report from Ladakh, Trans-Himalaya, India. Check List 18(2): 269-273.

Sarić-Krsmanović, M., Zagorchev, L., Umiljendić, J.G., Rajković, M., Radivojević, L., Teofanova, D., Božić, D. and Vrbničanin, S. 2022. Variability in early seed development of 26 populations of *Cuscuta campestris* yunck.: the significance of host, seed age, morphological trait, light, temperature, and genetic variance. Agronomy 12(3): (https://doi.org/10.3390/agronomy12030559) [Seeds of 26 populations of *C. campestris* were collected from different locations in Serbia. Study of different temperatures and light on seed germination and seedling growth showed large variability of germination patterns each agronomic region reflecting the ability of *C. campestris* to adapt to local agricultural management practices.]

Schröder, L., Hohnjec, N., Senkler, M., Senkler, J., Küster, H. amd Braun, H. P. 2021.The gene space of European mistletoe (*Viscum album*). Plant Journal 109(1): 278-294. [New molecular data proving insights into the metabolism and molecular biology of *V. album*, including the biosynthesis of lectins and viscotoxins. See also PRESS REPORTS above.]

Sebastián Padrón, P. and Vélez, A. 2021. Description of the immature stages of the high Andean pierid butterfly *Catasticta incerta incerta* (Dognin, 1888) (Lepidoptera: Pieridae). Tropical Lepidoptera Research30(21): 65-71. [Noting that the host of *C. incerta* is the mistletoe *Antidaphne andina*.]

Sharma, O.P. 2021. *Striga* Lour, root parasite angiosperm: a case study in Rajasthan state. Advances in Plant Sciences 34(1/2): 119-120. [A general review of the genus *Striga* in Rajastan.]

Shin ChaeRim, Choi DongJin, Shirasu, K. and Hahn YoonSoo. 2022. Identification of dicistro-like viruses in the transcriptome data of *Striga asiatica* and other plants. Acta Virologica.66(2): 157-165.

Sneha, S.R. and Sheeja, K.R. 2022. Weed management in millets- a holistic approach. Agricultural Reviews (R-2520: (DOI: 10.18805/ag.R-2520) [A broad review relating to all millets including comment of a broad range of potential methods for controlling *Striga* in sorghum and pearl, finger, Kodo, foxtail, barnyard and proso millets.]

Siahmarguee, A., Taliei, F. and Yazdandost, M. 2022. (Evaluation of resistance and biochemical responses of different varieties of tomato to dodder (*Cuscuta campestris* yunck.).) (in Persian) Journal of Plant Environmental Physiology 17(65); fa19-fa37. [Comparing the metabolites of 2 varieties of tomato, susceptible Supra Urbana and resistant Super Chef, at various times after infection by *C. campestris* showed a greater increase in enzymes catalase, guaiacol peroxidise and ascorbate peroxidise in the resistant variety. There were also differences in build-up of phenolics and flavonoids.]

Sidharthan, V.K., Chaturvedi, K.K. and Baranwal, V. K. 2022. Diverse RNA viruses in a parasitic flowering plant (spruce dwarf mistletoe) revealed through RNA-seq data mining. Journal of General Plant Pathology 88(2): 138-144. [Detecting 7 putative novel RNA viruses in *Arceuthobium sichuanense* an important parasite of *Picea crassifolia* in India.]

Sivaramakrishna, P.**,** Yugandhar, P. and Ekka, G.A. **2021.** A new species *Dendrophthoe laljii* (Loranthaceae) infesting *Artocarpus heterophyllus* Lam. (Moraceae) in Andaman and Nicobar Islands, India. Journal of Asia-Pacific Biodiversity 14(3): 452-459. [*D. laljii* resembles *D. curvata* but differs in vegetative and floral characteristics. A key to the species of *Dendrophthoe* Mart. in India is provided.]

Snyder, S.A., Blinn, C.R. and Roth, S. 2021. Results of a survey of Minnesota foresters regarding knowledge of and treatment practices for dwarf mistletoe in black spruce stands in northern Minnesota. Staff Paper Series - Department of Forest Resources, University of Minnesota.261: 75 pp. [This study relating to *Arceuthobrium pusillum* infestation on black spruce (*Picea mariana*) in Minnesota highlighted information gaps that could be addressed through education, research and monitoring to better understand the economic and ecological importance of the disease as well as the understanding of the effectiveness of dwarf mistletoe treatments.]

Soares da Silva, S., Simão-Bianchini, R., Giraldes Simões, A.R. and Costea, M. 2021. Disentangling parasitic vines in the tropics: taxonomic notes for an accurate identification of Cuscuta (Convolvulaceae) and Cassytha (Lauraceae). Rodriguésia 72: 1-11. (https://doi.org/10.1590/2175-7860202172131) [A guide to distinguishing *Cassytha* spp. from *Cuscuta* spp. in both vegetative and flowering stages, indicating important differences in micromorphology.]

Sofi Mursidawati and Adhityo Wicaksono. 2021. A preliminary study of *in vivo* injection of auxin and cytokinin into *Rafflesia patma* blume flower buds. Buletin Kebun Raya 24(2): 51-56. [Comparing injections of IAA, kinetin, or water into buds of *R. patna*, showed greater developmental response to IAA.]

Somssich, M. and Cesarino, I. 2022. Parasite-resistant ketchup! Lignin-based resistance to parasitic plants in tomato. Plant Physiology 189(1): 4-6. [Concludng that resistance to resisance to *Cuscuta campestris* in tomato is due to lignification in the ciretex.]

Song Juan, Bian JinGe, , Xu YuXing and Wu JianQiang. 2022. Inter-species mRNA transfer among green peach aphids, dodder parasites, and cucumber host plants. Plant Diversity 44(1): 1-10.

Soriano, G., Siciliano, A., Fernández-Aparicio, M., Peralta, A.C., Masi, M.,Moreno-Robles, A., Guida, M. and Cimmino, A. 2022. Iridoid glycosides isolated from *Bellardia trixago* identified as inhibitors of *Orobanche cumana* radicle growth. Toxins (Basel) 14(8): 559. [Five iridoid glycosides were isolated from shoots of *B. trixago* among which melampyroside was the most abundant and the most inhibitory to *O. cumana*.]

Soriano, G., Fernández-Aparicio, M., Masi, M., Vilariño-Rodríguez, S. and Cimmino, A. 2022. Complex mixture of arvensic acids isolated from *Convolvulus arvensis* roots identified as inhibitors of radicle growth of broomrape weeds. Agriculture 12: 585. (https://doi.org/10.3390/agriculture12050585) [*C. arvensis* is resistant to *Orobanche* spp. This study suggests that this is due to the presence of arvensic acids (resin glycosides) which caused abnormal radicle development in *O. crenata, O. cumana, O. minor* and *Phelipanche ramosa*].

Soto-Cruz, F.J., Zorrilla, J.G., Rial, C., Varela, R.M., Molinillo, J.M.G., Igartuburu, J.M. and Macías, F.A. 2021. Allelopathic activity of strigolactones on the germination of parasitic plants and arbuscular mycorrhizal fungi growth. Agronomy 11(11): (https://doi.org/10.3390/agronomy11112174) [An in-depth review of strigolactones, with discussion of their potential to provide control by suicidal germination via trap-crops or by the compounds themselves, but coming to no particularly optimistic conclusion on the latter.]

Stanley, A.E. and 12 others. 2021. Association analysis for resistance to *Striga hermonthica* in diverse tropical maize inbred lines. Scientific Reports 11(12): (https://doi.org/10.1038/s41598-021-03566-4) [Evaluating 150 diverse maize inbred lines under *Striga*-infested and non-infested conditions for two years and genotyping using the genotyping-by-sequencing platform revealed 30 single nucleotide polymorphisms associated with *Striga*-resistance.]

Su YaJie and 10 others. 2022. Screening trap crops of sunflower broomrape (*Orobanche cumana* Wallr.) in Bayannur. Journal of Northern Agriculture 50(2): 103-109. [Screening 10 crops for germination of *O. cumana.* Finding courgette and onion least active. Flx and carrot among the best and resisatant to the parasite, hence suitable as trap crops.]

Suetsugu, K., Okada, H., Hirota, S.K.and Suyama, Y. 2022. Evolutionary history of mycorrhizal associations between Japanese Oxygyne (Thismiaceae) species and Glomeraceae fungi. New Phytologist 235(3): 836-841. [Finding that each *Oxygyne* species (*O. hyodoi, O. shinzatoi*, and *O. yamashitae*) is predominantly colonized by a narrow clade within Glomeraceae and that closely related *Oxygyne* species target closely related arbuscular mycorrhizal fungi

Sui XiaoLin, Guan KaiYun, Chen Yan, Xue RuiJuan and Li AiRong. 2022. A legume host benefits more from arbuscular mycorrhizal fungi than a grass host in the presence of a root hemiparasitic plant. Microorganisms 10(2): (https://doi.org/10.3390/microorganisms10020440) [Finding that a legume host such as

Trifolium repens benefits more from mycorrhizal inoculation than a grass host in the presence of the hemiparasitic plant *Pedicularis kansuensis* and discussing the mechanisms involved.]

Sun Xiao Pei Jin, Zhao Lei, Bashir Ahmad ndf Huang LinFang. 2021. Fighting climate change: soil bacteria communities and topography play a role in plant colonization of desert areas. Environmental Microbiology 23(11): 6876-6894. [Discussing the role of *Cistanche deserticola*, *Cynomorium songaricum* and *Cistanche salsa*) in desert management in arid areas under global warming, demonstrating their high adaptability to future climate change. *Streptomyces eurythermus* and *S. flaveus* also somehow involved?]

Suo Qiu, Bradley, J.M., Perijun Zhang, Chaudhuri, R., Blaxter, M., Butlin, R.K. and Scoles, J.D. 2022. Genome-enabled discovery of candidate virulence loci in *Striga hermonthica* , a devastating parasite of African cereal crops. New Phytologist (https://doi.org/10.1111/nph.18305)

Suo Qiu, Bradley, J.M., Peijun Zhang, Chaudhuri, R., Blaxter, M., Butlin, R.K. and Scholes, J.D. 2022. Genome-enabled discovery of candidate virulence loci in *Striga hermonthica*, a devastating parasite of African cereal crops. New Phytologist (https://doi.org/10.1111/nph.18305). [Presenting a draft of the *S. hermonthica* genome, providing insight into the makeup and evolution of this species and leveraging the genome in combination with a population genetics analysis to identify several candidate genes for parasite virulence. See detailed commentary by Westwood, 2022 below.]

Suzuki, T., Kuruma, M. and Seto, Y. 2022. A new series of strigolactone analogs derived from cinnamic acids as germination inducers for root parasitic plants. Frontiers in Plant Science 13: (https://doi.org/10.3389/fpls.2022.843362) [Reporting the development of a series of strigolactone analogs derived from cinnamic acid (CA) and the methylbutenolide ring (D-ring) and finding that all the *cis*-CA-derived SL analogs had stronger activities as seed germination inducers for *Orobanche minor* and *Striga hermonthica*, compared with the corresponding *trans*-CA-derived analogs. They also stimulated the host *Arabidopsis.*]

Syarifah Haniera, S.K., Mohd Nazip Suratman, Shamsul Khamis, Ahmad Najmi, N.H. and Mohd Syaiful Mohammad. 2022. Growth rate, mortality rate and life cycle of *Rafflesia azlanii* and *R. cantleyi* in Belum-Temenggor Forest Complex, Perak, Malaysia. Sains Malaysiana 51(4) 943-957. [*R. cantleyi* grew faster than *R. azlani* but had a shorter life cycle (11 v. 14 months).]

Tahmasbali, M., Darvishzadeh, R. and Moghaddam, A.F. 2021. (Evaluation of oriental tobacco (*Nicotiana tabacum* L.) genotypes using selection indices under the presence and absence of broomrape.) (in Persian) Iranian Journal of Field Crop Science 52(3):.fa189-fa207. [Evaluating 92 oriental and water pipe tobacco genotypes and finding genotype 24 (H.T.I) to be best in both the presence and absence of *Orobanche cernua*.]

Takele Nagewo, Taye Tessema, Seid Ahmed and Tamado Tana. 2022. Biological characteristics, impacts, and management of crenate broomrape (*Orobanche crenata*) in faba bean (*Vicia faba*): a review. Frontiers in Agronomy 25(March): (**https://doi.org/10.3389/fagro.2022.708187**) [A general review, including a graphic account of its increasing spread in Ethiopia across South Tigray, South Gondar, and the South and North Wollo Zones, at low, medium and high elevations. Many farmers have had to give up growing faba bean and other legume crops and it is a threat to many other districts. Possible control measures are outlined and the need for legislative policies of the government bodies and the commitment of the community at all levels to implement them.]

Takikawa, H. 2021. Studies on strigolactone based on synthetic organic chemistry. Journal of Synthetic Organic Chemistry Japan 79(9): 819-828. [Reviewing the history of strigolactone research and introducing it from the viewpoint of synthetic orogranic chemistry. Also discussing their application for the control of root parasitic weeds.]

Tao Bo, Zhao Xu, Du Lei and Yun XiaoPeng. 2022. Study on induction of sunflower resistance by elicitor. Journal of Northern Agriculture 50(3): 53-59. ['The 600 and 800 times diluted elicitor (undefined but e.g. salicylic acid?) had obvious control effect on *Orobanche cumana'.* Reporting 90% control of *O. cumana* and safety to sunflower. The best application time was at 8-10 leaf stage and 12-14 leaf stage of sunflower.]

Tavares de Carvalho, J.D., Markus, C., Merotto, A., Záchia, R.A., Scuch, M.,Sulzbach, E. and Mariath, J.E.A. 2022. *Prosopanche cocuccii* (Hydnoraceae): a new species from Southern Brazil. Phytotaxa 521(3):177-192. [A full description of *P. cocuccii,* parasitic on tobacco, which resembles *P. bonacinae* but differs in floral characteristics. Including an updated key to the genus *Prosopanche.*]

Teklay Abebe, Gurja Belay, Taye Tadesse and Gemechu Keneni. 2022. In vitro evaluation of marker assisted conversion of adapted sorghum varieties into *Striga hermonthica* resistant versions. SINET: Ethiopian Journal of Science 45(1): 69-85. [The study confirmed that marker-assisted backcrossing for transfer of lgs QTLs from donor into popular and farmer-preferred cultivars has the potential to enhance tolerance/resistance to *Striga* in sorghum

Temesgen Begna. 2021. Effect of *Striga s*pecies on sorghum (*Sorghum bicolor* L Moench) production and its integrated management approaches. International Journal of Research Studies in Agricultural Sciences7(7): (http://dx.doi.org/10.20431/2454-6224.0707002) [A general review of the problem of *Striga* spp.and potential control methods.]

Teofanova,D., Lozanova, Y., Lambovska, K., Pachedjieva, K., Tosheva, A., Odjakova, M. and Zagordhev, L. 2022. *Cuscuta* spp. populations as potential reservoirs and vectors of four plant viruses. Phytoparasitica: (https://doi.org/10.1007/s12600-022-00981-9) [The introduced *C. campestris* frequently proved positive for Tomato Yellow Leaf Curl Virus (19%) and Cucumber Mosaic Virus (30%) in Bulgara, while only a single population of the other 3 native species were positive for both.]

Thorogood, C.J. and Rumsey, F.J. 2021. *Orobanche rapum-genistae*: Orobanchaceae. Curtis's Botanical Magazine 38(4): 487-499. [Another beautifully illustrated account, reviewing the current status of *O. rapum-genistae,* seriously declining across NW Europe, its ecology, variations, and narrow host range]

Thorogood, C.J. and Yunoh, S.M.M. 2021. Fairy lanterns in focus. Plants, People, Planet 3(6): 680-684. [Reviewing recent literature on *Thismia* spp. 'among the most extraordinary flowering plants' and their ' bewildering diversity of flower forms'.]

Tonev, T., Kalinova, S., Yanev, M., Mitkov, A. and Neshev, N. 2021. Weed association dynamics in the oilseed rape fields. Scientific Papers - Series A, Agronomy 64(1): 591-599. [Noting that *Phelipanche ramosa* and *P. mutelli* are commonest in S. Bulagaria and are associated with inadequate rotation.]

Touchette, B.W., Feely, S. and McCabe, S. 2022. Elevated nutrient content in host plants parasitized by swamp dodder (*Cuscuta gronovii*): evidence of selective foraging by a holoparasitic plant? Plant Biosystems 156(3): 671-678. [*C. gronovii* had limited impact on plant size for *Justicia americana*, but reduced that in *Impatiens capensis*. It is suggested this difference arises from the higher mineral content of *I. capensis*.]

Usta, A. and Yılmaz, M. 2021. Effects of land use and topographic variables on distribution of pine mistletoe (*Viscum album* subsp. *austriacum* (Wiesb.) Vollm.) in northeastern Turkey. Forest Ecology: Cerne 27(1): (https://doi.org/10.1590/01047760202127012618) [Distribution of *V. album* on *Pinus sylvestris* is associated with low altitude, sheltered valleys, humid areas and land use (agriculture, road and stream).]

Vasilevskaya, N.V. 2022. Polyvariance of ontogeny of *Castilleja lapponica* Gand. under industrial pollution of the subarctic. Conference paper : IOP Conference Series : Earth and Environmental Science 2022(981): (https://iopscience.iop.org/article/10.1088/1755-1315/981/3/032075) [Populations of *C. lapponica* studied in Murmansk, NW Russia, where it was exposed to chemical and radiation from tantalum-niobium and rare earth mining. Usually perennial it usually succumbed after a year, but it survives as an annual due to enhanced seed production.]

Verkhozina, A.V. and 71 others! 2022. Findings to the flora of Russia and adjacent countries: new national and regional vascular plant records, 4. Botanica Pacifica11(1): 129-157. [Recording *Orobanche korshinskyi* for the Republic of Buryatia.]

Wahyuningtias, Mardiastuti, A. and Mulyani, Y.A. 2021. Diversity of mistletoes and their distribution in Dramaga Campus, West Java, Indonesia. Conference paper : IOP Conference Series : Earth and Environmental Science International Conference on Biodiversity, Malaysia, 2021. [Mistletoes identified near Bogor, Java were *Dendrophthtoe pentandra* (55%), *Viscum ovalifolium* (32%), *Scurrula atropurpurea*

(9%), *Macrosolen cochinchinensis* (3%). Commonest hosts were *Falcataria moluccana* followed by *Samanea saman,* and *Averrhoa carambola*. Virtually all were on hosts in open areas.]

Wakabayashi, T. Ueno, K. and Sugimoto, Y. 2022. Structure elucidation and biosynthesis of orobanchol. Frontiers in Plant Science Feb 9: (https://doi.org/10.3389/fpls.2022.835160) [Reviewing the history leading to the discovery of the genuine structure of orobanchol and the current understanding of its biosynthetic mechanisms, involving cytochrome P450 monooxygenases downstream of carlactonoic acid via two pathways: either through 4-deoxyorobanchol or direct conversion from carlactonoic acid.]

Wallach, A., Achdari, G. and Eizenberg, H. 2022. Good News for cabbageheads: controlling *Phelipanche aegyptiaca* infestation under hydroponic and field conditions. Plants 11(9): 1107. (https://doi.org/10.3390/plants11091107) [Three sequential applications of glyphosate , 21, 35, and 49 days after planting, effectively controlled *P. aegyptiaca* without damaging the cabbages at a dose of 72 g ae $ha^{-1.}$ At 18 g ae ha^{-1} ethametsulfuron-methyl was less effective as a spray but more so by overhead irrigation.]

Wang Qi, He ZhiPeng, Zhang RuiRui, Dang XiaoLin and Zhao XueYan. 2022. Characterization of the complete chloroplast genome of *Pedicularis shansiensis* (Orobanchaceae), an endemic species of China. Mitochondrial DNA Part B 7(1): 251-252. [The chloroplast genome of *P. shansiensis* contains 132 genes, including 86 protein-coding, 8 rRNA, and 38 tRNA genes. Phylogenetic analysis shows *Pedicularis* species cluster together and *P. shansiensis* forms a clade with *P. dissect*.]

Wang SiHai**,** Chen Jian**,** Yang Wei**,** Hua Mei **and** Ma YongPeng**. 2021.** Fruiting character variability in wild individuals of *Malania oleifera*, a highly valued endemic species. Scientific Reports 11:12. (https://doi.org/10.1038/s41598-021-03080-7) [Studies of levels of nervonic and other fatty acids in *M. oleifera* (Olacaceae) could lead to selection of individuals with excellent fruit traits for commercial cultivation.]

Wang WeiJia, Liu Rong, Wu You, Wang Hong and Yu WenBin. 2022. The complete chloroplast genomes of two *Pedicularis* species (Orobanchaceae) from southwest China. Mitochondrial DNA Part B 7(6): 971-973. [Reporting on endemics *Pedicularis cephalantha* (147,087 bp) and *P. nigra* (145,726 bp), closely related to each other and sister to *P. oederi.*]

Wei He , Yan Li , Wenfang Luo, Junhui Zhou , Sifeng Zhao and Jianjun Xu. 2022. Herbicidal secondary metabolites from *Bacillus velezensis* JTB8-2 against *Orobanche aegyptiaca*. AMB Express **12(52): (** https://doi.org/10.1186/s13568-022-01395-w) [Four compounds isolated from *B. velezensis,* with diketopiperazine structure inhibited germination of *O. aegyptiaca* at concentrations from 0.5 mM to 4 mM. A *B. velezensis* broth Reduced *O. Aegytiaca* in the field and increased tomato yield.]

Westwood, J.H. 2022. Cracking open the witch's spell book: the witchweed genome provides clues to plant parasitism. New Phytologist (https://doi.org/10.1111/nph.18398) [A detailed critique of the paper by Suo Qiu *et al.*(2022) see above.]

Wicaksono, A., Cristy, G.P., Raihandhany, R., Mursidawati, S., da Silva, J.A.T. and Susatya, A. 2021. *Rhizanthes*, the forgotten relative of *Rafflesia* in the Rafflesiaceae. Botanical Review 88(1): 130-143. [Reviewing the status of *Rhizanthes* spp. which parastisise *Tetrastigma* spp. in Indonesia, emphasizing their cultural and ethnomedicinal importance and seeking to define methods for their conservation.]

Wicaksono, A., Trân, H.Đ. and Kamal, S.H.S. 2021. Preliminary histoanatomical study of *Sapria himalayana* Griff. f. *albovinosa* flower buds and its intersection with its host plant *Tetrastigma laoticum* Gagnep. Journal of Plant Development 28: 23-31. (https://doi.org/10.47743/jpd.2021.28.1.888) [Describing early development of *S. himalayana* (Rafflesiaceae) inside its host.]

Widad Al-Juhani, Al-Thagafi, N. T. and Al-Qthanin, R.N. 2022. Gene losses and plastome degradation in the hemiparasitic species *Plicosepalus acaciae* and *Plicosepalus curviflorus*: comparative analyses and phylogenetic relationships among Santalales members. Plants 11(14): (https://doi.org/10.3390/plants11141869)

Wu Sheng and Li YanRan. 2021. A unique sulfotransferase-involving strigolactone biosynthetic route in sorghum. Frontiers in Plant Science 12(December) (https://doi.org/10.3389/fpls.2021.793459)

Wu W, Huang H, Su J, Yun X, Zhang Y, Wei S, Huang Z, Zhang C, Bai Q. 2022. Dynamics of germination stimulants dehydrocostus lactone and costunolide in the root exudates and extracts of sunflower. Plant Signal Behavior: 35060434 (https://doi.org/10.1080/15592324.2022.2025669) [Comparing the exudation of stimulants for *Orobanche cumana* from susceptible confectionary sunflower SH363 and resistant TH33 showed no significant difference in costunolide, but 3.7 times more dehydrocostus lactone from the susceptible SH363.]

Wu YuGuo, Luo Dong, Fang LongFa, Zhou Qiang, Liu WenXian and Liu ZhiPeng. 2022. Bidirectional lncRNA transfer between *Cuscuta* parasites and their host plant. International Journal of Molecular Sciences 23(1): (https://doi.org/10.3390/ijms23010561) [Finding that numbers of long non-coding RNAs are transferred between *C. australis* and its host soybean, which may act as critical regulators to coordinate the host-dodder interaction at the whole parasitic level.]

Xiaolei Cao, Zhao Sifeng, Zhaoqun Yao, Xue Dong and Lu Zhang. 2022. First report of *Cirsium arvense* (Canada thistle) as a new host of *Orobanche*. Plant Disease 106(6): (https://doi.org/10.1094/PDIS-04-21-0773-PDN) [First record of *Orobanche 'cumana'* in Xinjiang, China.

Xiao TingTing, Kirschner, G.K., Kountche, B.A., Jamil, M., Savina, M., Lube, V., Mironova, V., Al-Babili, S. and Blilou, I. 2022. A PLETHORA/PIN-FORMED/auxin network mediates prehaustorium formation in the parasitic plant *Striga hermonthica*. Plant Physiology 189(4): 2281-2297. [Results reveal a fundamental molecular and cellular framework governing the switch of *S. hermonthica* roots to form the invasive prehaustoria - shortly after germination, cells in the root meristem undergo multiplanar divisions. During growth, the meristematic activity declines and is associated with reduced expression of the stem cell regulator *PLETHORA1* and the cell cycle genes *CYCLINB1* and *HISTONE H4*.]

Xiaolei Cao, Sifeng Zhao, Zhaoqun Yao, Xue Dong, Lu Zhang and QY Zho. 2022. First report of *Cirsium arvense* (Canada thistle) as a new host of *Orobanche cumana* in Xinjiang, China. Plant Disease 6: (https://doi.org/10.1094/PDIS-04-21-0773-PDN). Yuxing Xu and 9 others. 2021. A chromosome-scale *Gastrordia elata* genome and large-scale comparative genomic analysis indicate convergent evolution by gene loss in mycoheterotrophic and parasitic plants. Plant Journal 108(6): 1609-1623. [Comparing the genome of the completely heterotrophic *G. elata* (Orchidaceae) with that of *Cuscuta australis* and finding both had lost 10% of conserved orthogroups, genes associated with photosynthesis etc, while *Striga asiatica* had lost only 4.5%.]

Xu YuXing, Zhang JingXiong, Ma CanRong, Lei YunTingm and Shen GuoJing. 2022. Comparative genomics of orobanchaceous species with different parasitic lifestyles reveals the origin and stepwise evolution of plant parasitism. Molecular Plant 15(8): 1384-1399. [Concluding that an ancient whole-genome duplication (WGD) about 73 million years ago, which occurred earlier than the origin of Orobanchaceae, might have contributed to the emergence of parasitism. However, no such events occurred in any lineage of orobanchaceous parasites except for *Striga* after divergence from their autotrophic common ancestor, suggesting that, in contrast with previous speculations, WGD is not associated with the emergence of holoparasitism.]

Yacoubou, A., Zoumarou Wallis, N., Menkir, A., Zinsou, V.A., Onzo, A., Garcia-Oliveira, A.L., Meseka, S., Wende, M., Gedil, M., and Agre, P.A. (2021). Breeding maize (*Zea mays*) for *Striga* resistance: Past, current and prospects in sub-saharan Africa. Zeitschrift Fur Pflanzenzuchtung, 140: 195-210. [Providing a comprehensive overview of maize breeding activities related to *Striga* resistance and its management, noting that traditional breeding methods have been used more than molecular strategies. Resistance genes are still under study in the IITA maize breeding programme. Marker Assistance Breeding is expected to enhance maize breeding for *Striga* resisance.]

Yapa, S.S., Mohotti, A.J. and Samita, S. 2021. Mistletoe (*Dendrophthoe neelgherrensis* Wigh & Arn. Tiegh.) parasitism on yield of nutmeg (*Myristica fragrans* Houtt.): have we been underrating the destructivity? Tropical Agricultural Research 33(12): 18-28. [Results suggest that 40% coverage of nutmeg by *D. neelgherrensis* caused 65% yield loss. Loss was much higher in infested than in uninfested branches.]

Ye HuiYing, Zhao WanLi, Li YanQiong, Chen Xia, Zhang YaXing nd Zhao Ping. 2021.

Different effects of hemi-parasite *Taxillus chinensis* on water transport of its host angiosperms and gymnosperms trees. Flora (Jena) 285: (https://doi.org/10.1016/j.flora.2021.151955) [*T. chinensis* reduced transpiration in gymnosperm hosts, *Taxodium* spp. while transpiration and photosynthsis of the parasite was higher on the gymnosperms than on angiosperm hosts *Liquidambar formosana, Michelia chapensis.*]

Yego, J., Mwasi, S.M. and Cheramgoi, E. 2022. Effect of field dodder (Cuscuta campestrisYunck.) on tea clones' growth parameters and yield in Nandi County, Kenya. African Environmental Review Journal 5(1): 141-148. [

Yixiao Zhang, Jietian Su, Xiaopeng Yun, Wenlong Wu, Shouhui Wei, Zhaofeng Huang, Chaoxian Zhang, Quanjiang Bai & Hongjuan Huang. 2022. Molecular mechanism of the parasitic interaction between *Orobanche cumana* wallr. and sunflowers. Journal of Plant Interactions 17(1): 549-561) (https://doi.org/10.1080/17429145.2022.2062061) [Confirming that *O. cumana* infestation significantly inhibited sunflower height, fresh weight, chlorophyl contents, photosynthetic and the malondialdehyde content. Six parasite-related genes were selected, which markedly enriched plant hormone signal transduction, photorespiration and phenylpropanoid metabolism pathway.]

Yousefi, A.R., Ahmadikhah, A., Fotovat, R., Rohani, L., Soheily, F., Uberti, D.L. and Mastinu, A. 2022. Molecular characterization of a new ecotype of holoparasitic plant *Orobanche* L. on host weed *Xanthium spinosum* L. Plants 11(11): (https://doi.org/10.3390/plants11111406) [Describing a variant of *Phelipanche aegyptiaca* on *X. spinosum* in Iran.]

Yu RunXian, Sun ChenYu, Liu Ying and Zhou RenChao. 2021. Shifts from *cis*-to *trans*-splicing of five mitochondrial introns in *Tolypanthus maclurei*. PeerJ 9(12260): (https://doi.org/10.7717/peerj.12260) [Results suggest that shifts to trans-splicing of mitochondrial introns may not be uncommon among angiosperms.]

Zagorchev, L.I., Petrova, V.P., Albanova, I., Georgieva, K.P., Saric-Krsmanovic, M., Muscolo, A. and Teofanova, D.R. 2022. Salinity modulates crop plants suitability as hosts for *Cuscuta campestris* parasitism. Journal of the Saudi Society of Agricultural Sciences 21(5): 324-330. [Reporting varied effect of high salinity on the success of *C. campestris* and the susceptibility of the host.]

Zarban, R.A., Hameed, U.F.S., Muhammad Jamil, Ota, T., Wang JianYou, Arold, S.T., Asami, T. and Salim Al-Babili. 2021. Rational design of *Striga hermonthica*-specific seed germination inhibitors. Plant Physiology 188(2): 1369-1384. [Showing that KK023-N1, a compound derived from TritonX-100 detergent and triazole urea, is a potential candidate for combating *Striga* and a promising basis for rational design and development of further *Striga*-specific herbicides]

Zhang DaHan, Li Meng, Wang XinYue, Wang WanLong, Wang KunLong, Ding Meng and Han Jing. 2021. Design the formulation of instant *Cistanche deserticola* coffee and optimize its manufacturing process. Journal of Food Safety and Quality 12(23): 9233-9241.

Zhang H., Florentine, S. and Tennakoon, K.U. 2022. The angiosperm stem hemiparasitic genus *Cassytha* (Lauraceae) and its host interactions: a review. Frontiers in Plant Science 06 June: (https://doi.org/10.3389/fpls.2022.864110) [see PROFILE above.]

Zhang YiXiao, Su JieTian, Yun XiaoPeng, Wu WenLong, Wei ShouHui, Huang ZhaoFeng and Huang HongJuan. Molecular mechanism of the parasitic interaction between *Orobanche cumana* wallr. and sunflowers. Journal of Plant Interactions 17: 549-561. [Showing that *O. cumana* infestation significantly inhibits sunflower height, fresh weight, chlorophyl contents, photosynthetic and the MDA content, while superoxide dismutase and peroxidase activities were increased. 6 parasite-related genes were selected, which are markedly enriched in plant hormone signal transduction, photorespiration and phenylpropanoid metabolism pathway.]**Functional Ecology of Plants and Ecosystems**

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